UNITED STATES PATENT AND TRADEMARK OFFICE

# CERTIFICATE OF CORRECTION



| | |
|---|---|
| PATENT NO. | : 9,647,918 B2 |
| APPLICATION NO. | : 15/227814 |
| DATED | : May 9, 2017 |
| INVENTOR(S) | : Raleigh et al. |

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Page 2 Column 1, Line 48 Under item (63), Related U.S. Application Data:
"No. 12/380,788" should be changed to "No. 12/380,778"

Signed and Sealed this
Twelfth Day of February, 2019

Andrei Iancu
*Director of the United States Patent and Trademark Office*



SAMSUNG 1002

# IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

| | | | |
|---|---|---|---|
| In re Application of: | Raleigh et al. | Patent No.: 9,647,918 | |
| Serial No.: | 15/227,814 | Issue Date: May 9, 2017 | |
| Filing Date: | August 3, 2016 | Conf. No.: 2668 | |
| Title: | Mobile Device and Method Attributing Media Services Network Usage to Requesting Application | | |

Commissioner for Patents
Office of Patent Publication
ATTN: Certificate of Correction Branch
P.O. Box 1450
Alexandria, VA 22313-1450

## MISCELLANEOUS COMMUNICATION REGARDING CERTIFICATE OF CORRECTION

Applicant/Patentee (hereinafter, "Applicant") respectfully requests that the Office issue a Certificate of Correction for U.S. Patent No. 9,647,918 to correct a typographical error in the "Related U.S. Application Data (63)" section of the patent. The error being corrected is the Office's error.

In the published patent, section (63) recites an incorrect application number at page 2 col. 1, line 48 (the last citation in the section):

No. 12/380,788

The non-provisional application listed as: No. 12/380,788 should be: No. 12/380,778, as listed in the August 3, 2016 Application Data sheet page 9.

## CONCLUSION

Applicant respectfully requests issuance of the Certificate of Correction to correct the error in the priority claim. The Office is authorized to charge any fee deficiency or credit any overpayment to Deposit Account 50-5876.

Respectfully submitted,

Date: January 11, 2019 By: /James E. Harris/

James E. Harris
Reg. No. 40,013
Patent Counsel
Headwater Research LLC
1011 Pruitt Place
Tyler, TX 75703
(903) 201-6212

CERTIFICATE OF ELECTRONIC TRANSMISSION

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being filed electronically via EFS-Web addressed to the Commissioner for Patents on:

Date: January 11, 2019 By: /Jennifer Smith/
Jennifer Smith

PTO/SB/44 (09-07)
Approved for use through 08/31/2013. OMB 0651-0033
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.
(Also Form PTO-1050)

# UNITED STATES PATENT AND TRADEMARK OFFICE
## CERTIFICATE OF CORRECTION



PATENT NO. : 9,647,918

APPLICATION NO.: 15/227,814

ISSUE DATE : May 9, 2017

INVENTOR(S) : Raleigh et al.

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Page 2 col. 1, line 48:

"No. 12/380,788" should be changed to "No. 12/380,778"

MAILING ADDRESS OF SENDER (Please do not use customer number below):

Headwater Research LLC
1011 Pruitt Place
Tyler, TX 75703

This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Attention Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

## Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 34836587 |
| **Application Number:** | 15227814 |
| **International Application Number:** | |
| **Confirmation Number:** | 2668 |
| **Title of Invention:** | Mobile Device and Method Attributing Media Services Network Usage to Requesting Application |
| **First Named Inventor/Applicant Name:** | Gregory G. Raleigh |
| **Customer Number:** | 106963 |
| **Filer:** | James E. Harris/Jennifer Smith |
| **Filer Authorized By:** | James E. Harris |
| **Attorney Docket Number:** | RALEP046C2C1C1 |
| **Receipt Date:** | 11-JAN-2019 |
| **Filing Date:** | 03-AUG-2016 |
| **Time Stamp:** | 17:27:25 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| Submitted with Payment | no |
|---|---|

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Request for Certificate of Correction | P046C2C1C1_ReqforCoC_RTF.pdf | 202577<br>5a0016009de30f12bd2a5ba0c1aac20cf4884e02 | no | 4 |

**Warnings:**

| Information: | |
|---|---|
| **Total Files Size (in bytes):** | 202577 |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**
**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**
**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | ISSUE DATE | PATENT NO. | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 15/227,814 | 05/09/2017 | 9647918 | RALEP046C2C1C1 | 2668 |

106963 7590 04/19/2017

Headwater Research LLC
1011 Pruitt Place
Tyler, TX 75703

# ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

**Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)**
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Gregory G. Raleigh, Woodside, CA;
Headwater Partners I LLC, Tyler, TX;
Jeffrey Green, Sunnyvale, CA;
James Lavine, Corte Madera, CA;
Vien-Phuong Nguyen, Newark, CA;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | Application Number | 15227814 |
| | Filing Date | 2016-08-03 |
| | First Named Inventor | Raleigh |
| | Art Unit | |
| | Examiner Name | not yet assigned |
| | Attorney Docket Number | RALEP046C2C1C1 |

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M/

| | | | | | | |
|---|---|---|---|---|---|---|
| | 284 | 8930238 | | 2015-01-06 | Coffman et al. | |
| | 285 | 8880047 | | 2014-11-04 | Konicek et al. | |
| | 286 | 8739035 | | 2014-05-27 | Trethewey, Jim | |
| | 287 | 8571598 | | 10-2013 ~~2013-07-16~~ | Valavi, John J. | |
| | 288 | 8489110 | | 2013-07-16 | Frank et al. | |
| | 289 | 8406736 | | 2013-03-26 | Das et al. | |
| | 290 | 8259692 | | 2012-09-04 | Bajko, Gabor | |
| | 291 | 8233433 | | 2012-07-31 | Kalhan, Amit | |
| | 292 | 8155666 | | 2012-04-10 | Alizadeh-Shabdiz, Farshid | |
| | 293 | 8103285 | | 2012-01-24 | Kalhan, Amit | |
| | 294 | 7936736 | | 2011-05-03 | Proctor Jr., James Arthur et al. | |

Change(s) applied to document. /D.D./ 4/10/2017

EFS Web 2.1.17

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | Application Number | 15227814 |
| | Filing Date | 2016-08-03 |
| | First Named Inventor | Raleigh |
| | Art Unit | |
| | Examiner Name | not yet assigned |
| | Attorney Docket Number | RALEP046C2C1C1 |

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M/

| | | | | | | |
|---|---|---|---|---|---|---|
| | 218 | 8353001 | | 2013-01-08 | Herrod, Allan | |
| Change(s) applied to document, /D.D./ 4/7/2017 | 219 | 8195093 | | 06-2012 ~~2013-08-05~~ | Garrett, Darrin et al. | |
| | 220 | 8036600 | | 2011-10-11 | Garrett, Darrin et al. | |
| | 221 | 8301513 | | 2012-10-30 | Peng, Shih-Ta et al. | |
| | 222 | 8230061 | | 2012-07-24 | Hassan, Amer A. et al. | |
| | 223 | 8204794 | | 2012-06-19 | Peng, Shih-Ta et al. | |
| | 224 | 8350700 | | 2013-01-08 | Fast, Raymond D. et al. | |
| | 225 | 8204190 | | 2012-06-19 | Bang, Jung-Hee et al. | |
| | 226 | 7865182 | | 2011-01-04 | Macaluso, Anthony G. | |
| | 227 | 7962622 | | 2011-06-14 | Friend, John et al. | |
| | 228 | 7583964 | | 2009-09-01 | Wong, Gregory A. | |

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United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 15/227,814 | 08/03/2016 | Gregory G. Raleigh | RALEP046C2C1C1 | 2668 |

106963 7590 03/23/2017

Headwater Research LLC
1011 Pruitt Place
Tyler, TX 75703

| EXAMINER | |
|---|---|
| MOUTAOUAKIL, MOUNIR | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2476 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 03/23/2017 | ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patent@headwaterllc.com

| ***Supplemental Notice of Allowability*** | **Application No.** 15/227,814 | **Applicant(s)** RALEIGH ET AL. | |
|---|---|---|---|
| | **Examiner** MOUNIR MOUTAOUAKIL | **Art Unit** 2476 | **AIA (First Inventor to File) Status** No |

***-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--***

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *amendment filed on 02-08-2017*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *2 and 4-21(renumbered as 1-19)*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   **Certified copies:**

   a) ☐ All b) ☐ Some *c) ☐ None of the:
   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

5. ☐ CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   **Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).**
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

1. ☐ Notice of References Cited (PTO-892)
2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/MOUNIR MOUTAOUAKIL/
Primary Examiner, Art Unit 2476

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 15227814 | RALEIGH ET AL. |
| | **Examiner** | **Art Unit** |
| | MOUNIR MOUTAOUAKIL | 2476 |

| CPC | | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | | | | | **Type** | **Version** |
| H04L | | 43 | / | 0876 | F | 2013-01-01 |
| H04L | | 47 | / | 14 | I | 2013-01-01 |
| H04L | | 47 | / | 2441 | I | 2013-01-01 |
| H04W | | 28 | / | 0268 | I | 2013-01-01 |
| H04L | | 41 | / | 0896 | I | 2013-01-01 |
| G06F | | 9 | / | 54 | I | 2013-01-01 |
| H04L | | 41 | / | 5041 | I | 2013-01-01 |
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| CPC Combination Sets | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Symbol** | | | | **Type** | **Set** | **Ranking** | **Version** |
| | | | / | | | | |
| | | | / | | | | |

| NONE | | **Total Claims Allowed:** | |
|---|---|---|---|
| (Assistant Examiner) | (Date) | 19 | |
| /MOUNIR MOUTAOUAKIL/<br>Primary Examiner.Art Unit 2476 | 03/19/2017 | O.G. Print Claim(s) | O.G. Print Figure |
| (Primary Examiner) | (Date) | 1 | 1 |

U.S. Patent and Trademark Office — Part of Paper No. 20170319

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 15227814 | RALEIGH ET AL. |
| | Examiner | Art Unit |
| | MOUNIR MOUTAOUAKIL | 2476 |

| US ORIGINAL CLASSIFICATION | | INTERNATIONAL CLASSIFICATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CLASS | SUBCLASS | CLAIMED | | | | | NON-CLAIMED | | | | | |
| | | H | 0 | 4 | L | 12 / 26 (2006.01.01) | | | | | | |
| CROSS REFERENCE(S) | | | | | | | | | | | | |
| CLASS | SUBCLASS (ONE SUBCLASS PER BLOCK) | | | | | | | | | | | |
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| NONE<br><br>(Assistant Examiner) | (Date) | Total Claims Allowed:<br>19 | |
|---|---|---|---|
| /MOUNIR MOUTAOUAKIL/<br>Primary Examiner.Art Unit 2476<br><br>(Primary Examiner) | 03/19/2017<br><br>(Date) | O.G. Print Claim(s)<br>1 | O.G. Print Figure<br>1 |

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 15227814 | RALEIGH ET AL. |
| | **Examiner** | **Art Unit** |
| | MOUNIR MOUTAOUAKIL | 2476 |

☒ **Claims renumbered in the same order as presented by applicant** ☐ **CPA** ☐ **T.D.** ☐ **R.1.47**

| Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original |
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| NONE<br><br>(Assistant Examiner) | (Date) | **Total Claims Allowed:**<br>19 | |
|---|---|---|---|
| /MOUNIR MOUTAOUAKIL/<br>Primary Examiner.Art Unit 2476<br><br>(Primary Examiner) | 03/19/2017<br><br>(Date) | O.G. Print Claim(s)<br>1 | O.G. Print Figure<br>1 |

U.S. Patent and Trademark Office

Part of Paper No. 20170319

## PART B - FEE(S) TRANSMITTAL

**Complete and send this form, together with applicable fee(s), to: Mail** Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
**or Fax** (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

188963 3550 92692617
Headwater Research LLC
1011 Pruitt Place
Tyler, TX 75703

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

**Certificate of Mailing or Transmission**
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

| |
|---|
| Ann Taylor (Depositor's name) |
| /Ann Taylor/ (Signature) |
| March 9, 2017 (Date) |

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 15/227,814 | 08/03/2016 | Gregory G. Raleigh | RALEP046C2C1C1 | 2068 |

TITLE OF INVENTION: Mobile Device and Method Attributing Media Services Network Usage to Requesting Application

| APPLN. TYPE | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEES DUE | DATE DUE |
|---|---|---|---|---|---|---|
| nonprovisional | SMALL | $480 | $0 | $0 | $480 | 06/07/2017 |

| EXAMINER | ART UNIT | CLASS-SUBCLASS |
|---|---|---|
| MOUTAOUAKIL, MOUNIR | 2476 | 370-252000 |

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list:
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 James E. Harris
2
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: Headwater Research LLC
(B) RESIDENCE: (CITY and STATE OR COUNTRY): Tyler, TX

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☑ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
- ☑ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☑ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number 505876 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
- ☐ Applicant changing to regular undiscounted fee status

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature: /James E. Harris/ Date: March 9, 2017
Typed or printed name: James E. Harris Registration No.: 40013



PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

| Electronic Patent Application Fee Transmittal | | | | |
|---|---|---|---|---|
| **Application Number:** | 15227814 | | | |
| **Filing Date:** | 03-Aug-2016 | | | |
| **Title of Invention:** | Mobile Device and Method Attributing Media Services Network Usage to Requesting Application | | | |
| **First Named Inventor/Applicant Name:** | Gregory G. Raleigh | | | |
| **Filer:** | James E. Harris/Ann Taylor | | | |
| **Attorney Docket Number:** | RALEP046C2C1C1 | | | |
| Filed as Small Entity | | | | |
| **Filing Fees for Utility under 35 USC 111(a)** | | | | |
| **Description** | **Fee Code** | **Quantity** | **Amount** | **Sub-Total in USD($)** |
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| UTILITY APPL ISSUE FEE | 2501 | 1 | 480 | 480 |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Extension-of-Time:** | | | | |
| **Miscellaneous:** | | | | |
| | | | **Total in USD ($)** | **480** |

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 28587608 |
| **Application Number:** | 15227814 |
| **International Application Number:** | |
| **Confirmation Number:** | 2668 |
| **Title of Invention:** | Mobile Device and Method Attributing Media Services Network Usage to Requesting Application |
| **First Named Inventor/Applicant Name:** | Gregory G. Raleigh |
| **Customer Number:** | 106963 |
| **Filer:** | James E. Harris/Ann Taylor |
| **Filer Authorized By:** | James E. Harris |
| **Attorney Docket Number:** | RALEP046C2C1C1 |
| **Receipt Date:** | 09-MAR-2017 |
| **Filing Date:** | 03-AUG-2016 |
| **Time Stamp:** | 17:33:26 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | DA |
| Payment was successfully received in RAM | $480 |
| RAM confirmation Number | 031017INTEFSW00004436505876 |
| Deposit Account | |
| Authorized User | |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Issue Fee Payment (PTO-85B) | P046C2C1C1_IssueFee.pdf | 2584405<br>cd01969a3386ebc5cafc4689f77fb6b2f1ab16b2 | no | 1 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Fee Worksheet (SB06) | fee-info.pdf | 30875<br>f7bdf6e22a601d429a7373d29069e50aca7fc35a | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 2615280 | | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

# NOTICE OF ALLOWANCE AND FEE(S) DUE

106963 7590 03/07/2017

Headwater Research LLC
1011 Pruitt Place
Tyler, TX 75703

| EXAMINER | |
|---|---|
| MOUTAOUAKIL, MOUNIR | |
| ART UNIT | PAPER NUMBER |
| 2476 | |

DATE MAILED: 03/07/2017

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 15/227,814 | 08/03/2016 | Gregory G. Raleigh | RALEP046C2C1C1 | 2668 |

TITLE OF INVENTION: Mobile Device and Method Attributing Media Services Network Usage to Requesting Application

| APPLN. TYPE | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE |
|---|---|---|---|---|---|---|
| nonprovisional | SMALL | $480 | $0 | $0 | $480 | 06/07/2017 |

**THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.**

**THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.**

**HOW TO REPLY TO THIS NOTICE:**

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

**IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.**

## PART B - FEE(S) TRANSMITTAL

**Complete and send this form, together with applicable fee(s), to: Mail** **Mail Stop ISSUE FEE**
**Commissioner for Patents**
**P.O. Box 1450**
**Alexandria, Virginia 22313-1450**
**or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

106963 7590 03/07/2017
Headwater Research LLC
1011 Pruitt Place
Tyler, TX 75703

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

**Certificate of Mailing or Transmission**
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

| |
|---|
| (Depositor's name) |
| (Signature) |
| (Date) |

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 15/227,814 | 08/03/2016 | Gregory G. Raleigh | RALEP046C2C1C1 | 2668 |

TITLE OF INVENTION: Mobile Device and Method Attributing Media Services Network Usage to Requesting Application

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|---|---|---|---|---|---|---|
| nonprovisional | SMALL | $480 | $0 | $0 | $480 | 06/07/2017 |

| EXAMINER | ART UNIT | CLASS-SUBCLASS |
|---|---|---|
| MOUTAOUAKIL, MOUNIR | 2476 | 370-252000 |

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❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
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2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

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(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:
❑ Issue Fee
❑ Publication Fee (No small entity discount permitted)
❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): (**Please first reapply any previously paid issue fee shown above**)
❑ A check is enclosed.
❑ Payment by credit card. Form PTO-2038 is attached.
❑ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
❑ Applicant certifying micro entity status. See 37 CFR 1.29
NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
❑ Applicant asserting small entity status. See 37 CFR 1.27
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
❑ Applicant changing to regular undiscounted fee status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____



PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 15/227,814 | 08/03/2016 | Gregory G. Raleigh | RALEP046C2C1C1 | 2668 |

106963 7590 03/07/2017

Headwater Research LLC
1011 Pruitt Place
Tyler, TX 75703

| EXAMINER | |
|---|---|
| MOUTAOUAKIL, MOUNIR | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2476 | |

DATE MAILED: 03/07/2017

**Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)**
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

## OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

## Privacy Act Statement

**The Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

| Notice of Allowability | Application No. 15/227,814 | Applicant(s) RALEIGH ET AL. | |
|---|---|---|---|
| | Examiner MOUNIR MOUTAOUAKIL | Art Unit 2476 | AIA (First Inventor to File) Status No |

***-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--***

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *amendment filed on 02-08-2017*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *1,2 and 4-21(renumbered as 1-20)*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   **Certified copies:**

   a) ☐ All b) ☐ Some *c) ☐ None of the:
   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has **THREE MONTHS FROM THE** "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE**.

5. ☐ CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   **Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).**
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

1. ☐ Notice of References Cited (PTO-892)
2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/MOUNIR MOUTAOUAKIL/
Primary Examiner, Art Unit 2476

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

| **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** ( **Not for submission under 37 CFR 1.99**) | | |
|---|---|---|
| | Application Number | 15227814 |
| | Filing Date | 2016-08-03 |
| | First Named Inventor | Raleigh |
| | Art Unit | |
| | Examiner Name | not yet assigned |
| | Attorney Docket Number | RALEP046C2C1C1 |

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M/

**U.S.PATENTS** Remove

| Examiner Initial* | Cite No | Patent Number | Kind Code[1] | Issue Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|---|
| | 1 | | | | | |

If you wish to add additional U.S. Patent citation information please click the Add button. Add

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| Examiner Initial* | Cite No | Publication Number | Kind Code[1] | Publication Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|---|
| | 1 | 20070259656 | | 2007-11-08 | Jeong, Jong Woo | |
| | 2 | 20080263348 | | 2008-10-23 | Zaltsman, Etai et al. | |
| | 3 | 20080313315 | | 2008-12-18 | Karaoguz, Jeyhan et al. | |
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Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

**OR**

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ None

**SIGNATURE**

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

| Signature | /James E. Harris/ | Date (YYYY-MM-DD) | 2016-08-12 |
|---|---|---|---|
| Name/Print | James E. Harris | Registration Number | 40013 |

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

## Privacy Act Statement

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| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 15227814 | RALEIGH ET AL. |
| | Examiner | Art Unit |
| | MOUNIR MOUTAOUAKIL | 2476 |

| CPC- SEARCHED | | |
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| Symbol | Date | Examiner |
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| CPC COMBINATION SETS - SEARCHED | | |
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| Symbol | Date | Examiner |
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| US CLASSIFICATION SEARCHED | | | |
|---|---|---|---|
| Class | Subclass | Date | Examiner |
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| SEARCH NOTES | | |
|---|---|---|
| Search Notes | Date | Examiner |
| Inventorship Search | 10/20/2016 | MM |
| IDS | 10/20/2016 | MM |
| East | 10/20/2016 | MM |
| NPL | 10/20/2016 | MM |
| EPO | 10/20/2016 | MM |
| WIPO | 10/20/2016 | MM |
| Double patenting search | 10/20/2016 | MM |
| family search | 10/20/2016 | MM |

| INTERFERENCE SEARCH | | | |
|---|---|---|---|
| US Class/ CPC Symbol | US Subclass / CPC Group | Date | Examiner |
| | see search history printout | 2/26/2017 | MM |

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| | 15227814 | RALEIGH ET AL. |
| | **Examiner** | **Art Unit** |
| | MOUNIR MOUTAOUAKIL | 2476 |

| CPC | | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | | | | | **Type** | **Version** |
| H04L | | 43 | / | 0876 | F | 2013-01-01 |
| H04L | | 47 | / | 14 | I | 2013-01-01 |
| H04L | | 47 | / | 2441 | I | 2013-01-01 |
| H04W | | 28 | / | 0268 | I | 2013-01-01 |
| H04L | | 41 | / | 0896 | I | 2013-01-01 |
| G06F | | 9 | / | 54 | I | 2013-01-01 |
| H04L | | 41 | / | 5041 | I | 2013-01-01 |
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| **Symbol** | | | | **Type** | **Set** | **Ranking** | **Version** |
| | | | / | | | | |
| | | | / | | | | |

| NONE | | **Total Claims Allowed:** | |
|---|---|---|---|
| (Assistant Examiner) | (Date) | 20 | |
| /MOUNIR MOUTAOUAKIL/<br>Primary Examiner.Art Unit 2476 | 02/26/2017 | O.G. Print Claim(s) | O.G. Print Figure |
| (Primary Examiner) | (Date) | 1 | 1 |

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| | 15227814 | RALEIGH ET AL. |
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| | MOUNIR MOUTAOUAKIL | 2476 |

| US ORIGINAL CLASSIFICATION | | INTERNATIONAL CLASSIFICATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CLASS | SUBCLASS | CLAIMED | | | | | NON-CLAIMED | | | | | |
| | | H | 0 | 4 | L | 12 / 26 (2006.01.01) | | | | | | |
| CROSS REFERENCE(S) | | | | | | | | | | | | |
| CLASS | SUBCLASS (ONE SUBCLASS PER BLOCK) | | | | | | | | | | | |
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| NONE<br><br>(Assistant Examiner) | (Date) | Total Claims Allowed:<br>20 | |
|---|---|---|---|
| /MOUNIR MOUTAOUAKIL/<br>Primary Examiner.Art Unit 2476<br><br>(Primary Examiner) | 02/26/2017<br><br>(Date) | O.G. Print Claim(s)<br>1 | O.G. Print Figure<br>1 |

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 15227814 | RALEIGH ET AL. |
| | **Examiner** | **Art Unit** |
| | MOUNIR MOUTAOUAKIL | 2476 |

☒ **Claims renumbered in the same order as presented by applicant** ☐ **CPA** ☐ **T.D.** ☐ **R.1.47**

| Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original |
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|---|---|---|---|
| NONE<br><br>(Assistant Examiner) | (Date) | **Total Claims Allowed:**<br>20 | |
| /MOUNIR MOUTAOUAKIL/<br>Primary Examiner.Art Unit 2476<br><br>(Primary Examiner) | 02/26/2017<br><br>(Date) | O.G. Print Claim(s)<br>1 | O.G. Print Figure<br>1 |

**EAST Search History**

**EAST Search History (Prior Art)**

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | Time Stamp |
|---|---|---|---|---|---|---|
| L1 | 17149 | (application adj programming adj interface).clm. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2017/02/26 21:45 |
| L2 | 1497 | (application adj programming adj interface with first with second).clm. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2017/02/26 21:46 |
| L3 | 23 | (application adj programming adj interface with first with second with stack).clm. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2017/02/26 21:47 |

**EAST Search History (Interference)**

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | Time Stamp |
|---|---|---|---|---|---|---|
| L4 | 7227 | (application adj programming adj interface).clm. | USPAT | OR | ON | 2017/02/26 21:47 |
| L5 | 793 | (application adj programming adj interface with first with second).clm. | USPAT | OR | ON | 2017/02/26 21:47 |
| L6 | 14 | (application adj programming adj interface with first with second with stack).clm. | USPAT | OR | ON | 2017/02/26 21:47 |

**2/26/2017 9:49:40 PM**
**C:\Users\mmoutaouakil\Documents\EAST\Workspaces\15227814.wsp**

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**INFORMATION DISCLOSURE STATEMENT BY APPLICANT**
**( Not for submission under 37 CFR 1.99)**

| | |
|---|---|
| Application Number | 15227814 |
| Filing Date | 2016-08-03 |
| First Named Inventor | Gregory G. Raleigh |
| Art Unit | 2476 |
| Examiner Name | Moutaouakil, Mounir |
| Attorney Docket Number | RALEP046C2C1C1 |

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|---|---|---|---|---|---|---|
| | 1 | 6115823 | A | 2000-09-05 | Velasco et al. | |
| | 2 | 7203721 | B1 | 2007-04-10 | Ben-Efraim et al. | |
| | 3 | 7219123 | B1 | 2007-05-15 | Fiechter et al. | |
| | 4 | 7505795 | B1 | 2009-03-17 | Lim et al. | |
| | 5 | 9326173 | B2 | 2016-04-26 | Luft, Achim | |

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|---|---|---|---|---|---|---|
| | 1 | 20090065571 | A1 | 2009-03-12 | Jain, Deepak | |

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| | Application Number | 15227814 |
| | Filing Date | 2016-08-03 |
| | First Named Inventor | Gregory G. Raleigh |
| | Art Unit | 2476 |
| | Examiner Name | Moutaouakil, Mounir |
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| Examiner Signature | /MOUNIR MOUTAOUAKIL/ | Date Considered | 02/26/2017 |
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[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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| | Art Unit | 2476 |
| | Examiner Name | Moutaouakil, Mounir |
| | Attorney Docket Number | RALEP046C2C1C1 |

**CERTIFICATION STATEMENT**

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

**OR**

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

**SIGNATURE**

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

| Signature | /James E. Harris/ | Date (YYYY-MM-DD) | 2017-02-08 |
|---|---|---|---|
| Name/Print | James E. Harris | Registration Number | 40013 |

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| Filing Date | 2016-08-03 |
| First Named Inventor | Gregory G. Raleigh |
| Art Unit | 2476 |
| Examiner Name | Moutaouakil, Mounir |
| Attorney Docket Number | RALEP046C2C1C1 |

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M/

**U.S.PATENTS** Remove

| Examiner Initial* | Cite No | Patent Number | Kind Code[1] | Issue Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|---|
| | 1 | 5617539 | A | 1997-04-01 | Ludwig et al. | |
| | 2 | 6401113 | B2 | 2002-06-04 | Lazaridis et al. | |
| | 3 | 6601040 | B1 | 2003-07-29 | Kolls, H. Brock | |
| | 4 | 6636721 | B2 | 2003-10-21 | Threadgill et al. | |
| | 5 | 6879825 | B1 | 2005-04-12 | Daly, Brian Kevin | |
| | 6 | 6959393 | B2 | 2005-10-25 | Hollis et al. | |
| | 7 | 7151764 | B1 | 2006-12-19 | Heinonen et al. | |
| | 8 | 7177919 | B1 | 2007-02-13 | Truong et al. | |

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| | 9 | 7191248 | B2 | 2007-03-13 | Chattopadhyay et al. | |
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| | 14 | 7562213 | B1 | 2009-07-14 | Timms, Natalie | |
| | 15 | 7599714 | B2 | 2009-10-06 | Kuzminskiy, Alexandr | |
| | 16 | 7602746 | B2 | 2009-10-13 | Calhoun et al. | |
| | 17 | 7610047 | B2 | 2009-10-27 | Hicks III et al. | |
| | 18 | 7643411 | B2 | 2010-01-05 | Andreasen et al. | |
| | 19 | 7660419 | B1 | 2010-02-09 | Ho, Jin-Meng | |

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| | 20 | 7719966 | B2 | 2010-05-18 | Luft et al. | |
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| | 24 | 8125897 | B2 | 2012-02-28 | Ray et al. | |
| | 25 | 8132256 | B2 | 2012-03-06 | Bari, Farooq | |
| | 26 | 8140690 | B2 | 2012-03-20 | Ly et al. | |
| | 27 | 8145194 | B2 | 2012-03-27 | Yoshikawa et al. | |
| | 28 | 8194581 | B1 | 2012-06-05 | Schroeder et al. | |
| | 29 | 8307095 | B2 | 2012-11-06 | Clark et al. | |
| | 30 | 8380247 | B2 | 2013-02-19 | Engstrom | |



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| | Attorney Docket Number | RALEP046C2C1C1 |

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M/

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M/

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | Application Number | 15227814 |
| | Filing Date | 2016-08-03 |
| | First Named Inventor | Gregory G. Raleigh |
| | Art Unit | 2476 |
| | Examiner Name | Moutaouakil, Mounir |
| | Attorney Docket Number | RALEP046C2C1C1 |

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M/

| | | | | | | |
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**U.S.PATENT APPLICATION PUBLICATIONS** Remove

| Examiner Initial* | Cite No | Publication Number | Kind Code[1] | Publication Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|---|
| | 1 | 20020138599 | A1 | 2002-09-26 | Dilman et al. | |

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M/

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | Application Number | 15227814 |
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| | First Named Inventor | Gregory G. Raleigh |
| | Art Unit | 2476 |
| | Examiner Name | Moutaouakil, Mounir |
| | Attorney Docket Number | RALEP046C2C1C1 |

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M/

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 ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M/

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| | Attorney Docket Number | RALEP046C2C1C1 |

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M/

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**FOREIGN PATENT DOCUMENTS** Remove

| Examiner Initial* | Cite No | Foreign Document Number[3] | Country Code[2]i | Kind Code[4] | Publication Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear | T[5] |
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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M/

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
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| | Application Number | 15227814 |
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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M/

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**NON-PATENT LITERATURE DOCUMENTS** Remove

| Examiner Initials* | Cite No | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published. | T5 |
|---|---|---|---|
| | 1 | | |

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**EXAMINER SIGNATURE**

| Examiner Signature | /MOUNIR MOUTAOUAKIL/ | Date Considered | 02/26/2017 |
|---|---|---|---|

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M/

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
|---|---|---|
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| | Art Unit | 2476 |
| | Examiner Name | Moutaouakil, Mounir |
| | Attorney Docket Number | RALEP046C2C1C1 |

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | Application Number | 15227814 |
| | Filing Date | 2016-08-03 |
| | First Named Inventor | Gregory G. Raleigh |
| | Art Unit | 2476 |
| | Examiner Name | Moutaouakil, Mounir |
| | Attorney Docket Number | RALEP046C2C1C1 |

**CERTIFICATION STATEMENT**

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

**OR**

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

**SIGNATURE**

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

| Signature | /James E. Harris/ | Date (YYYY-MM-DD) | 2017-01-26 |
|---|---|---|---|
| Name/Print | James E. Harris | Registration Number | 40013 |

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

## Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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| APPLICATION NUMBER | FILING or 371(c) DATE | GRP ART UNIT | FIL FEE REC'D | ATTY.DOCKET.NO | TOT CLAIMS | IND CLAIMS |
|---|---|---|---|---|---|---|
| 15/227,814 | 08/03/2016 | 2476 | 1140 | RALEP046C2C1C1 | 15 | 2 |

**CONFIRMATION NO. 2668**

**CORRECTED FILING RECEIPT**

106963
Headwater Research LLC
1011 Pruitt Place
Tyler, TX 75703

OC000000089643765

Date Mailed: 03/06/2017

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

**Inventor(s)**

Gregory G. Raleigh, Woodside, CA;
Jeffrey Green, Sunnyvale, CA;
James Lavine, Corte Madera, CA;
Vien-Phuong Nguyen, Newark, CA;

**Applicant(s)**

Headwater Partners I LLC, Tyler, TX;

**Power of Attorney:** The patent practitioners associated with Customer Number 106963

**Domestic Priority data as claimed by applicant**

This application is a CON of 14/339,110 07/23/2014
which is a CON of 14/338,807 07/23/2014 PAT 9094311
which is a CON of 14/098,527 12/05/2013 PAT 9270559
which is a CON of 13/374,959 01/24/2012 PAT 8606911
which is a CIP of 12/695,019 01/27/2010 PAT 8275830
and is a CIP of 12/695,020 01/27/2010 PAT 8406748
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and is a CIP of 12/694,451 01/27/2010 PAT 8548428
and is a CIP of 12/694,455 01/27/2010 PAT 8402111
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and is a CIP of 13/309,463 12/01/2011 PAT 8793758
and is a CIP of 13/134,028 05/25/2011 PAT 8589541
and claims benefit of 61/435,564 01/24/2011
and claims benefit of 61/472,606 04/06/2011
and claims benefit of 61/550,906 10/24/2011
and claims benefit of 61/589,830 01/23/2012
and said 12/695,019 01/27/2010
claims benefit of 61/264,126 11/24/2009
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claims benefit of 61/275,208 08/25/2009
and claims benefit of 61/237,753 08/28/2009
and said 12/694,455 01/27/2010
claims benefit of 61/264,120 11/24/2009
and said 13/134,028 05/25/2011
claims benefit of 61/348,022 05/25/2010
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and is a CIP of 13/134,005 05/25/2011 PAT 8635335
and is a CIP of 12/695,021 01/27/2010 PAT 8346225
which claims benefit of 61/252,151 10/15/2009
and claims benefit of 61/252,153 10/15/2009
and is a CIP of 12/380,780 03/02/2009 PAT 8839388
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is a CIP of 12/380,780 03/02/2009 PAT 8839388
and is a CIP of 12/380,778 03/02/2009 PAT 8321526
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claims benefit of 61/206,354 01/28/2009
and claims benefit of 61/206,944 02/04/2009
and claims benefit of 61/207,393 02/10/2009
and claims benefit of 61/207,739 02/13/2009
and said 12/380,778 03/02/2009
claims benefit of 61/206,354 01/28/2009
and claims benefit of 61/206,944 02/04/2009
and claims benefit of 61/207,393 02/10/2009
and claims benefit of 61/207,739 02/13/2009

**Foreign Applications** for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
*Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.*

**Permission to Access Application via Priority Document Exchange:** Yes

**Permission to Access Search Results:** Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

**If Required, Foreign Filing License Granted:** 08/16/2016

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 15/227,814**

**Projected Publication Date:** Not Applicable

**Non-Publication Request:** No

**Early Publication Request:** No

**** SMALL ENTITY ****

**Title**

Mobile Device and Method Attributing Media Services Network Usage to Requesting##Application

**Preliminary Class**

370

**Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:** No

## PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

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## Title 35, United States Code, Section 184

## Title 37, Code of Federal Regulations, 5.11 & 5.15

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**NOT GRANTED**

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# IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

| | | | |
|---|---|---|---|
| In re Application of: | Raleigh et al. | Examiner: | Moutaouakil, Mounir |
| Serial No.: | 15/227,814 | Art Unit: | 2476 |
| Filed: | August 3, 2016 | Conf. No.: | 2668 |
| Title: | Mobile Device and Method Attributing Media Services Network Usage to Requesting Application | | |

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

## REQUEST FOR A CORRECTED FILING RECEIPT

Applicant respectfully requests a corrected filing receipt for the above-captioned application. Submitted with this request are:

(1) The application data sheet (ADS) filed on August 3, 2016;

(2) A copy of the Filing Receipt mailed August 18, 2016 with the requested changes noted thereon.

Applicant respectfully notes that this request is not a request to add or correct a benefit claim. Applicant is simply seeking a filing receipt that reflects the ADS that was filed on August 3, 2016.

## CONCLUSION

The Commissioner is authorized to charge any fee deficiency or credit any overpayment to Deposit Account 50-5876.

Respectfully submitted,

Date: March 1, 2017 By: /James E. Harris/

James E. Harris
Reg. No. 40,013
Headwater Research LLC
1011 Pruitt Place
Tyler, TX 75703
(903) 201-6212

CERTIFICATE OF ELECTRONIC TRANSMISSION

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being filed electronically via EFS-Web addressed to the Commissioner for Patents on:

Date: March 1, 2017 By: /Ann Taylor/
Ann Taylor

PTO/AIA/14 (11-15)
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| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | RALEP046C2C1C1 |
|---|---|---|
| | Application Number | |
| Title of Invention | Flow Tagging for Service Policy Implementation | |

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

## Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

## Inventor Information:

**Inventor 1** Remove

**Legal Name**

| Prefix | Given Name | Middle Name | Family Name | Suffix |
|---|---|---|---|---|
| | Gregory | G. | Raleigh | |

**Residence Information (Select One)** ● US Residency Non US Residency Active US Military Service

| City | Woodside | State/Province | CA | Country of Residence | US |
|---|---|---|---|---|---|

**Mailing Address of Inventor:**

| Address 1 | 1011 Pruitt Place | | |
|---|---|---|---|
| Address 2 | | | |
| City | Tyler | State/Province | TX |
| Postal Code | 75703 | Country | US |

**Inventor 2** Remove

**Legal Name**

| Prefix | Given Name | Middle Name | Family Name | Suffix |
|---|---|---|---|---|
| | Jeffrey | | Green | |

**Residence Information (Select One)** ◉ US Residency Non US Residency Active US Military Service

| City | Sunnyvale | State/Province | CA | Country of Residence | US |
|---|---|---|---|---|---|

**Mailing Address of Inventor:**

| Address 1 | 1011 Pruitt Place | | |
|---|---|---|---|
| Address 2 | | | |
| City | Tyler | State/Province | TX |
| Postal Code | 75703 | Country | US |

**Inventor 3** Remove

**Legal Name**

| Prefix | Given Name | Middle Name | Family Name | Suffix |
|---|---|---|---|---|
| | James | | Lavine | |

**Residence Information (Select One)** ◉ US Residency Non US Residency Active US Military Service

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| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | RALEP046C2C1C1 |
|---|---|---|
| | Application Number | |
| Title of Invention | Flow Tagging for Service Policy Implementation | |

| City | Corte Madera | State/Province | CA | Country of Residence | US |
|---|---|---|---|---|---|

**Mailing Address of Inventor:**

| Address 1 | 1011 Pruitt Place | | |
|---|---|---|---|
| Address 2 | | | |
| City | Tyler | State/Province | TX |
| Postal Code | 75703 | Country | US |

Inventor 4 Remove

**Legal Name**

| Prefix | Given Name | Middle Name | Family Name | Suffix |
|---|---|---|---|---|
| | Vien-Phuong | | Nguyen | |

**Residence Information (Select One)** ◉ US Residency ○ Non US Residency ○ Active US Military Service

| City | Newark | State/Province | CA | Country of Residence | US |
|---|---|---|---|---|---|

**Mailing Address of Inventor:**

| Address 1 | 1011 Pruitt Place | | |
|---|---|---|---|
| Address 2 | | | |
| City | Tyler | State/Province | TX |
| Postal Code | 75703 | Country | US |

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

## Correspondence Information:

**Enter either Customer Number or complete the Correspondence Information section below.**
**For further information see 37 CFR 1.33(a).**

☐ **An Address is being provided for the correspondence Information of this application.**

| Customer Number | 106963 | | |
|---|---|---|---|
| Email Address | patent@headwaterllc.com | Add Email | Remove Email |

## Application Information:

| Title of the Invention | Flow Tagging for Service Policy Implementation | | |
|---|---|---|---|
| Attorney Docket Number | RALEP046C2C1C1 | Small Entity Status Claimed | ☒ |
| Application Type | Nonprovisional | | |
| Subject Matter | Utility | | |
| Total Number of Drawing Sheets (if any) | 40 | Suggested Figure for Publication (if any) | |

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| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | RALEP046C2C1C1 |
|---|---|---|
| | Application Number | |
| Title of Invention | Flow Tagging for Service Policy Implementation | |

## Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

| Application number of the previously filed application | Filing date (YYYY-MM-DD) | Intellectual Property Authority or Country |
|---|---|---|
| | | |

## Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

## Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

| Please Select One: | ● Customer Number | US Patent Practitioner | ○ Limited Recognition (37 CFR 11.9) |
|---|---|---|---|
| Customer Number | 106963 | | |

## Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the "Application Number" field blank.

| Prior Application Status | Pending | | Remove |
|---|---|---|---|
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| thisapplication | Continuation of | 14339110 | 2014-07-23 |

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| **Application Data Sheet 37 CFR 1.76** | Attorney Docket Number | RALEP046C2C1C1 |
|---|---|---|
| | Application Number | |
| Title of Invention | Flow Tagging for Service Policy Implementation | |

| Prior Application Status | Patented | | | | Remove |
|---|---|---|---|---|---|
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 14339110 | Continuation of | 14338807 | 2014-07-23 | 9094311 | 2015-07-28 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 14338807 | Continuation of | 14098527 | 2013-12-05 | 9270559 | 2016-02-23 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 14098527 | Continuation of | 13374959 | 2012-01-24 | 8606911 | 2013-12-10 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 12695019 | 2010-01-27 | 8275830 | 2012-09-25 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 12695020 | 2010-01-27 | 8406748 | 2013-03-26 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 12694445 | 2010-01-27 | 8391834 | 2013-03-05 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 12694451 | 2010-01-27 | 8548428 | 2013-10-01 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 12694455 | 2010-01-27 | 8402111 | 2013-03-19 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 12695980 | 2010-01-28 | 8340634 | 2012-12-25 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 13229580 | 2011-09-09 | 8626115 | 2014-01-07 |

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|---|---|---|
| | Application Number | |
| Title of Invention | Flow Tagging for Service Policy Implementation | |

| Prior Application Status | Patented | | | | Remove |
|---|---|---|---|---|---|
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 13237827 | 2011-09-20 | 8832777 | 2014-09-09 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 13239321 | 2011-09-21 | 8898293 | 2014-11-25 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 13248028 | 2011-09-28 | 8924469 | 2014-12-30 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 13247998 | 2011-09-28 | 8725123 | 2014-05-13 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 13248025 | 2011-09-28 | 8924543 | 2014-12-30 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 13253013 | 2011-10-04 | 8745191 | 2014-06-03 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 13309556 | 2011-12-01 | 8893009 | 2014-11-18 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 13309463 | 2011-12-01 | 8793758 | 2014-07-29 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 13134028 | 2011-05-25 | 8589541 | 2013-11-19 |
| Prior Application Status | Expired | | | | Remove |

| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
|---|---|---|---|
| 13374959 | Claims benefit of provisional | 61435564 | 2011-01-24 |

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| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | RALEP046C2C1C1 |
|---|---|---|
| | Application Number | |
| Title of Invention | Flow Tagging for Service Policy Implementation | |

| Prior Application Status | Expired | | Remove |
|---|---|---|---|
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13374959 | Claims benefit of provisional | 61472606 | 2011-04-06 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13374959 | Claims benefit of provisional | 61550906 | 2011-10-24 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13374959 | Claims benefit of provisional | 61589830 | 2012-01-23 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 12695019 | Claims benefit of provisional | 61264126 | 2009-11-24 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 12695019 | Claims benefit of provisional | 61270353 | 2009-07-06 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 12695020 | Claims benefit of provisional | 61275208 | 2009-08-25 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 12695020 | Claims benefit of provisional | 61237753 | 2009-08-28 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 12694455 | Claims benefit of provisional | 61264120 | 2009-11-24 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61348022 | 2010-05-25 |

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| **Application Data Sheet 37 CFR 1.76** | Attorney Docket Number | RALEP046C2C1C1 |
|---|---|---|
| | Application Number | |
| Title of Invention | Flow Tagging for Service Policy Implementation | |

| Prior Application Status | Expired | | Remove |
|---|---|---|---|
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61381159 | 2010-09-09 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61381162 | 2010-09-09 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61384456 | 2010-09-20 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61389547 | 2010-10-04 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61385020 | 2010-09-21 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61387243 | 2010-09-28 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61387247 | 2010-09-28 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61407358 | 2010-10-27 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61418507 | 2010-12-01 |

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|---|---|---|
| | Application Number | |
| Title of Invention | Flow Tagging for Service Policy Implementation | |

| Prior Application Status | Expired | | Remove |
|---|---|---|---|
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61418509 | 2010-12-01 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61420727 | 2010-12-07 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61422565 | 2010-12-13 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61422572 | 2010-12-13 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61422574 | 2010-12-13 |
| Prior Application Status | Patented | | Remove |

| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
|---|---|---|---|---|---|
| 13134028 | Continuation in part of | 13134005 | 2011-05-25 | 8635335 | 2014-01-21 |
| Prior Application Status | Patented | | | | Remove |

| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
|---|---|---|---|---|---|
| 13134028 | Continuation in part of | 12695021 | 2010-01-27 | 8346225 | 2013-01-01 |
| Prior Application Status | Expired | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | | | Filing or 371(c) Date (YYYY-MM-DD) |
| 12695021 | Claims benefit of provisional | 61252151 | | | 2009-10-15 |
| Prior Application Status | Expired | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | | | Filing or 371(c) Date (YYYY-MM-DD) |
| 12695021 | Claims benefit of provisional | 61252153 | | | 2009-10-15 |

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|---|---|---|
| | Application Number | |
| Title of Invention | Flow Tagging for Service Policy Implementation | |

| Prior Application Status | Patented | | | | Remove |
|---|---|---|---|---|---|
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 12695021 | Continuation in part of | 12380780 | 2009-03-02 | 8839388 | 2014-09-16 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13134005 | Continuation in part of | 12380780 | 2009-03-02 | 8839388 | 2014-09-16 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13134005 | Continuation in part of | 12380778 | 2009-03-02 | 8321526 | 2012-11-27 |
| Prior Application Status | Expired | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) | | |
| 12380780 | Claims benefit of provisional | 61206354 | 2009-01-28 | | |
| Prior Application Status | Expired | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) | | |
| 12380780 | Claims benefit of provisional | 61206944 | 2009-02-04 | | |
| Prior Application Status | Expired | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) | | |
| 12380780 | Claims benefit of provisional | 61207393 | 2009-02-10 | | |
| Prior Application Status | Expired | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) | | |
| 12380780 | Claims benefit of provisional | 61207739 | 2009-02-13 | | |
| Prior Application Status | Expired | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) | | |
| 12380778 | Claims benefit of provisional | 61206354 | 2009-01-28 | | |
| Prior Application Status | Expired | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) | | |
| 12380778 | Claims benefit of provisional | 61206944 | 2009-02-04 | | |

| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | RALEP046C2C1C1 |
|---|---|---|
| | Application Number | |
| Title of Invention | Flow Tagging for Service Policy Implementation | |

| Prior Application Status | Expired | | Remove |
|---|---|---|---|
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 12380778 | Claims benefit of provisional | 61207393 | 2009-02-10 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 12380778 | Claims benefit of provisional | 61207739 | 2009-02-13 |
| Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. | | | Add |

## Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)[i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

| | | | Remove |
|---|---|---|---|
| Application Number | Country[i] | Filing Date (YYYY-MM-DD) | Access Code[i] (if applicable) |
| | | | |
| Additional Foreign Priority Data may be generated within this form by selecting the **Add** button. | | | Add |

## Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | RALEP046C2C1C1 |
|---|---|---|
| | Application Number | |
| Title of Invention | Flow Tagging for Service Policy Implementation | |

## Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

**NOTE**: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

**1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)**

**A. Priority Document Exchange (PDX)** - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

**B. Search Results from U.S. Application to EPO** - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

**2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)**

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

**NOTE:** Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

PTO/AIA/14 (11-15)
Approved for use through 04/30/2017. OMB 0651-0032
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| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | RALEP046C2C1C1 |
|---|---|---|
| | Application Number | |
| Title of Invention | Flow Tagging for Service Policy Implementation | |

## Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

**Applicant 1** Remove

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

| ● Assignee | Legal Representative under 35 U.S.C. 117 | Joint Inventor |
|---|---|---|
| Person to whom the inventor is obligated to assign. | Person who shows sufficient proprietary interest | |

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☒

| Organization Name | Headwater Partners I LLC |
|---|---|

**Mailing Address Information For Applicant:**

| **Address 1** | 1011 Pruitt Place | | |
|---|---|---|---|
| Address 2 | | | |
| **City** | Tyler | **State/Province** | TX |
| **Country** | US | Postal Code | 75703 |
| Phone Number | 903-201-6212 | Fax Number | |
| Email Address | patent@headwaterllc.com | | |

Additional Applicant Data may be generated within this form by selecting the Add button. Add

## Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

PTO/AIA/14 (11-15)
Approved for use through 04/30/2017. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | RALEP046C2C1C1 |
|---|---|---|
| | Application Number | |
| Title of Invention | Flow Tagging for Service Policy Implementation | |

**Assignee 1**

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

Remove

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

| Prefix | **Given Name** | Middle Name | **Family Name** | Suffix |
|---|---|---|---|---|
| | | | | |

**Mailing Address Information For Assignee including Non-Applicant Assignee:**

| | | | |
|---|---|---|---|
| **Address 1** | | | |
| Address 2 | | | |
| **City** | | **State/Province** | |
| **Country** i | | Postal Code | |
| Phone Number | | Fax Number | |
| Email Address | | | |

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button. Add

## Signature:

Remove

**NOTE:** This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

| **Signature** | /James E. Harris/ | | | Date (YYYY-MM-DD) | 2016-08-03 |
|---|---|---|---|---|---|
| First Name | James E. | Last Name | Harris | Registration Number | 40013 |

Additional Signature may be generated within this form by selecting the Add button. Add

PTO/AIA/14 (11-15)
Approved for use through 04/30/2017. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

| **Application Data Sheet 37 CFR 1.76** | Attorney Docket Number | RALEP046C2C1C1 |
|---|---|---|
| | Application Number | |
| Title of Invention | Flow Tagging for Service Policy Implementation | |

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NUMBER | FILING or 371(c) DATE | GRP ART UNIT | FIL FEE REC'D | ATTY.DOCKET.NO | TOT CLAIMS | IND CLAIMS |
|---|---|---|---|---|---|---|
| 15/227,814 | 08/03/2016 | 2414 | 930 | RALEP046C2C1C1 | 15 | 2 |

**CONFIRMATION NO. 2668**

106963
Headwater Partners I LLC
1011 Pruitt Place
Tyler, TX 75703

**FILING RECEIPT**

OC000000085148310

Date Mailed: 08/18/2016

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

**Inventor(s)**

Gregory G. Raleigh, Woodside, CA;
Jeffrey Green, Sunnyvale, CA;
James Lavine, Corte Madera, CA;
Vien-Phuong Nguyen, Newark, CA;

**Applicant(s)**

Headwater Partners I LLC, Tyler, TX;

**Power of Attorney:** The patent practitioners associated with Customer Number 106963

**Domestic Priority data as claimed by applicant**

This application is a CON of 14/339,110 07/23/2014
which is a CON of 14/338,807 07/23/2014 PAT 9094311
which is a CON of 14/098,527 12/05/2013 PAT 9270559
which is a CON of 13/374,959 01/24/2012 PAT 8606911
which is a CIP of 12/695,019 01/27/2010 PAT 8275830
and is a CIP of 12/695,020 01/27/2010 PAT 8406748
and is a CIP of 12/694,445 01/27/2010 PAT 8391834
and is a CIP of 12/694,451 01/27/2010 PAT 8548428
and is a CIP of 12/694,455 01/27/2010 PAT 8402111
and is a CIP of 12/695,980 01/28/2010 PAT 8340634
and is a CIP of 13/229,580 09/09/2011 PAT 8626115
and is a CIP of 13/237,827 09/20/2011 PAT 8832777
and is a CIP of 13/239,321 09/21/2011 PAT 8898293
and is a CIP of 13/248,028 09/28/2011 PAT 8924469
and is a CIP of 13/247,998 09/28/2011 PAT 8725123
and is a CIP of 13/248,025 09/28/2011 PAT 8924543

and is a CIP of 13/253,013 10/04/2011 PAT 8745191
and is a CIP of 13/309,556 12/01/2011 PAT 8893009
and is a CIP of 13/309,463 12/01/2011 PAT 8793758
and is a CIP of 13/134,028 05/25/2011 PAT 8589541
and claims benefit of 61/435,564 01/24/2011
and claims benefit of 61/472,606 04/06/2011
and claims benefit of 61/550,906 10/24/2011
and claims benefit of 61/589,830 01/23/2012
and said 12/695,019 01/27/2010
claims benefit of 61/264,126 11/24/2009
and claims benefit of 61/270,353 07/06/2009
and said 12/695,020 01/27/2010
claims benefit of 61/275,208 08/25/2009
and claims benefit of 61/237,753 08/28/2009
and said 12/694,455 01/27/2010
claims benefit of 61/264,120 11/24/2009
and said 13/248,028 09/28/2011 and said 13/134,028 05/25/2011
claims benefit of 61/348,022 05/25/2010
and said 13/134,028 05/25/2011
claims benefit of 61/381,159 09/09/2010
and claims benefit of 61/381,162 09/09/2010
and claims benefit of 61/384,456 09/20/2010
and claims benefit of 61/389,547 10/04/2010
and claims benefit of 61/385,020 09/21/2010
and claims benefit of 61/387,243 09/28/2010
and claims benefit of 61/387,247 09/28/2010
and claims benefit of 61/407,358 10/27/2010
and claims benefit of 61/418,507 12/01/2010
and claims benefit of 61/418,509 12/01/2010
and claims benefit of 61/420,727 12/07/2010
and claims benefit of 61/422,565 12/13/2010
and claims benefit of 61/422,572 12/13/2010
and claims benefit of 61/422,574 12/13/2010
and is a CIP of 13/134,005 05/25/2011 PAT 8635335
and is a CIP of 12/695,021 01/27/2010 PAT 8346225
which claims benefit of 61/252,151 10/15/2009
and claims benefit of 61/252,153 10/15/2009
and is a CIP of 12/380,780 03/02/2009 PAT 8839388
and said 13/134,005 05/25/2011
is a CIP of 12/380,780 03/02/2009 PAT 8839388
and said 13/134,005
is a CIP of 12/380,778 03/02/2009 PAT 8321526
and said 12/380,780
claims benefit of 61/206,354 01/28/2009
and claims benefit of 61/206,944 02/04/2009
and claims benefit of 61/207,393 02/10/2009
and claims benefit of 61/207,739 02/13/2009
and said 12/380,778 03/02/2009
claims benefit of 61/206,354 01/28/2009
and claims benefit of 61/206,944 02/04/2009
and claims benefit of 61/207,393 02/10/2009

and claims benefit of 61/207,739 02/13/2009

**Foreign Applications** for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
*Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.*

**Permission to Access Application via Priority Document Exchange:** Yes

**Permission to Access Search Results:** Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

**If Required, Foreign Filing License Granted:** 08/16/2016

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 15/227,814**

**Projected Publication Date:** 11/24/2016

**Non-Publication Request:** No

**Early Publication Request:** No
**** SMALL ENTITY ****
**Title**

Mobile Device and Method Attributing Media Services Network Usage to Requesting Application

**Preliminary Class**

370

**Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:** No

## PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application

serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

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## Title 35, United States Code, Section 184

## Title 37, Code of Federal Regulations, 5.11 & 5.15

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The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

**NOT GRANTED**

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 28505222 |
| **Application Number:** | 15227814 |
| **International Application Number:** | |
| **Confirmation Number:** | 2668 |
| **Title of Invention:** | Mobile Device and Method Attributing Media Services Network Usage to Requesting Application |
| **First Named Inventor/Applicant Name:** | Gregory G. Raleigh |
| **Customer Number:** | 106963 |
| **Filer:** | James E. Harris/Ann Taylor |
| **Filer Authorized By:** | James E. Harris |
| **Attorney Docket Number:** | RALEP046C2C1C1 |
| **Receipt Date:** | 01-MAR-2017 |
| **Filing Date:** | 03-AUG-2016 |
| **Time Stamp:** | 16:25:47 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| Submitted with Payment | no |
|---|---|

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Request for Corrected Filing Receipt | P046C2C1C1_Request.pdf | 772498<br>4ffd6712b6b06b77932c092a7bb4b37bcb73b931 | no | 20 |

**Warnings:**

| Information: | |
|---|---|
| Total Files Size (in bytes): | 772498 |

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**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (03-15)
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| **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** ( **Not for submission under 37 CFR 1.99)** | | |
|---|---|---|
| | Application Number | 15227814 |
| | Filing Date | 2016-08-03 |
| | First Named Inventor | Gregory G. Raleigh |
| | Art Unit | 2476 |
| | Examiner Name | Moutaouakil, Mounir |
| | Attorney Docket Number | RALEP046C2C1C1 |

**U.S.PATENTS** Remove

| Examiner Initial* | Cite No | Patent Number | Kind Code[1] | Issue Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|---|
| | 1 | 6115823 | A | 2000-09-05 | Velasco et al. | |
| | 2 | 7203721 | B1 | 2007-04-10 | Ben-Efraim et al. | |
| | 3 | 7219123 | B1 | 2007-05-15 | Fiechter et al. | |
| | 4 | 7505795 | B1 | 2009-03-17 | Lim et al. | |
| | 5 | 9326173 | B2 | 2016-04-26 | Luft, Achim | |

If you wish to add additional U.S. Patent citation information please click the Add button. Add

**U.S.PATENT APPLICATION PUBLICATIONS** Remove

| Examiner Initial* | Cite No | Publication Number | Kind Code[1] | Publication Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|---|
| | 1 | 20090065571 | A1 | 2009-03-12 | Jain, Deepak | |

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**FOREIGN PATENT DOCUMENTS** Remove

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | Application Number | 15227814 |
| | Filing Date | 2016-08-03 |
| | First Named Inventor | Gregory G. Raleigh |
| | Art Unit | 2476 |
| | Examiner Name | Moutaouakil, Mounir |
| | Attorney Docket Number | RALEP046C2C1C1 |

| Examiner Initial* | Cite No | Foreign Document Number[3] | Country Code[2] i | Kind Code[4] | Publication Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear | T[5] |
|---|---|---|---|---|---|---|---|---|
| | 1 | | | | | | | |

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**NON-PATENT LITERATURE DOCUMENTS** Remove

| Examiner Initials* | Cite No | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published. | T[5] |
|---|---|---|---|
| | 1 | | |

If you wish to add additional non-patent literature document citation information please click the Add button Add

**EXAMINER SIGNATURE**

| Examiner Signature | | Date Considered | |
|---|---|---|---|

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | Application Number | 15227814 |
| | Filing Date | 2016-08-03 |
| | First Named Inventor | Gregory G. Raleigh |
| | Art Unit | 2476 |
| | Examiner Name | Moutaouakil, Mounir |
| | Attorney Docket Number | RALEP046C2C1C1 |

**CERTIFICATION STATEMENT**

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

**OR**

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

**SIGNATURE**

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

| Signature | /James E. Harris/ | Date (YYYY-MM-DD) | 2017-02-08 |
|---|---|---|---|
| Name/Print | James E. Harris | Registration Number | 40013 |

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

| Electronic Patent Application Fee Transmittal | | | | | |
|---|---|---|---|---|---|
| **Application Number:** | 15227814 | | | | |
| **Filing Date:** | 03-Aug-2016 | | | | |
| **Title of Invention:** | Mobile Device and Method Attributing Media Services Network Usage to Requesting Application | | | | |
| **First Named Inventor/Applicant Name:** | Gregory G. Raleigh | | | | |
| **Filer:** | James E. Harris/Ann Taylor | | | | |
| **Attorney Docket Number:** | RALEP046C2C1C1 | | | | |
| Filed as Small Entity | | | | | |
| **Filing Fees for Utility under 35 USC 111(a)** | | | | | |
| **Description** | | **Fee Code** | **Quantity** | **Amount** | **Sub-Total in USD($)** |
| **Basic Filing:** | | | | | |
| **Pages:** | | | | | |
| **Claims:** | | | | | |
| **Miscellaneous-Filing:** | | | | | |
| **Petition:** | | | | | |
| **Patent-Appeals-and-Interference:** | | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | | |
| **Extension-of-Time:** | | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Miscellaneous:** | | | | |
| SUBMISSION- INFORMATION DISCLOSURE STMT | 2806 | 1 | 90 | 90 |
| | | **Total in USD ($)** | | **90** |

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 28303791 |
| **Application Number:** | 15227814 |
| **International Application Number:** | |
| **Confirmation Number:** | 2668 |
| **Title of Invention:** | Mobile Device and Method Attributing Media Services Network Usage to Requesting Application |
| **First Named Inventor/Applicant Name:** | Gregory G. Raleigh |
| **Customer Number:** | 106963 |
| **Filer:** | James E. Harris/Ann Taylor |
| **Filer Authorized By:** | James E. Harris |
| **Attorney Docket Number:** | RALEP046C2C1C1 |
| **Receipt Date:** | 08-FEB-2017 |
| **Filing Date:** | 03-AUG-2016 |
| **Time Stamp:** | 16:54:44 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | DA |
| Payment was successfully received in RAM | $90 |
| RAM confirmation Number | 020917INTEFSW00003641505876 |
| Deposit Account | |
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## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Information Disclosure Statement (IDS) Form (SB08) | P046C2C1C1_IDS.pdf | 1053873<br>fbcf7ff87f19aa5444ed56e9ea6d1fcf70009047 | no | 4 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Fee Worksheet (SB06) | fee-info.pdf | 31049<br>13d2c10ef355f3fa5814ddef60173ce8074f05b3 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 1084922 | | |

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**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

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# IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

| | | | |
|---|---|---|---|
| In re Application of: | Raleigh et al. | Examiner: | Moutaouakil, Mounir |
| Serial No.: | 15/227,814 | Art Unit: | 2476 |
| Filed: | August 3, 2016 | Conf. No.: | 2668 |
| Title: | Mobile Device and Method Attributing Media Services Network Usage to Requesting Application | | |

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

## AMENDMENT AND RESPONSE

In response to the Office Action dated October 26, 2016, the no-fee deadline for response being January 26, 2017, please amend the above-identified application as follows:

**Amendments to the Claims** begin on page 2.

**Remarks** begin on page 9.

AMENDMENTS TO THE CLAIMS

Without prejudice and without surrender of any subject matter, please amend the claims as follows:

1. (Canceled).

2. (Currently Amended) A wireless end-user device, comprising:

a wireless modem configurable to connect to a wireless network;

a network stack configurable to receive and transmit data via the wireless modem and the wireless network;

a first network stack Application Programming Interface (API), containing at least one first call ~~to allow~~ accessible to each of a plurality of device applications, the first network stack API callable by each of the plurality of device applications to open and use data packet flows via the network stack, the wireless modem, and the at least one wireless network;

a second API containing at least one second call ~~to allow~~ accessible to each of the plurality of device applications, the second API callable by each of the plurality of device applications to make a data transfer request for a media object associated with a network resource identifier supplied by the calling device application;

a media service manager prompted by the second call, to manage network data transfers for the media object by interfacing with the network stack to retrieve the media object associated with the network resource identifier via the wireless modem and the wireless network; and

[[a]] one or more service classification and measurement agents to associate wireless network data usage for the media object network data transfers with the device application that requests the data transfer for the media object, to associate wireless network data usage for respective data packet flows opened and used via the first network stack API with the device application opening such respective data packet flow, and to reconcile wireless network data usage for each of the plurality of device applications to track an aggregate wireless network data usage attributable to each of the plurality of device applications via both the first network stack API and the second API.

3. (Canceled).

4. (Currently Amended) The wireless end-user device of claim 2, wherein to associate wireless network data usage for the media object network data transfers with the device application that makes the data transfer request for the media object comprises to identify at least one of an application name, an application identifier, or a process identifier for the application that makes the data transfer request.

5. (Previously Presented) The wireless end-user device of claim 4, wherein the data transfer request comprises a network resource identifier that identifies a source of the data to be transferred, a proxy to the source of the data to be transferred, or the media object to be transferred, in particular, wherein the network resource identifier comprises one or more of an Internet Protocol address, a Uniform Resource Locator, a remote file name/address, a stream name, and an object name.

6. (Currently Amended) The wireless end-user device of claim 5, wherein to associate wireless network data usage for the media object network data transfers with the device application that makes the data transfer request for the media object further comprises to store an entry comprising the at least one of the application name, the application identifier, or the process identifier for each of the device applications that makes a data transfer request, each stored entry further comprising information about the corresponding network resource identifier for the data transfer request.

7. (Currently Amended) The wireless end-user device of claim 6, wherein the one or more service classification and measurement agents includes a requesting application storing function within the media services manager.

8. (Previously Presented) The wireless end-user device of claim 7, wherein the media service manager is a first media service manager and the requesting application storing function is a first requesting application storing function, the device further comprising a second media service manager of a different type than the first media service manager, the service classification agent including a second requesting application storing function within the second media service manager.

9. (Currently Amended) The wireless end-user device of claim 8, further comprising ~~a usage and classification reconciliation agent and~~ a usage and classification database, the one or more service classification and measurement agents ~~usage and classification reconciliation agent~~ to receive application association information stored by the first and second requesting application

storing functions, and to maintain the usage and classification database based in part on the received application association information.

10. (Currently Amended) The wireless end-user device of claim 5, wherein to manage network data transfers for the media object by interfacing with the at least one network stack comprises to map the data transfer request and network resource identifier to one or more data flow connections communicated through the device network[[ing]] stack.

11. (Previously Presented) The wireless end-user device of claim 2, further comprising a media player and a user interface, wherein the media object comprises media data that is, as a result of the media service manager management of network data transfers for the media object, received by the device and played by the media player through the user interface.

12. (Currently Amended) The wireless end-user device of claim 11, the media service manager ~~function~~ to receive, from the application launching the data transfer request, a network resource indicator that identifies the media object,

return to the application a media object handle descriptor,

call a proxy service to perform one or more network data transfers comprising the media object,

accept, from the application, commands associated with the media object handle descriptor, and

control playback of the media data by the media player based on the commands.

13. (Currently Amended) The wireless end-user device of claim 2, wherein the one or more service classification and measurement agents comprise[[s]]:

a requesting application storage agent to, for each device application that makes a data transfer request using the second API, store application identification information and network resource identification information;

a network data flow storage agent to, for each network data flow associated with the media service manager, identify network data flow identification information; and

an association agent to match the network data flow identification information for a network data flow with application identification information for the network data transfer associated with the network data flow.

14. (Previously Presented) The wireless end-user device of claim 2, further comprising:

a local database to store data usage, including data usage for network data transfers managed by the media service manager on behalf of a device application, the stored data usage classified by device application;

a user interface; and

a user interface display agent to display the data usage classified by application to a user.

15. (Currently Amended) The wireless end-user device of claim 2, the one or more service classification and measurement agents to further associate one or more traffic flows, comprising the media object network data transfers, with the device application that makes the data transfer request, the device further comprising an enforcement agent to, based on the association between the one or more traffic flows and the device application, enforce an application-based usage control on network data usage by one or more of the device applications.

16. (Currently Amended) A method of operating a wireless end-user device when connected via a wireless modem to a wireless network, the method comprising:

operating a first network stack Application Programming Interface (API), containing at least one first call ~~that allows~~ accessible to each of a plurality of device applications, the first network stack API callable by each of the plurality of device applications to open and use data flows via a network stack coupled to the wireless modem;

operating a second API containing at least one second call ~~that allows~~ accessible to each of the plurality of device applications, the second API callable by each of the plurality of device applications to make a data transfer request for a media object associated with a network resource identifier supplied by the calling device application;

operating a media service manager prompted by the second call, the media service manager managing network data transfers for the media object by interfacing with the network stack to retrieve the media object associated with the network resource identifier via the wireless modem and the wireless network; and

associating wireless network data usage for the media object network data transfers with the device application that requests the data transfer for the media object, associating wireless network data usage for respective data packet flows opened and used via the first network stack API with the device application opening such respective data packet flow, and reconciling wireless network data usage for each of the plurality of device applications to track an aggregate wireless network data

usage attributable to each of the plurality of device applications via both the first network stack API and the second API.

17. (New) A wireless end-user device, comprising:

a wireless modem configurable to connect to a wireless network;

a network stack configurable to receive and transmit data via the wireless modem and the wireless network;

a first network stack Application Programming Interface (API), containing at least one first call to allow device applications to open and use data flows via the network stack, the wireless modem, and the at least one wireless network;

a second API containing at least one second call to allow device applications to make a data transfer request for a media object associated with a network resource identifier supplied by the device application, wherein the data transfer request comprises a network resource identifier that identifies a source of the data to be transferred, a proxy to the source of the data to be transferred, or the media object to be transferred, in particular, wherein the network resource identifier comprises one or more of an Internet Protocol address, a Uniform Resource Locator, a remote file name/address, a stream name, and an object name;

a media service manager prompted by the second call, to manage network data transfers for the media object by interfacing with the network stack to retrieve the media object associated with the network resource identifier via the wireless modem and the wireless network; and

a service classification agent to associate wireless network data usage for the media object network data transfers with the device application that requests the data transfer for the media object, wherein to associate data usage for the media object network data transfers with the device application that makes the data transfer request for the media object comprises to identify and store at least one of an application name, an application identifier, or a process identifier for the application that makes the data transfer request, each stored entry further comprising information about the corresponding network resource identifier for the data transfer request.

18. (New) The wireless end-user device of claim 17, wherein the service classification agent includes a requesting application storing function within the media services manager.

19. (New) The wireless end-user device of claim 18, wherein the media service manager is a first media service manager and the requesting application storing function is a first requesting application storing function, the device further comprising a second media service manager of a different type than the first media service manager, the service classification agent including a second requesting application storing function within the second media service manager.

20. (New) The wireless end-user device of claim 19, further comprising a usage and classification reconciliation agent and a usage and classification database, the usage and classification reconciliation agent to receive application association information stored by the first and second requesting application storing functions, and to maintain the usage and classification database based in part on the received application association information.

21. (New) A wireless end-user device, comprising:

a wireless modem configurable to connect to a wireless network;

a network stack configurable to receive and transmit data via the wireless modem and the wireless network;

a first network stack Application Programming Interface (API), containing at least one first call to allow device applications to open and use data flows via the network stack, the wireless modem, and the at least one wireless network;

a second API containing at least one second call to allow device applications to make a data transfer request for a media object associated with a network resource identifier supplied by the device application, wherein the data transfer request comprises a network resource identifier that identifies a source of the data to be transferred, a proxy to the source of the data to be transferred, or the media object to be transferred, in particular, wherein the network resource identifier comprises one or more of an Internet Protocol address, a Uniform Resource Locator, a remote file name/address, a stream name, and an object name;

a media service manager prompted by the second call, to manage network data transfers for the media object by interfacing with the network stack to retrieve the media object associated with the network resource identifier via the wireless modem and the wireless network, wherein to manage network data transfers for the media object by interfacing with the at least one network stack comprises to map the data transfer request and network resource identifier to one or more data flow connections communicated through the device networking stack; and

a service classification agent to associate wireless network data usage for the media object network data transfers with the device application that requests the data

transfer for the media object, wherein to associate data usage for the media object network data transfers with the device application that makes the data transfer request for the media object comprises to identify at least one of an application name, an application identifier, or a process identifier for the application that makes the data transfer request.

## REMARKS

Claims 2-16 were pending, with claims 2-5, 11, and 13-16 rejected by the Office Action dated October 26, 2016, and claims 6-10 and 12 objected to. Claim 1 was previously canceled. Applicant has amended claims 2, 4, 6, 7, 9, 10, 12, 13, 15, and 16 herein, canceled claim 3, and added new claims 17-21 to place prior claims 6 and 10 in independent form and duplicate the prior claim 6 dependent claims as new claims 18-20, depending from new claim 17. In view of the claim amendments and the following remarks, Applicant respectfully requests reconsideration.

### Claim Amendment Overview

Applicant has amended prior independent claims 2 and 16 to clarify that plural device applications can call both APIs (see Figure 32), and to add further operational concepts of the service classification and measurement agent(s), previously found in claim 3 and the description of, e.g., Figure 35, detailing a solution for classifying and measuring application network data usage when the applications have multiple ways to access network data flows, including at least one way in which the application is itself not an endpoint for flows it requests.

Applicant has carefully reviewed and amended the prior dependent claims to maintain antecedent basis with amended claim 2.

Prior claims 6 and 10 were objected to as each dependent on rejected base claims 2, 4, and 5, but allowable if rewritten in independent form. New claims 17 and 21 represent, respectively, claims 6 and 10 rewritten in independent form. New claims 18-20 depend from claim 17, and mirror prior claims 7-9.

No new matter has been added. The application continues to have no more than 4 independent claims and no more than 30 total claims, and remains eligible for expedited prosecution.

Claim Rejections – 35 U.S.C. § 102

In section 3, the Office Action rejected claims 2-4, 11, and 13-16 under 35 U.S.C. § 102(e) as being unpatentable over U.S. 8,402,165 to Deu-Ngoc (hereinafter, "Deu-Ngoc"). Applicant respectfully traverses the rejection on the grounds that Deu-Ngoc fails to disclose all elements of any rejected claim.

Deu-Ngoc addresses a problem for mobile devices having applications that require different packet data sessions to different APNs (in order to reach different network "communication services"). When operated in a network that limits the number of simultaneous connections to different APNs, the operation of one application may preclude the network connectivity of another application that needs a different APN. Deu-Ngoc proposes a solution to this problem, where different priorities are established for different applications/APNs. A lower-priority application may temporarily displace the APN of a higher-priority application, but after a set period of network inactivity, the APN of the higher-priority application is reestablished.

Deu-Ngoc fails to disclose that the mobile device has both a first network stack API available to applications, that allows the applications to open and use data packet flows via a network stack, and a second API available to the applications, and that allows the applications to make a data transfer request for a media object, with the network data transfers for that media object being managed not by the application, but by a media service manager that interfaces with the network stack. (Note that Applicant has amended claims 2 and 16 to further clarify that both APIs are available to a common group of applications). Deu-Ngoc is silent as to any API constructs present on the device—it is just assumed in the reference that applications can access the network when Deu-Ngoc's priority system allows them to reach an APN that is useful. The Office Action identifies as the first API "a voice telephony application;" Applicant cannot identify in the reference any teachings that a "voice telephony application" is a network stack API accessible to a plurality of device applications and callable by those applications to open and use data packet flows via the stack and modem. The Office Action's identification of a second API is not understood to disclose an API at all, and Applicant cannot identify in the reference any teachings of a second API callable by the plurality of device applications to make a data transfer request for a media object (to be handled by a media service manager).

Deu-Ngoc also fails to disclose a media service manager prompted by the second call, to manage network data transfers for the media object. The Office Action identifies the "Controller 106" of Deu-Ngoc, but this is merely the processor of the mobile device. Unless that processor is disclosed as providing the media service manager elements of the claim (something that Applicant has been unable to locate in the reference), it fails to provide anticipatory support for the claim element. Again, the reference provides no details as to APIs or underlying mechanisms for opening and using flows via a network stack.

The Office Action further states that "it is inherent that each application, in smart phone, is associated with its own ID which is used to exchanged data, for example: Skype, gmail, google voice, Hotmail, Viber, Vonage…)." Applicant disagrees with this statement, as inherency requires that something necessarily happen. Clearly, one case is already present which violates this statement, as Applicant's second API and media service manager allow a data exchange wherein the requesting application is not involved with the network data transfers and thus "its own ID" is not used inherently to exchange data. Deu-Ngoc completely fails to discuss an intermediary to interface with a network stack on behalf of an application and handle a data flow.

Deu-Ngoc associates different APNs with different applications, but there is no mention of associating wireless network data usage for media object network data transfers with requesting device applications. Deu-Ngoc comprehends that multiple APNs can be active simultaneously (see, e.g., col. 13, ll. 35-41), but never suggests that data usage is tracked or associated as claimed. Further, even if Deu-Ngoc would have disclosed a media service manager, according to the teachings of Deu-Ngoc that media service manager would have one APN, with no mention of classifying network data transfers over a single APN based on which application called the media service manager.

Although not required to distinguish claims 2 and 16 from Deu-Ngoc, Applicant has elected to include several other concepts, each of which further distinguish from Deu-Ngoc. First, a concept previously found in claim 3, the association of data usage for each data packet flow opened and used via the first network stack API with the device application opening that data packet flow, is now in claims 2 and 16. As addressed in the preceding paragraph, Deu-Ngoc

is silent as to data usage. Second, Applicant has added the concept of reconciling data usage for each of the applications to track wireless network data usage attributable to each application via both APIs. Deu-Ngoc is silent as to aggregating data usage per application, much less data usage via multiple APIs as claimed.

Accordingly, Deu-Ngoc fails to disclose all elements of claim 2 or 16. Applicant requests that the rejection be withdrawn as to claims 2-4, 11, and 13-16. Further, the dependent claims contain further patentable concepts not found in Deu-Ngoc. For instance, claim 4 describes identifying each media object network data transfer with an application name, an application identifier, or a process identifier for the application making the request. In contrast, Deu-Ngoc merely associates an APN with the application using the APN (and not whatever application may have requested a media object network data transfer being associated with that data transfer). As to claim 13, Deu-Ngoc fails to describe the second API, nor the different tracking elements of claim 13 that allow network data flows with applications that did not participate in those flows. Applicant cannot locate in Deu-Ngoc any disclosure of a data usage database or display agent to display data usage classified by application, as recited in claim 14. Claim 15 recites an enforcement agent that enforces a network data usage control on an application, for traffic flows conducted by the media service manager and associated with that application. Deu-Ngoc contains no such agent—to Applicant's understanding, Deu-Ngoc merely controls available APNs based on a priority, with no network data usage control.

Claim Rejections – 35 U.S.C. § 103

In section 14, the Office Action rejected claim 5 under 35 U.S.C. § 103(a) as being unpatentable over Deu-Ngoc in view of U.S. 2014/0241342 to Constantinof (hereinafter, "Constantinof"). Applicant respectfully traverses the rejection on the grounds that the combination of Deu-Ngoc and Constantinof fails to disclose all elements of claim 5, and therefore fails to support a *prima facie* case of obviousness for claim 5.

Constantinof discloses a SIP proxy reachable by a URL. A user agent contacts the SIP proxy to set up a call with a remote user agent identified in a SIP request. Applicant fails to see how this pertains to a data transfer request for some entity other than the first user agent, which presumably manages its own session. Further, Constantinof does not appear to cure any of the

deficiencies noted above regarding Deu-Ngoc and parent claims 2 and 4. Accordingly, Applicant respectfully requests that this rejection be withdrawn.

## CONCLUSION

Applicant respectfully requests entry of these amendments as provided herein. The application is believed to be in condition for allowance, and a Notice of Allowance is hereby respectfully requested. If the Examiner has any questions or needs any additional information, the Examiner is invited to contact the undersigned.

The Commissioner is authorized to charge any fee deficiency or credit any overpayment to Deposit Account 50-5876.

Respectfully submitted,

Date: January 25, 2017

By: /James E. Harris/

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CERTIFICATE OF ELECTRONIC TRANSMISSION

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being filed electronically via EFS-Web addressed to the Commissioner for Patents on:

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Ann Taylor

# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | 15227814 |
| **Filing Date:** | 03-Aug-2016 |
| **Title of Invention:** | Mobile Device and Method Attributing Media Services Network Usage to Requesting Application |
| **First Named Inventor/Applicant Name:** | Gregory G. Raleigh |
| **Filer:** | James E. Harris/Ann Taylor |
| **Attorney Docket Number:** | RALEP046C2C1C1 |

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**Filing Fees for Utility under 35 USC 111(a)**

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| INDEPENDENT CLAIMS IN EXCESS OF 3 | 2201 | 1 | 210 | 210 |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |

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| | | **Total in USD ($)** | | **300** |

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|---|---|
| **EFS ID:** | 28178568 |
| **Application Number:** | 15227814 |
| **International Application Number:** | |
| **Confirmation Number:** | 2668 |
| **Title of Invention:** | Mobile Device and Method Attributing Media Services Network Usage to Requesting Application |
| **First Named Inventor/Applicant Name:** | Gregory G. Raleigh |
| **Customer Number:** | 106963 |
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| **Attorney Docket Number:** | RALEP046C2C1C1 |
| **Receipt Date:** | 26-JAN-2017 |
| **Filing Date:** | 03-AUG-2016 |
| **Time Stamp:** | 15:17:58 |
| **Application Type:** | Utility under 35 USC 111(a) |

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## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
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| 1 | Information Disclosure Statement (IDS) Form (SB08) | P046C2C1C1_IDS.pdf | 1056006<br>156a3475d9cacf93984e79604242a9ffd609269b | no | 11 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Foreign Reference | 2084.pdf | 1397656<br>9e6a8957ad2e807f979431120ddbd1741e2acde7 | no | 57 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Foreign Reference | 2085.pdf | 441333<br>e8defb411cdca2f87d3c0c97eae168e0c2960826 | no | 19 |
| **Warnings:** | | | | | |
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| 4 | Foreign Reference | 2086.pdf | 232424<br>fbefdfe44bda45a08d0dfa2e2b40b5d0f577f976 | no | 29 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 5 | Foreign Reference | 2087.pdf | 922375<br>5370f148f48d4def4ad535f2c2b1762f0ca57119 | no | 47 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 6 | Foreign Reference | 2088.pdf | 255944<br>b4b8ef7ddc1f98c4716aaed35917fdb84c9be0fa | no | 18 |
| **Warnings:** | | | | | |
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| 7 | Foreign Reference | 2089.pdf | 172902<br>9025822de8f174376f282787af6b3524407be5db | no | 13 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 8 | Foreign Reference | 2090.pdf | 643809<br>f84e3fb9347dd0d758241de1f737fa384a62bebe | no | 38 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 9 | Foreign Reference | 2091.pdf | 4030163<br>9f5a695d3972f432ff9791f8b2ac99ef7cbca74d | no | 16 |
| **Warnings:** | | | | | |
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| 10 | Foreign Reference | 2092.pdf | 2382529<br>5c57dc228f491cd9301830aad5e4493f4c99b261 | no | 12 |
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| **Information:** | | | | | |
| 11 | | P046C2C1C_OAR.pdf | 133470<br>dc9d58df6fdafeb100ad1609e043f283c91cca6c | yes | 14 |

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| Claims | 2 | 8 |
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| 12 | Fee Worksheet (SB06) | fee-info.pdf | 32643<br>3a78091e5d5c47100d097becb3bd315849c03521 | no | 2 |
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|---|---|
| Application Number | 15227814 |
| Filing Date | 2016-08-03 |
| First Named Inventor | Gregory G. Raleigh |
| Art Unit | 2476 |
| Examiner Name | Moutaouakil, Mounir |
| Attorney Docket Number | RALEP046C2C1C1 |

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| | Filing Date | 2016-08-03 |
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| | Attorney Docket Number | RALEP046C2C1C1 |

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| | Attorney Docket Number | RALEP046C2C1C1 |

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| | Attorney Docket Number | RALEP046C2C1C1 |

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| | Attorney Docket Number | RALEP046C2C1C1 |

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| | Attorney Docket Number | RALEP046C2C1C1 |

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| | Application Number | 15227814 |
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| | Examiner Name | Moutaouakil, Mounir |
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| | Attorney Docket Number | RALEP046C2C1C1 |

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| | Examiner Name | Moutaouakil, Mounir |
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| Signature | /James E. Harris/ | Date (YYYY-MM-DD) | 2017-01-26 |
|---|---|---|---|
| Name/Print | James E. Harris | Registration Number | 40013 |

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60/313,968 21 August 2001 (21.08.2001) US

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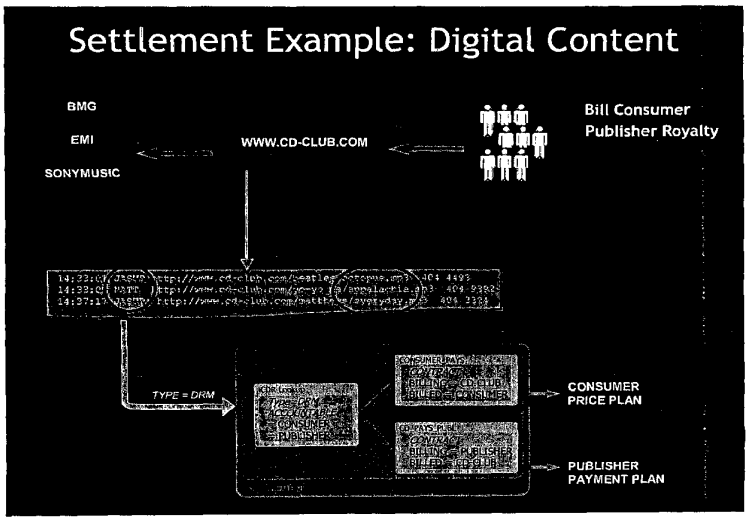
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(54) Title: SETTLEMENT OF TRANSACTIONS SUBJECT TO MULTIPLE PRICING PLANS____




(57) Abstract: The invention includes a method, system, and computer-readable medium having computer-executable instructions for rating a transaction. The inventive method includes processing a transaction, where the transaction is processed when a service is provided from a service provider to a service consumer, accessing via a computer network multiple pricing plans related to the transaction, and rating the transaction in accordance with the multiple pricing plans. The method further may include receiving output states from at least one pricing plan. The rating may be accomplished within one pricing plan, or within a group of pricing plans.

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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

# SETTLEMENT OF TRANSACTIONS SUBJECT TO MULTIPLE PRICING PLANS

## Cross Reference to Related Applications

This application claims priority under 35 U.S.C. § 119 (e) from provisional application no. 60/313,968 filed August 21, 2001. The provisional application 60/313,968 is incorporated by reference herein, in its entirety, for all purposes.

## Technical Field

The invention relates generally to the processing of data, and more particularly to efficiently and generically aggregating data available on a communication network and billing/paying multiple parties for access to the content of the aggregated data.

## Background of the Invention

Recently, the collection and processing of data transmitted over communication networks, like the Internet, has moved to the forefront of business objectives. In fact, with the advent of the Internet, new revenue generating business models have been created to account for the consumption of content received from a data network (*i.e.*, content-based billing). For example, content distributors, application service providers (ASPs), Internet service providers (ISPs), and wireless Internet providers have realized new opportunities based on the value of the content that they deliver. As a result of this content-billing initiative, it has become increasingly important to resolve intelligently and flexibly the corresponding transactions according to the business needs of the customer.

Often, even in traditional commerce streams, there are many different participants between the maker and the consumer of the good. Some of these so-called "middlemen" simply may facilitate access to the good, while others may add useful characteristics to the good. This is especially true in a distributed network environment, like the Internet, that impose additional burdens on capturing the

transaction process because of the unlimited number of data sources and the correspondingly unlimited number of data types. As a result, adequately describing the transacting of the goods and services in such an environment, or even across any of the traditional environments requires a technique that is capable of understanding and processing the participants and the various types of data.

To date, resolving the characteristics of a transaction has been accomplished over data-specific environments using certain application-specific (*i.e.*, "non-generic") methods. For example, a typical telephone bill captures the characteristics of a voice-based telecommunications transaction. In particular, the participants may be identified as the party initiating the call (*i.e.*, the "calling party" telephone number), the party receiving the call (*i.e.*, the "called party" telephone number), and one or more parties connecting the communication (*i.e.*, the "local" or "long distance carrier"). This simple example adequately captures all of the necessary aspects of the telephone call to properly account for the transaction by requiring payment from certain parties (*e.g.*, the calling and/or the called party) to certain other parties (*e.g.*, the local and/or long distance carrier). While these "hard-coded" transaction resolution techniques are sufficient to accommodate only specific environments involving well-defined participants, they are correspondingly too rigid to efficiently satisfy the ever-changing face of a communication network like the Internet. Also, these "hard-coded" techniques are too specific to operate across the many and varied transaction environments that exist throughout the business world.

Therefore, there exists a need to provide a flexible technique that can capture and resolve transactions of any type and involving any participants without requiring modification of the technique for each type. Such a technique would serve to accommodate multi-faceted network environments like the Internet, as well as to provide a single solution that would apply to any business environment.

## Summary of the Invention

The invention includes a method, system, and computer-readable medium having computer-executable instructions for rating a transaction. The inventive

method includes processing a transaction, where the transaction is processed when a service is provided from a service provider to a service consumer, accessing via a computer network multiple pricing plans related to the transaction, and rating the transaction in accordance with the multiple pricing plans. The method further may include receiving output states from at least one pricing plan. The rating may be accomplished within one pricing plan, or within a group of pricing plans. Also, accessing the multiple pricing plans may be accomplished via interconnected building blocks located within each of the pricing plans. The method also may include a revenue fold that summarizes the output of multiple pricing plans, including child and parent accounts. Selection of the appropriate child accounts may be a function of end dates that are within a parent account's time period. The method further may pool revenue/usage data as a function of billing cycles, and update the pooled revenue/usage data by summing the values of data from selected account plan periods. Values of the pooled revenue/usage data may be obtained via a building block. The inventive method also may determine a commission, wherein the commission is a credit given to an account.

## Brief Description of the Drawings

Other features of the invention are further apparent from the following detailed description of the embodiments of the invention taken in conjunction with the accompanying drawings, of which:

Figure 1 is a block diagram of a system for analyzing content transmitted over a communication network, according to the invention;

Figure 2 is a block diagram further describing the components of the system described in Figure 1;

Figures 3A and 3B provide a flow diagram further detailing the operation the system described in Figure 1;

Figure 4 provides a block diagram of the system described in Figure 1, providing greater detail of a configuration and operation of a transaction layer;

Figures 5A and 5B provide a flow diagram of a method for identifying the characteristics of a transaction, according to the invention;

Figure 6 is a block diagram further detailing the operation and configuration of the transaction layer, according to the invention;

Figure 7 is a flow diagram that details the operation and configuration of the transaction layer of transaction layer, according to the invention;

Figure 8 illustrates a sample settlement scenario for settling the fees associated with the download of certain content;

Figure 9 illustrates a general system description of settlement technologies useful in accordance with the invention to accommodate multiple aggregation of usage, multiple ownership of content, and multiple settlement options;

Figure 10 illustrates a settlement example for digital music downloaded by a consumer from an on-line music club that implements a pricing plan to the consumer and a publisher payment plan using the settlement techniques of the invention;

Figure 11 illustrates a transaction pricing usage based settlement model for use in settling low volume, high value transactions;

Figure 12 illustrates a billing cycle pricing, usage based settlement model for use in settling high volume, low value transactions;

Figure 13 illustrates a revenue sharing settlement using folds in accordance with a first embodiment of the invention;

Figure 14 illustrates a revenue sharing settlement using revenue/usage pools in accordance with a second embodiment of the invention;

Figure 15 illustrates a revenue pool contribution example for the embodiment of Figure 14;

Figure 16 illustrates a revenue pool accessor example for the embodiment of Figure 14;

Figure 17 illustrates a revenue sharing settlement using commissions in accordance with a third embodiment of the invention;

Figure 18 provides an example of computing revenue fold;

Figure 19 illustrates how accounts and pools with different billing cycles contribute to and access from pool instances; and

Figure 20 provides an example of how an account with billing period ending will get one commission from account.

## Detailed Description of the Invention

System Overview

Figure 1 is a block diagram of a system 100 for analyzing content transmitted over a communication network. Although the following description will be discussed in the context of collecting, processing and billing for data transmitted over the Internet, it should be appreciated that the invention is no so limited. In fact, the invention may be applied to any type of network, including a private local area network, for example. Also, the invention may be used for purposes other than billing for the usage of content. For example, the invention may be used to analyze the type of data transmitted over a particular network, or to determine the routing patterns of data on a network. Furthermore, the invention may be used to facilitate the intelligent collection and aggregation of data relevant to a particular industry. In addition, the invention may be used to track specific Internet protocol (IP) network resources and to detect fraud, for example.

In addition, it should be appreciated that the term "content" may be defined as data that is transmitted over the network. In the context of the Internet, content may include .mp3 files, hypertext markup language (html) pages, videoconferencing data, and streaming audio, for example. The terms "content provider" and "customer" will be used throughout the description as well. Content provider may refer to the primary creator or provider of the content, while customer is the primary recipient of the content. Both the producer and customer may be a human or a computer-based system.

As shown in Figure 1, an instrumentation layer 101 provides raw data to a content collection layer 102. Instrumentation layer 101 may consist of various data sources, for example, network routers. The network routers may provide information

regarding the various types of routed data, including for example, data format, originating Internet protocol (IP) address, and destination IP address. One example of such information is Cisco System's NetFlow™.

Content collection layer 102 collects information about the delivery of the content, as well as the substance of the content itself. Content collection layer 102 also may sort, filter, aggregate, and store the content according to the particular needs of the end user. In effect, content collection layer is responsible for extracting meaningful information about IP traffic, and so it is provided with an understanding of the data sources in instrumentation layer 101. Content collection layer 102 also may transform the data from the plurality of sources in instrumentation layer 101 into standard formats for use in a transaction layer 103.

Content collection layer 102 is in communication with transaction layer 103. Generally, content collection layer 102 reports to transaction layer 103 that a relevant communication event has occurred and should be considered by the remainder of system 100. A communication event may be defined as any transfer of data between systems. Transaction layer 103 captures the predetermined agreements among all of the parties involved in system 100 regarding the value of the transferred content, as well as the value added by each of the individual parties in transferring such content. Therefore, transaction layer 103 is charged with understanding the nature of the parties, as well as the understanding the actions that one or more parties perform and the influence of such action on the respective parties.

Transaction layer 103 is in communication with a settlement layer 104. Settlement layer 104 captures the operations that are necessary to understand the significance of the transaction defined by transaction layer 103. For example, settlement layer 104 may rate a particular transaction by assigning a monetary value to the transaction. Settlement layer 104 also may divide the burdens and benefits of the monetary value among the relevant parties. In this way, settlement layer 104 ensures that certain parties receive a particular portion of the payment made by the other parties. Settlement layer 104 also may be responsible for delivering this burden and benefit information to the appropriate parties with the appropriate identifiers (*e.g.*,

account numbers). As will be explained in more detail below, the present invention is directed to operations of the settlement layer 104.

Figure 2 is a block diagram further describing the components of system 100. As shown in Figure 2, instrumentation layer 101 includes data sources 201-203 that each provide raw data 204-206, respectively, to collection layer 102. As discussed, data sources 201-203 may include various internetworking devices like routers, bridges, and network switches. Data sources 201-203 provide raw data to an input data adapter 207. Accordingly, input data adapter 207 understands the operation of and the data provided by data sources 201-203. Although one input data adapter is shown in Figure 2, it should be appreciated that more than one input data adaptermay be used in system 100. For example, each data source may have a dedicated input data adapter.

Input data adapter 207 understands the incoming data and extracts the data into the appropriate fields. This field-delimited data, called flow objects 208, are sets of attributes. The attributes may be any characteristics that are provided by, or can be derived from, raw data 204-206 provided by data sources 201-203, respectively. For example, flow objects 208 may include a set of attributes describing the source and destination, including source IP address, destination IP address, source interface, and destination interface. Because input data adapter 207 is charged with understanding raw data 204-206 from data sources 201-203, as well as the required flow objects 208 of system 100, it is capable of transforming the raw data to the flow objects, where the flow objects may all be of a standard format.

Input data adapter 207 provides flow objects 208 to a content data language 209. Content data language 209 may transform the attributes in flow objects 208 into other attributes that are desired by a particular customer. For example, content data language 209 may derive a network identifier attribute that is not readily available from a data source, from a source address attribute and a destination address attribute that are provided by flow object 208 attributes from input data adapter 207. This derivation may be based on a customer's desire to determine which network conveyed the transaction between the source and the destination. Therefore, following this

example, content data language 209 will know to extract the source address attribute and the destination address attribute from flow objects 208.

Content data language 209 may perform other functions as well. For example, content data language 209 may perform a generic lookup function 219 that is built into content data language 209. Generally, generic lookup 219 describes a technique for mapping any number of attributes to any number of other derived attributes. For example, generic lookup 219 may be used to map a unique resource locator (URL) attribute to a particular content-type attribute.

Content data language 209 also is in communication with a correlator 211. Generally, correlator 211 connects the many daily network content events from various network devices, like routers for example. Often, the connected data may come from distinctly different data sources at distinctly unrelated times. Correlator 211 allows this data to be intelligently connected to each other, regardless of how different the sources or of how disparate the time received. For example, a Netflow™ enabled router and a Radius™ enabled network access switch may each provide certain data that is relevant to one particular transaction. However, because portions of the data come from different devices, the data may arrive at system 100 at different times, and in different formats. Also, because each provides data that is necessary to complete one transaction, the data from each cannot be considered separately. Correlator 211 allows this data to be intelligently grouped regardless of the format of the data or of the time the data pieces are received.

Furthermore, correlator 209 may rearrange the order of the received flow objects 208 to suit the needs of the remainder of system 100. By performing such correlation without having to first store all of the data on a disk (*e.g.*, a database), significantly faster processing is achieved. Correlator 209 may perform this correlation in real-time, for example.

Although system 100 has been described using content data language 209 and correlator 211, it should be appreciated that flow objects 208 may proceed directly to a filter 212, if no correlation is required and if no attribute derivation is required, for example. Filter 212 analyzes flow objects 208 to ensure that the provided attributes

are desired by system 100. If flow objects 208 are not needed (*i.e.*, a mismatch), filter 212 may prevent flow objects 208 from passing to an aggregator 213. Also, although filter 212 has been shown as a separate device in system 100, it should be appreciated that the functionality of filter 212 may be incorporated into aggregator 213.

Filter 212 passes the matching flow objects to aggregator 213. Aggregator 213 may provide additional filtering and classification of the multitude of daily network content transactions, based on user criteria. Aggregator 213 may perform such filtering and classification in real-time. Aggregator 213 provides the filtered and classified information to an output data adapter 214. Output data adapter 214 may convert the data from aggregator 213 into one or more content detail records for storage in CDR database 215. Therefore, CDR database 215 stores a complete description of a content event.

Transaction layer 103 includes CDR database 215, an ownership resolution component 216, and a transaction resolution component 221. CDR database 215 passes the CDR onto ownership resolution component 216. A proper accounting of a communication event, for any purpose including billing, requires both identifying the participants and defining the relationships among those participants. These tasks are accomplished by ownership resolution component 216 and transaction resolution component 221.

Ownership resolution component 216 serves to define the participants of the communication event. In particular, because raw data 204-206 may not provide sufficient "ownership" data relating to the parties involved in the content transaction, such "ownership" data must be provided by system 100 to properly account for the entire transaction. Ownership resolution component 216 operates to provide such ownership-based data to system 100.

Ownership resolution component 216 is in communication with transaction resolution component 221. Transaction resolution component 221 serves to capture the predetermined relationships and/or agreements among the parties defined by ownership resolution component 216 regarding the value of the transferred content, as well as the value added by each of the individual parties in transferring such content.

Such predetermined relationships may be previously agreed upon by the participants, or may be created and agreed upon with the implementation of system 100. Therefore, transaction component 103 understands the nature of the parties, the actions that one or more parties perform, and the influence of such action on the respective parties.

Transaction component 216 provides the transaction information to a rating component 217. Rating component 217 provides a weight or significance (*e.g.*, a price) to the transaction, so as to provide a tangible value to the transaction. Rating component 217 may make this determination based on various metrics including the type of the content, the quantity of content consumed, the place and time delivered, or the quality of the content, for example. Therefore, rating component 217 allows system 100 to provide some contextual value, indicting the significance or relevance that certain content or information has to the individual customer.

Rating component 217 provides the rated transaction to a presentment component 218. Presentment component 218 may provide the capability for a customer 220 to view their real-time billing information, for example, over the network. Presentment component 218 also may attach relevant identifiers to the bill (*e.g.*, account numbers, etc.).

Figures 3A and 3B provide a flow diagram further detailing the operation 300 of system 100. As shown in Figure 3A, in step 301, raw data 204-206 is received from data sources 201-203. In step 302, input data adapter 207 converts raw data 204-206 to flow objects 208, where flow objects 208 are sets of attributes, determined from raw data 204-206. In step 303, it is determined whether there is a need to derive new attributes from the existing attributes found in flow objects 208. If there is such a need, in step 304, CDL 209 is used to derive new attributes from existing attributes. Also, as discussed above, attributes may be correlated by correlator 211.

In step 305, flow objects 208 are filtered by filter 212. In step 306, the matching flow objects (*i.e.*, those passed by filter 212) are further filtered and classified by aggregator 213. In step 307, output data adapter 214 converts the data aggregated by aggregator 213 to a format compatible with transaction layer 103.

As shown in Figure 3B, in step 308, output adapter 214 may format the aggregated data into one or more content data records for storage in CDR database 215. In step 309, ownership resolution component 216 identifies the parties involved in the transaction. In step 310, transaction resolution component 221 captures the predetermined agreements among the parties, as well as the value added by each of the individual parties. In step 311, the CDR is rated based on predetermined metrics (*e.g.*, time of transmission, quality of content). In step 312, a bill is presented to the customer.

Content Transaction Layer

A transaction, including a business transaction for example, may be any activity between two or more participants that affects certain parties. The affected parties may be considered the participants to the transaction, although parties and participants may be mutually exclusive entities. It should be appreciated that the terms "parties" and "owners" may be used interchangeably throughout. Also, a transaction may include one or more events, where an event may be some action (*e.g.*, the transfer of a service or good) that the participants conduct with each other. Such events may be the exchange of data over a communication network, for example. Also, it should be appreciated that the same event or action may take place in any direction (*e.g.*, from party A to party B or from party B to party A). The "subject" of the action is the party who performs the activity, while the "object" of the action is the party who is affected or influenced in any way by the action.

Transaction layer 103 is responsible for capturing the characteristics of the transaction, including the parties, participants, subject, object, event/action type, direction of the action, for example. The scope of the characteristics captured by transaction layer 103 will vary with the nature of instrumentation layer 101, the capability of content collection layer 102, and the requirements of settlement layer 104. Generally, transaction layer 103 captures the predetermined agreements among all of the parties involved in system 100 regarding the value of the transferred content, as well as the value added by each of the individual parties in transferring such content. Therefore, transaction layer 103 is charged with understanding the nature of

the parties, as well as the understanding the actions that one or more parties perform and the influence of such action on the respective parties.

Transaction layer 103 includes CDR database 215, an ownership resolution component 216, and a transaction resolution component 221. CDR database 215 is a data store that holds each CDR for further processing by ownership resolution component 216 and transaction resolution component 221. In the context of a billable electronic business transaction, a proper accounting of a communication event, for any purpose including billing, requires both identifying the participants and defining the relationships among those participants. As discussed, ownership resolution component 216 serves to define the participants of the communication event, while transaction resolution component 221 serves to capture the predetermined relationships and/or agreements among the parties defined by ownership resolution component 216.

Transaction layer 103 is generic in that it operates without requiring an understanding of instrumentation layer 101 and content collection layer 102. Instead, transaction layer 103 takes the relevant characteristics of the transaction provided by instrumentation layer 101 and content collection layer 102, and selects and generates those characteristics required by settlement layer 104.

Although the operation of transaction layer 103 will be described in the context of an electronic event over a communication network for the purposes of billing for the event, it should be appreciated that the invention is not so limited, but is so described the purpose of clarity. For example, it should be appreciated that the invention may include functions other than billing, including security, network capacity planning, and content monitoring, for example. Also, the generic techniques described may be applied beyond the context of an electronic event over a communication network.

Figure 4 provides a block diagram of system 100 providing greater detail of the configuration and operation of transaction layer 103. As shown in Figure 4, content collection layer 102 provides a usage record 401 to transaction layer 103. A series of fields 403-408 comprise usage record 401. Although fields 403-408 will be

identified by certain labels for the purpose of clarity, it should be appreciated that fields 403-408 may identify any of the many possible characteristics of the transaction.

In the example provided by Figure 4, fields 407 and 408 identify the parties or participants to the transaction. In particular, field 407 identifies "User A" and field 408 identifies "User B." User A may be the subject party and User B may be the object party. For example, in the context of a telecommunication event, User A may be the "calling" party and User B may be the "called" party. Field 405 and field 406 identify a measurable quantity of the event. In particular, following the example of the telecommunications event, field 405 identifies a duration (in minutes) of the event and field 406 identifies the quantity of data exchanged during the event (in megabytes). Field 403 and field 404 may identify a "start time" and an "end time," respectively, of the communication event.

Although fields 403-408 provide just one example, in any case, it should be appreciated that user record 401 will include certain characteristics provided by instrumentation layer 101 and/or derived by content collection layer 102. These characteristics typically are provided to transaction layer 103 because they have some particular significance to identifying the characteristics necessary to allow settlement layer 104 to provide some accounting of the transaction. Therefore, usage record 401 may not necessarily include all of the characteristics provide by instrumentation layer 101 and/or derived by content collection layer 102, because certain characteristics may not relevant to the settlement of the transaction (*e.g.*, network type). Yet, usage record 401 will include those available characteristics that pertain to permitting settlement layer 104 to properly account for the transaction.

Once usage record 401 passes through transaction layer 103, a modified usage record 402 may be provided to settlement layer 104. Modified usage record 402 may be modified by transaction layer 103 to include additional details of the transaction event required by settlement layer 104 and/or required by the customer's system to which the usage record applies (*e.g.*, a usage billing system). As shown for modified usage record 402, an account A field 409 and an account B field 410 may be added to

further identify the transaction. In one example, account A field 409 may include an alphanumeric designator that identifies the account number that has been assigned by the customer's billing system for User A. In the context of the telecommunications system, account A field 409 may hold User A's ten-digit home telephone number, for example.

In any case, the components of transaction layer 103 operate to identify these additional fields, based on the requirements of the customer's system and of settlement layer 104. In particular, ownership resolution component 216 operates to ensure that the necessary participants or parties to the transaction are identified, while transaction resolution component 221 operates to ensure that the relationships among the parties or participants are identified.

Identification of the relevant entities and their relationships may be accomplished using "lookups" in data stores located within ownership resolution component 216 and transaction resolution component 221, for example. For example, a data table may have a "User" data field and an associated "Account" data field. When User A is received by ownership resolution component 216, it will conduct a lookup in the data table and identify Account A as the appropriate account associated with User A. Also, transaction resolution component 221 may have a data table that permits a lookup of the relationship between User A and User B, identified in usage record 401. For example, upon receiving field 407 designating User A and field 408 designating User B, transaction resolution component 221 may conduct a lookup of an algorithm that identifies the appropriate burdens and benefits (*e.g.*, debit and credit of money) assigned to each of the users with respect to each other.

It also should be appreciated that transaction layer 103 may not provide additional characteristics to usage record 401, as described but may select the relevant characteristics (*i.e.*, those characteristics needed by settlement layer 104) from the characteristics made available by instrumentation layer 101 and/or derived by content collection layer 102. In fact, usage record 401 may include all of the necessary characteristics to properly account for the transaction. In this case, ownership resolution component 216 and transaction resolution component 221 select the

relevant characteristics from the available characteristics. As will be explained in more detail below, the information added to the usage record 402 may also constitute pricing plans and the settlement layer may be configured to handle more sophisticated settlement strategies involving multiple parties and multiple pricing plans over a multiplicity of noncontiguous time periods.

Figures 5A and 5B provide a flow diagram of a method 500 for identifying the characteristics of a transaction using system 100. As shown in Figure 5A, in step 501, raw data 204-206 is received into system 100. Raw data 204-206 includes certain characteristics provided by data sources 201-203, respectively, in instrumentation layer 101. In step 502, content collection layer 102 processes (*e.g.*, aggregates, correlates and filters) raw data 204-206. In step 503, content collection layer 102 provides the processed data to CDR database 215 in transaction layer 103. CDR database 215 stores the data for further processing by transaction layer 103.

In step 505, it is determined whether the contents of the data provided to transaction layer 103 already include the needed ownership data. If the data includes the needed ownership data, the relevant data is selected by ownership resolution component 216 and provided to transaction resolution component 221, in step 507. If, on the other hand, the data provided to transaction layer 103 does not already include the needed ownership data, the required data is identified (*e.g.*, using database lookups) by ownership resolution component 216, in step 506. Once ownership resolution component 216 identifies the required ownership data, the relevant data is selected by ownership resolution component 216 and provided to transaction resolution component 221, in step 507.

As shown in Figure 5B, in step 508 it is determined whether the contents of the data provided to transaction layer 103 already include the needed relationship data (*i.e.*, data defining the burdens and benefits encountered by the parties/participants to the transaction). If the data includes the needed relationship data, the relevant data is selected by transaction resolution component 221 and provided to settlement layer 104, in step 510. If, on the other hand, the data provided to transaction layer 103 does not already include the needed relationship data, the required data is identified (*e.g.*,

using database lookups) by transaction resolution component 221, in step 509. Once ownership resolution component 216 identifies the required ownership data, the relevant data is selected by ownership resolution component 216 and provided to transaction resolution component 221, in step 510.

Ownership and Transaction Resolution

Figure 6 is a block diagram further detailing the operation and configuration of transaction layer 103. It should be appreciated that elements described for transaction layer 103 are not exclusive, but provide just one example of a configuration for transaction layer 103. In particular, the functionality of the previously described ownership resolution component 216 and transaction resolution component 221 will be described in greater detail in the various components described with reference to Figure 6. In practice, however, it should be appreciated that transaction layer 103 may comprise of any number of components that ensure that the necessary parties to a transaction are identified generically.

As shown in Figure 6, transaction layer 103 includes a configuration repository 601, a configuration database 610, a configuration manager 603, and a fail over detector 604. In addition, transaction layer 103 includes a transaction layer engine 608 in communication with configuration repository 601, configuration manager 603, and fail over detector 604.

Transaction layer engine 608 includes a rules processor 605, a CDR reader 606, and a transaction writer 607. Transaction layer engine 608 processes raw data 204-206 in usage record 401 and creates a modified usage record 402, based upon the requirements of settlement layer 104. It should be appreciated that there may be more than one transaction layer engine 608 for each transaction layer 103. However, a single transaction layer engine 608 is shown for the purpose of clarity and brevity.

CDR reader 106 understands the nature of the transaction and operates to read a particular usage record 401 stored in CDR database 215. CDR reader 106 then submits usage record 401 to rules processor 605. Rules processor 605 applies rules (*e.g.*, written in XML) to usage record 401 so as to determine ownership and the relationships among the ownership, for each individual usage record 401. Rules

processor 605 may then generate one or more modified usage records 402, based on the application of the rules to usage record 401. Once rules processor 605 generates the modified usage record 402, transaction writer 607 operates to write a transaction (based on the modified usage record 402) to CDR database 215. Modified usage record 402 is then used by settlement layer 104 to further process the transaction (*e.g.*, rate the transactions monetarily).

Fail over detector 604 operates to provide fault tolerance and initiate a fail over engine (not shown) for a failed transaction layer engine, in accordance with one or more mathematical algorithms, the discussion of which is beyond the scope of the invention. Configuration manager 603 provides an external interface to transaction layer 103 using a business editor 609. Business editor 609 may be manipulated by a user or customer using a graphics user interface (GUI). In particular, the GUI of business editor 609 receives commands from a user and translates them into actions to be performed on usage record 401, for example, by rules processor 605. Configuration repository 601 operates to provide an abstraction to configuration database 610. Configuration database 610 may be a relational database or a set of extensible markup language (XML) computer-readable files, for example.

Figure 7 is a flow diagram that details the operation of transaction layer 103, as shown in Figure 6. As discussed, it should be appreciated that multiple transaction engines may be used to implement a process. Where the invention is instituted using computer-readable instruction, transaction layer engine 608 may be implemented as a computer-executable instruction or thread. Therefore, multiple transaction layer engines may be implemented by having multiple computer-readable instructions.

In step 701, transaction layer engine 608 reads usage record 401 using CDR reader 606. In step 702, rules processor 605 applies one or more rules to usage record 401 read by CDR reader 606, so as to determine one or more "accountables." Accountables are labels that are used to facilitate identifying the parties or owners to a transaction. Accountables may be defined and/or modified by an external user (*e.g.*, a customer) using the graphical user interface provided by business editor 609. Also, it should be appreciated that accountables may be defined for a new usage types for

which no rules in rules processor 605 are provided. The identification of accountables is the function of ownership resolution component 216, as described with reference to Figure 4.

In step 703, "contracts" are identified that define the relationships or agreements between one or more accountables. In the context of a billing system, a contract identifies which parties pays (*i.e.*, the billed party) and which party receives payment (*i.e.*, the billing party). A particular contract may be identified and executed when one or more "conditions" are satisfied. The identification of contracts is conducted by transaction resolution component 221, as described with reference to Figures 2 and 4. A condition is an expression of a logical assertion that can be evaluated as true or false. In transaction layer 103, for example, a condition may be true if a certain data element is present and false if the data element is not present. The following is an example of a condition in XML:

```
<condition name="condition1" function="IsPresent" outcome="true"
type="Accountable" id="ColoProvider"/>
```

In step 704, once the contracts are determined, they are executed. In step 705, usage record 401 is changed to modified usage record 402 based upon the execution of the contract and the identification of the accountables. In step 706, modified usage record 402 may be written to a data table using transaction writer 607, so that settlement layer 104 can rate it, in step 707. Therefore, a transaction may be represented as modified usage record 402, where modified usage record may include the elements of usage record 401 in addition to the accountable and contract elements (*e.g.*, fields 409-410 as discussed with reference to Figure 4).

Although the discussion provided an example of a single contract and two accountables for a single usage record, it should be appreciated that many contracts and many accountables (*i.e.*, and therefore many "transactions") may be derived from a single usage record, because there may be multiple transactions implicated from a single usage record 401. For example, usage record 401 may involve three parties

each having a contract with the other respective parties. In this example, therefore, there may be three separate contracts for a single usage record 401, and three individual accountables for each party or owner. Moreover, as will be explained below, the contracts may operate according to pricing plans that vary over time and from party to party.

In addition to requiring a certain accountable, it may be necessary to determine a value of the accountable. For example, transaction layer 103 may determine not only that the "called party" accountable be a part of the transaction, but also that a value for the called party (*e.g.*, "856-555-1212" or "John Doe") be identified. Also, it may be necessary to transform one accountable into another accountable to satisfy the requirement of settlement layer 104. For example, settlement layer 104 may require the called party accountable (either determined by transaction layer 103 or provided in usage record 401) be transformed into a network identifier accountable.

In either case, the value or transformation of accountables or contracts may be determined using certain predetermined functions or "primitives." A primitive defines a transformation or a valuation of an accountable or contract. As discussed, transformations may allow a value of an accountable to be determined using another accountable, for example. Primitives define and direct such transformations. The input to a primitive can be one of fields 403-408 from usage record 401 or a previously determined accountable, for example.

Primitives may be described and distinguished based on their prescribed functionality. For example, one type of primitive may be a database lookup. A database lookup is a primitive that operates to transform one accountable or contract to another accountable or contract. Also, a database lookup primitive may function to assign a value to an accountable or contract, as a result of conducting a lookup of the accountable or contract in a database. It should be appreciated that the database lookup primitive also allows flexibility in that any database that has Java Database Connectivity (JDBC) drivers (*e.g.*, Oracle, Microsoft SQL Server, Sybase, Database 2) can be used to perform complex lookups. In this way, therefore, previous

accountable or contact transformations can be linked to find new accountables or contracts, respectively.

Other types of primitives may include direct value assignment, and a function primitive that looks up data in an external database. Other primitives may include a function primitive that it allows a third party based library (*e.g.*, Java-based) to be used. Another primitive may be a "regular expression" based primitive that allows parsing of complex text-based fields with a full feature (*e.g.*, PERL5 compliant) pattern specification. Common used techniques would include parsing URLs, filenames and paths, calling/called telephone numbers, email address, for example. In addition, a CDR database 215 lookup primitive allows holding on to an ownership entity if no further processing is required. This primitive is used where usage record 401 provides the information needed by settlement layer 104 without any need for more data correlation and/or manipulation by transaction layer 103.

A default primitive may be a hard-coded primitive that is used where the value is known and/or is not dependent on usage record 401. For example, such a primitive may be used where a party is always present in a consumption event, regardless of the other relevant parties. A network address primitive allows determination of a network entity given an arbitrary string. An area code primitive may be used to determine an area code of a telephone number given the complete telephone number. This primitive may be relevant for a Voice-over-IP application. These examples primitives are not exclusive, but are meant to provide a few examples of the manipulation and correlation that may be achieved by the primitives on the accountables and contracts.

The following is an example of an accountable primitive in XML:

```
<accountable>
<name> ColoProvider </name>
<role> ServiceProvider </role>
<usageType> RMONHost </usageType>
<valid from="past" to="present" />
<primitive type="default">
<value> Exodus </value>
</primitive>
</accountable>
```

Each accountable that is involved in a contract will have an assigned "role." It follows, therefore, that an accountable that is not involved in a contract may not need to have an assigned role. The role associates the particular accountable for integration with settlement layer 104.

Similar to the accountable, a contract is implemented using a set of primitives. The following is an example of a contract primitive in XML. In the example, a Web hosting scenario is present where a content provider (*e.g.*, CNN) places content on one or more Web servers and pays a Web Hoster for doing so based on some predefined pricing plan.

In order to define the accountables, certain elements of usage record 401 may be assumed as follows: Web Hit Time, Web Server Name/IP address, Client IP address, bytes, Mime type, and URL. In this example, if a rule in the business world requires the "Content Provider" of the Web Server (*e.g.*, CNN) to pay to the Web Hoster, there are two accountables: Web Hoster and Content Provider. The XML definition of a contract that captures this business rule may be as follows:

```
01  <contract>
02  <name> ContentProvider-Pays-WebHoster </name>
03  <usageType> WebHosting </usageType>
04  <valid from="past" to="present" />
05  <condition function="IsPresent" type="Accountable"
    name="condition1"  id=" ContentProvider " />
06  <condition function="IsPresent" type="Accountable"
    name="condition2" id="WebHoster" />
07  <billedFunction>
08  <status> enabled </status>
09  <primitive type="internal-account-lookup">
10  <database name="GlobalDB"/>
11  <argument order="1" type="Accountable"
    name="ContentProvider"/>
12  </primitive>
13  </billedFunction>
14  <billingFunction>
15  <status> disabled </status>
16  <primitive type="internal-account-lookup">
17  <database name="GlobalDB"/>
```

```
18      <argument order="1" type="Accountable"
name="WebHoster"/>
19      </primitive>
20      </billingFunction>
21      </contract>
```

In this example, a contract has a name defined in line 02 as "ContentProvider-Pays-WebHoster." The contract also defines an element or usage type called "WebHosting" in line 03. The contract also has two sets of conditions in lines 05 and 06, called "IsPresent," which consider whether "ContentProvider" and "WebHoster" elements are present, respectively. Therefore, this particular contract will be selected and executed by transaction layer 103 if these elements are present.

Also, in this contract example, there are two primitives that are specified. There is a first primitive for finding the account number of the billed entity "ContentProvider," which begins on line 07 and ends on line 13, and there is a primitive for determining the account of the billing entity "WebHoster" beginning on line 14 and ending on line 20. Therefore, the example contract contemplates the "who pays to whom" logic, and results in the execution of a contract that creates a modified usage record 402, which captures the transaction. Notably, in lines 09 and 16, both primitives are defined as database lookups.

As noted above, to settle a transaction, the system must determine who should compensate whom and by how much. Many processes contribute to such "settlement." Accordingly, the settlement layer 104 is not necessarily a particular logical component but may be spread throughout the system. In operation, a typical "settlement" might occur as described below with respect to Figure 8.

Figure 8 illustrates a sample content event as received by transaction layer 103 pursuant to the processes described above. In this example, "content.com" is identified as the billed party for a caching service, and IP address "128.33.2.41" is identified as the billed party for consuming content type "audio video interleave" (.avi). This IP address may be mapped to a customer account that may vary over time. The system also may identify the log provider (*e.g.*, web host service) and may identify the content property owner (*e.g.*, "Disney") as the party to receive a royalty,

or some other form of compensation, for the download. This ownership may create rules based on the unique resource locator (URL) substring and other event information. Also, links may be provided from the event to the multiple accounts related to that event. The use of pricing plans and pools, as described below, allow business rules to be captured regarding compensation for events, for example, in ways that greatly increase system flexibility. In this example, a fee may be charged to "content.com," while revenue may be paid back to the log provider.

Settlement of Transactions Subject to Multiple Pricing Plans

In many transactions, the accounts include one or more pricing plans that are customized to particular customers. As shown in Figure 9, the settlement technologies used to settle such transactions may allow for multiple ownership of content, multiple aggregation of usage, and provide a variety of revenue sharing models. Several of such models will be described below including folds with parent account plans, revenue pooling, and commission relationships between plans.

Figure 10 illustrates a settlement example for the case of digital content, such as digital music content downloadable off of the Internet. In this example, an on-line music club (*e.g.,* BMG, EMI, Sony) has a contractual relationship with the consumers as well as the music publishers (*e.g.,* "www.cd-club.com") and, at settlement, allocates payment according to the price plan(s) with the consumer and the payment plan(s) with the publishers. These payment plans recognize that each song may have a different price and that the revenue paid to the publisher, author, etc. may vary over time depending upon the frequency of download, for example. The price to the consumer also may vary with use. Figures 11 and 12 illustrate settlement models that take into account transaction pricing and billing cycle pricing for such usage based settlements. As those skilled in the art will appreciate, the per transaction usage based model may be best utilized for low volume, high value transactions, while the billing cycle pricing usage based model may be better for high volume, low value transactions.

The present invention allows for the networking of a multiplicity of pricing plans during rating process 217 in settlement layer 104. Thus, the system described

below is implemented primarily in ratings 217 described above with respect to Figure 2.

Pricing Plan Overview

In accordance with the invention, pricing plans may be created by interconnecting rating building blocks with customizable properties. Each rating building block may be specialized in one well-defined function that falls roughly into five classes: usage selection and filtering, usage computation, accumulation, rate computation, and bill presentation. By interconnecting these rating building blocks, together with the ability to add new rating building blocks to the system, very flexible and extensible pricing plans can be created. The computation may be desirably constrained within one pricing plan.

A new class of rating building blocks also may be defined to extend the usefulness of pricing plans. This new class of rating building blocks allows a plan to access the states of another pricing plan or a group of pricing plans. These states can be usages and/or charges associated with line items and/or intermediate computations. With this new capability, computation is not constrained within one pricing plan but within a network of pricing plans working together. This new computation offers, but is not limited to, many settlement features.

A revenue fold summarizes revenue, which is the output of a pricing plan, from child accounts and presents the folded revenue to their corresponding parent accounts as input to their pricing plans. This process may start from the lowest level and continue on up to the root level. The value of revenue fold may be available to a parent account in a pricing plan through a building block (*e.g.*, "RevenueToDate"). As illustrated in Figure 13, the revenue fold settlement model of the invention may provide for pricing plans at each level in the hierarchy and allow for the use of resellers.

Revenue/usage pools are similar to global variables except that they include the concept of billing cycles. Different periods of a pool imply different instances and therefore different values. A pool value may be updated during invoice processing by summing the values of invoice line items associated with the pool from appropriate

account plan periods. An account plan period is considered appropriate if the end date is within the period of the particular pool instance. Note that it is possible to have zero or more than one account plan periods from the same account to be included in the same pool instance. The computation of a pool value may not be cumulative between updates. When a pool value needs to be updated, the computation may start over with the previous value of a pool having no consequence. For example, the value of a pool may be accessible from a pricing plan through a building block (*e.g.*, "PoolAccessor") with the pool name as its property. The output of the "PoolAccessor" is the sum of the pool instances having the same pool name and billing period end dates within the start and end dates of the account plan period. As shown in Figure 14, this settlement feature is useful in revenue sharing scenarios where total revenue and resources are pooled together and total revenue is shared among the contributing accounts based on contributed resources. The pools may be hierarchy independent and defined by the pricing plans. A revenue pool contribution example is given in Figure 15, and a revenue pool accessor example is given in Figure 16.

A commission is a credit given to an account. The credit amount is computed based on the revenue, or states of another account. The two accounts involved in the transaction are commission source account and commission destination account. As shown in Figure 17, the commission source account (commission generator plan) generates the commission contribution iCDR using a building block (*e.g.*, "CommissionGenerator") with "AccountNumber" and "CommissionDescription" as its properties. The amount, not necessarily revenue, going into the CommissionGenerator (commission plan) is the commission amount. When used in conjunction with existing rating building blocks, commission features such as the following can be supported: commission going to multiple accounts, commission based on total revenue or a subset of the revenue (*e.g.*, only monthly and usage charges, but not setup charges), commission for the first "n" billing period only (or different rate after first "n" periods), and step rate.

The commission destination account may receive the commission data through a building block (*e.g.*, "CommissionAccumulator"). Additional commission features such as the following can be supported on the destination account: a recurring base commission, promotional commission rate, and step commission rate. The commission settlement model also may be hierarchy independent and permit variable settlement arrangements.

When computation involves a network of pricing plans, the correct output of a particular pricing plan may be dependent on the processing of another pricing plan. The output of the other pricing plan may in turn dependent on yet another pricing plan. A cyclic dependence can even exist. In order to have the correct computation for the network of pricing plans as a whole, the system detects and continues processing until all pricing plans reach their final values. Accordingly, the settlement processing software in accordance with the invention has a built-in mechanism to repeat processing of the pricing plans until their values are final. The algorithm will stop after a configurable loop count to prevent infinite processing in case there is a cyclic dependence.

Billing Cycle Considerations

Because more than one account may be involved in settlement, it is possible that they have different billing periods. The following section details how each settlement feature is processed for the settlement models of the invention when accounts with different billing periods are involved.

Revenue fold summarizes revenue from child accounts and presents the folded revenue to their parent accounts. This process starts from the lowest level and continues up to the root level. In actual settlement processing, revenue fold is a post order traversal of a tree whose nodes are account plan periods, where a post order tree traversal traverses each sub tree of the root in post order followed by the root. The child account plan periods are selected if the end dates are within the parent's account plan period. It is possible to have zero or more than one account plan period from the same account included in one revenue fold. The root account's account plan period is defined by the invoice processing start and end dates.

An iCDR is generated for each revenue fold. The iCDR is rated by the pricing plan for the account plan period receiving the revenue fold. Therefore, pricing plans for non-leaf accounts take revenue fold into consideration. The value of revenue fold is available in a pricing plan through a building block (*e.g.*, "RevenueToDate").

Figure 18 provides an example of computing revenue fold. To compute the revenue fold for account 1001, the revenue from all child accounts of 1001 with account plan period end dates between 3/1 and 4/1 are summed. In this example, the revenue for account 2001 for the billing period 2/7 to 3/7, account 2002 for the billing period 2/15 to 3/15, account 2003 for the billing period 2/22 to 3/22 are summed. Before the summing of the revenue of these accounts can occur, their own revenues are determined. In order to determine the revenue of these child accounts, their child accounts with account plan period end dates between their account plan period start and end dates are selected and summed. The following example shows that to determine the revenue for account 2003 for the billing period 2/22 to 3/22, revenue for account 3001 for the billing period 2/1 to 3/1 and account 3002 for the billing period 2/15 to 3/15 are summed. This process repeats until the leaf level account is reached.

The value of a pool is accessible from a pricing plan through a rating building block (*e.g.*, "PoolAccessor"). The output of "PoolAccessor" is the sum of the pool instances having billing period end dates within the start and end dates of the account plan period. It is possible to have zero or more than one instance selected given a particular account plan period depending on the billing period of the pool and the account. Therefore, given the same plan, "PoolAccessor" output may vary according to the account plan period. This technique ensures that each invoice line item associated with a pool will be included a pool instance and that each pool instance will be accessed once by an account which accesses the pool.

Figure 19 illustrates how accounts and pools with different billing cycles contribute to and access from pool instances. For example, line items associated with pool A for account 1001 with billing period from 4/1 to 6/1 and account 1002 with billing periods from 3/22 to 4/22 and 4/22 to 5/22 will contribute to the pool A's

instance with period from 4/1 to 6/1. The output of the PoolAccessor will be zero for account 2001 during the period 4/1 to 5/1. For billing period from 5/1 to 6/1, account 2001 will get the value of pool A's instance with period from 4/1 to 6/1. Account 2002 with billing period from 4/1 to 6/1 will also get pool A's 4/1 to 6/1 instance. The account plan period from 4/1 to 8/1 for account 2003 will get the sum of the two pool A's instances, 4/1 to 6/1 and 6/1 to 8/1.

During invoice processing, one or more iCDRs will be generated for each commission producing account plan periods. The generated record will have the destination account number, amount, and a timestamp. The timestamp is the end date of the account plan period that generated the record. The record will then be rated by the destination account in the appropriate account plan period.

Figure 20 provides an example of how an account 2001 with billing period ending 6/1 will get one commission from account 1001 for the period 4/1 to 6/1 and two commissions from account 1002 for the periods 3/22 to 4/22 and 4/22 to 5/22.

An invoice output may be dependent on the processing of settlement features. In turn, processing of settlement features may be dependent on correct invoice output. For example, if the pricing plan associated with an invoice accesses one or more pools, revenue/usage pool processing should be completed successfully before a correct invoice can be produced. To process a revenue/usage pool correctly, account plan periods associated with a pool have to produce a correct invoice that in turn may be dependent on revenue fold. There may not be a single, correct pre-defined order of processing for these settlement features. In some cases, the same settlement features may have to be processed more than once (*e.g.*, revenue fold, generate commission and then revenue fold again).

The settlement processing has a built-in mechanism to repeat processing of the settlement features in a fixed sequence until the values are final. To prevent the algorithm from looping forever, there is a configurable maximum loop count. If the result is not final after the maximum loop count, a warning will be given, and the user may remove the circular dependency (if one exists) and/or increases the maximum loop count.

The invention described above is directed to a system and method for handling the networking of pricing plans in the settlement of transactions. The invention often was described in the context of the Internet, but is not so limited to the Internet, regardless of any specific description in the drawing or examples set forth herein. For example, the invention may be applied to wireless networks, as well as non-traditional networks like Voice-over-IP-based networks and/or private networks. It will be understood that the invention is not limited to the use of any of the particular components or devices herein. Indeed, this invention can be used in any application that requires aggregating data. Further, the system disclosed in the invention can be used with the method of the invention or a variety of other applications.

While the invention has been particularly shown and described with reference to the embodiments thereof, it will be understood by those skilled in the art that the invention is not limited to the embodiments specifically disclosed herein. Those skilled in the art will appreciate that various changes and adaptations of the invention may be made in the form and details of these embodiments without departing from the true spirit and scope of the invention as defined by the following claims.

**What is claimed is:**

1. A method of rating a transaction, comprising:

processing a transaction, wherein the transaction is processed when a service is provided from a service provider to a service consumer;

accessing via a computer network multiple pricing plans related to the transaction; and

rating the transaction in accordance with the multiple pricing plans.

2. The method of claim 1, wherein at least one of the pricing plans includes at least one of the following: revenue folds, revenue/usage pools, and commissions.

3. The method of claim 1, further comprising receiving output states from at least one pricing plan.

4. The method of claim 1, wherein the rating is accomplished within one pricing plan.

5. The method of claim 1, wherein the rating is accomplished within a group of pricing plans.

6. The method of claim 1, wherein the accessing is accomplished via interconnected building blocks located within each of the pricing plans.

7. The method of claim 1, wherein the building blocks perform at least one of the following functions: data usage selection and filtering, data usage computation, data accumulation, rate computation, and presentation of required payment.

8. The method of claim 6, wherein the building blocks have customizable properties.

9. The method of claim 6, wherein the building blocks allow a first pricing plan to access states of another pricing plan.

10. The method of claim 9, wherein the states are usages and charges associated with one or more pricing plans.

11. The method of claim 6, wherein the building blocks allow a first pricing plan to access the states of a group of pricing plans.

12. The method of claim 11, wherein the states are usages and charges associated with one or more pricing plans.

13. The method of claim 1, further comprising a revenue fold, wherein the revenue fold summarizes the output of multiple pricing plans.

14. The method of claim 13, wherein the revenue fold summarizes child accounts and inputs the summary information to pricing plans of corresponding parent accounts.

15. The method of claim 13, wherein the value of the revenue fold is available to the pricing plan via a building block.

16. The method of claim 13, wherein the revenue fold is available to child and parent accounts.

17. The method of claim 13, further comprising selecting child accounts with end dates that are within a parent account's time period.

18. The method of claim 1, further comprising pooling revenue/usage data as a function of billing cycles.

19. The method of claim 18, further comprising updating the pooled revenue/usage data by summing the values of data from selected account plan periods.

20. The method of claim 18, further comprising selecting the account plan period as a function of the end date of the account plan with respect to the pooled revenue/usage data.

21. The method of claim 18, further comprising accessing a value of the pooled revenue/usage data via a building block.

22. The method of claim 1, further comprising determining the value of a pricing plan as a function of another pricing plan.

23. The method of claim 22, further comprising providing a configurable loop count.

24. A computer-readable medium having computer-executable instructions, comprising:

processing a transaction, wherein the transaction is processed when a service is provided from a service provider to a service consumer;

accessing via a computer network multiple pricing plans related to the transaction; and

rating the transaction in accordance with the multiple pricing plans.

25. The computer-readable medium of claim 24, having computer-executable instructions further comprising receiving output states from at least one pricing plan.

26. The computer-readable medium of claim 24, having computer-executable instructions further comprising a revenue fold, wherein the revenue fold summarizes the output of multiple pricing plans.

27. The computer-readable medium of claim 24, having computer-executable instructions further comprising selecting child accounts with end dates that are within a parent account's time period.

28. The computer-readable medium of claim 24, having computer-executable instructions further comprising pooling revenue/usage data as a function of billing cycles.

29. The computer-readable medium of claim 24, having computer-executable instructions further comprising determining a commission, wherein the commission is a credit given to an account.

30. The computer-readable medium of claim 24, having computer-executable instructions further comprising determining the value of a pricing plan as a function of another pricing plan.

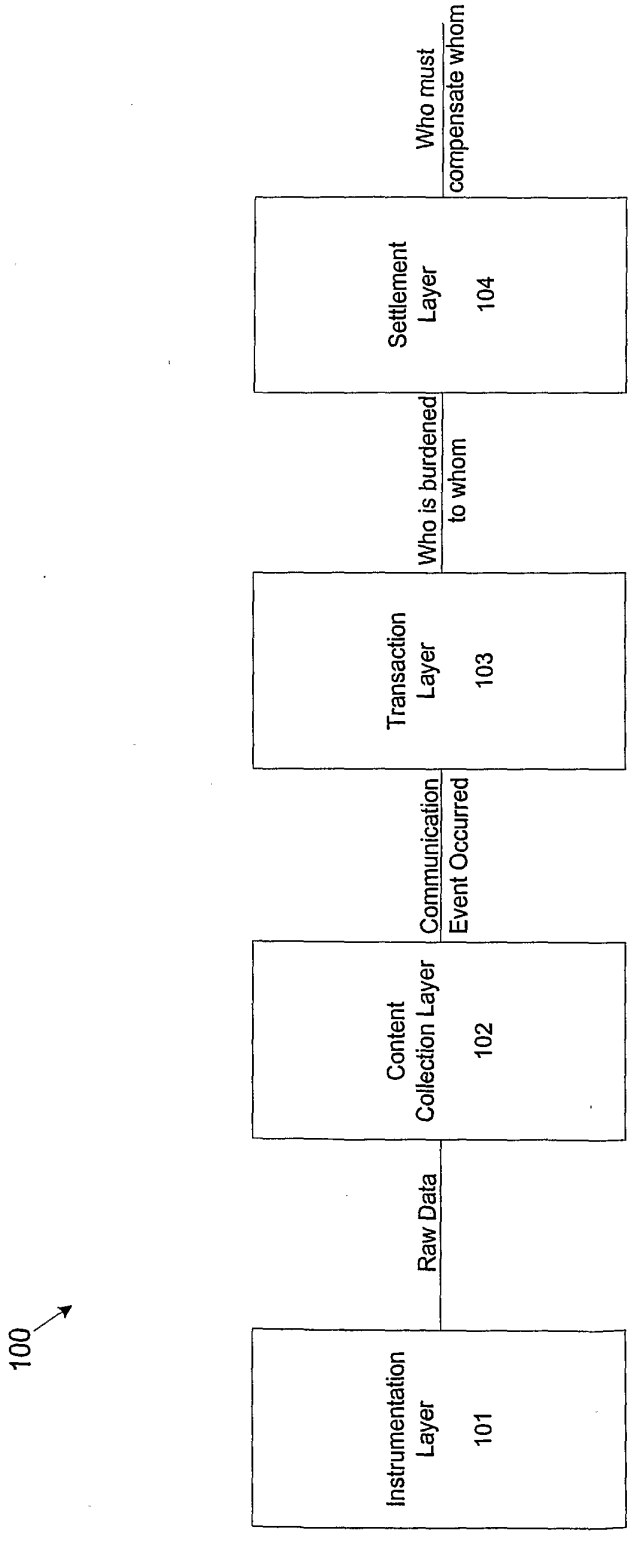

100
Instrumentation Layer 101
Raw Data
Content Collection Layer 102
Communication Event Occurred
Transaction Layer 103
Who is burdened to whom
Settlement Layer 104
Who must compensate whom

Figure 1

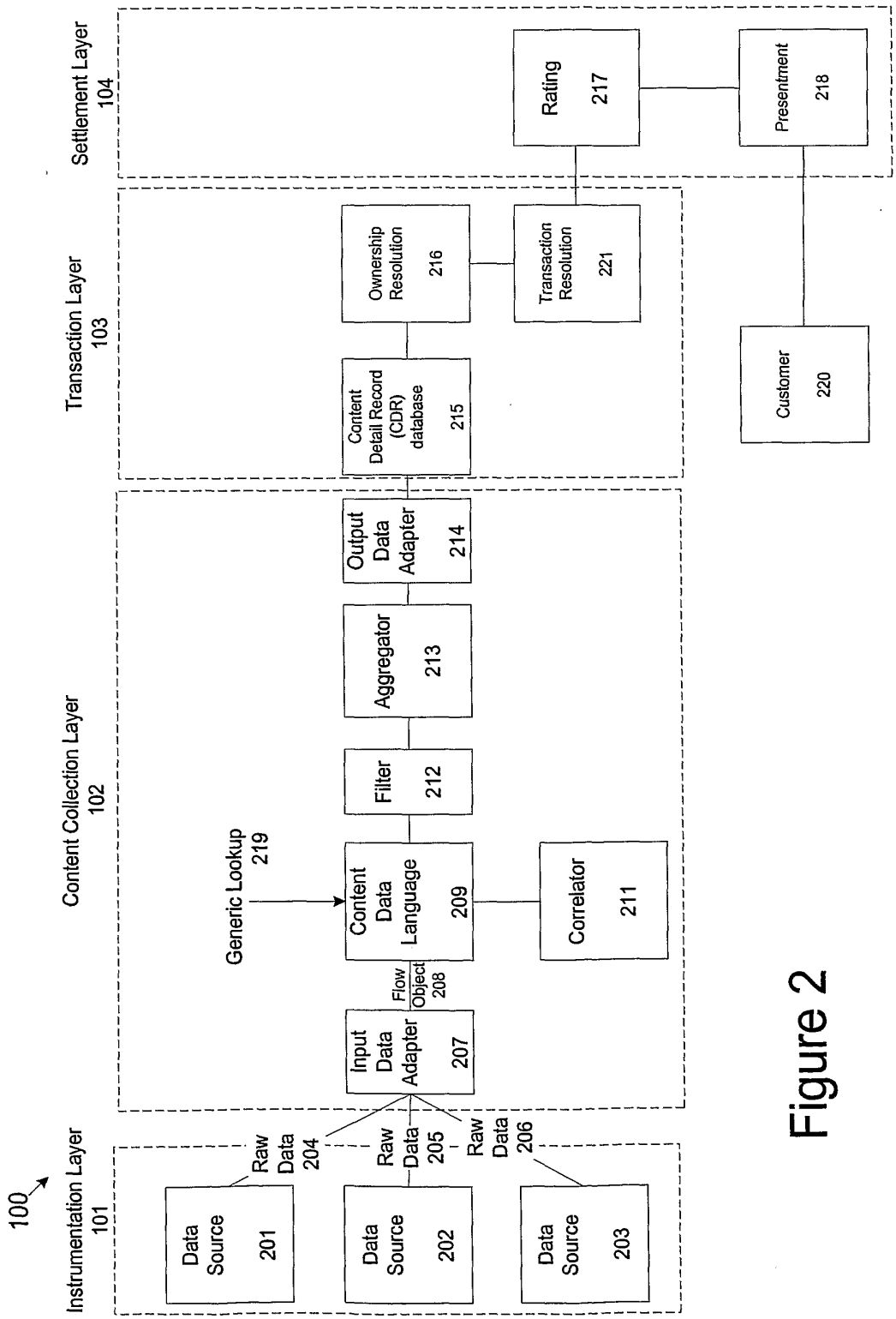

100
Instrumentation Layer
101
Data Source
201
Data Source
202
Data Source
203
Raw Data
204
Raw Data
205
Raw Data
206
Content Collection Layer
102
Input Data Adapter
207
Flow Object
208
Content Data Language
209
Generic Lookup
219
Filter
212
Aggregator
213
Output Data Adapter
214
Correlator
211
Transaction Layer
103
Content Detail Record (CDR) database
215
Ownership Resolution
216
Transaction Resolution
221
Settlement Layer
104
Rating
217
Presentment
218
Customer
220

Figure 2

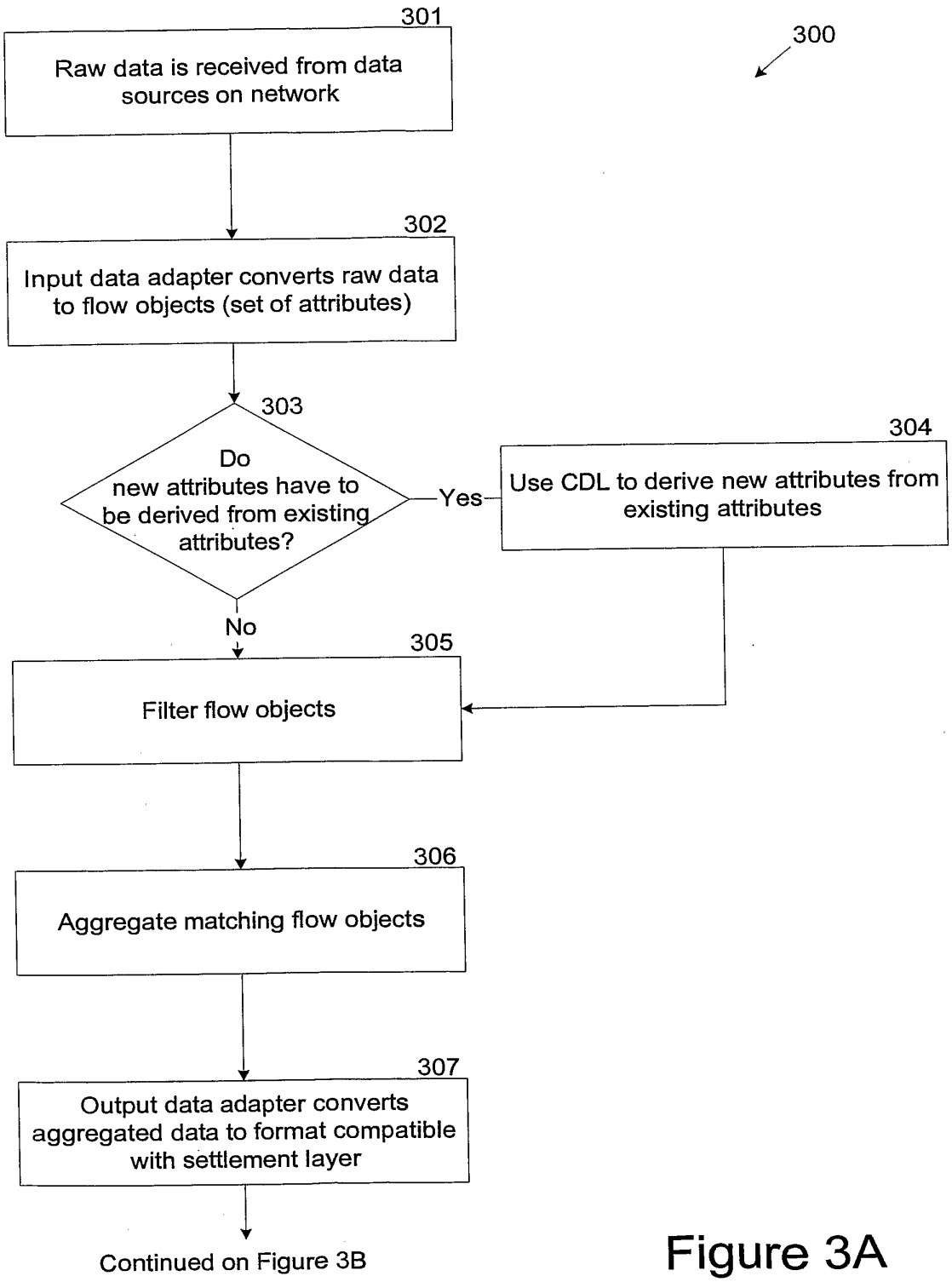

301
Raw data is received from data sources on network
300
302
Input data adapter converts raw data to flow objects (set of attributes)
303
Do new attributes have to be derived from existing attributes?
Yes
304
Use CDL to derive new attributes from existing attributes
No
305
Filter flow objects
306
Aggregate matching flow objects
307
Output data adapter converts aggregated data to format compatible with settlement layer
Continued on Figure 3B

Figure 3A

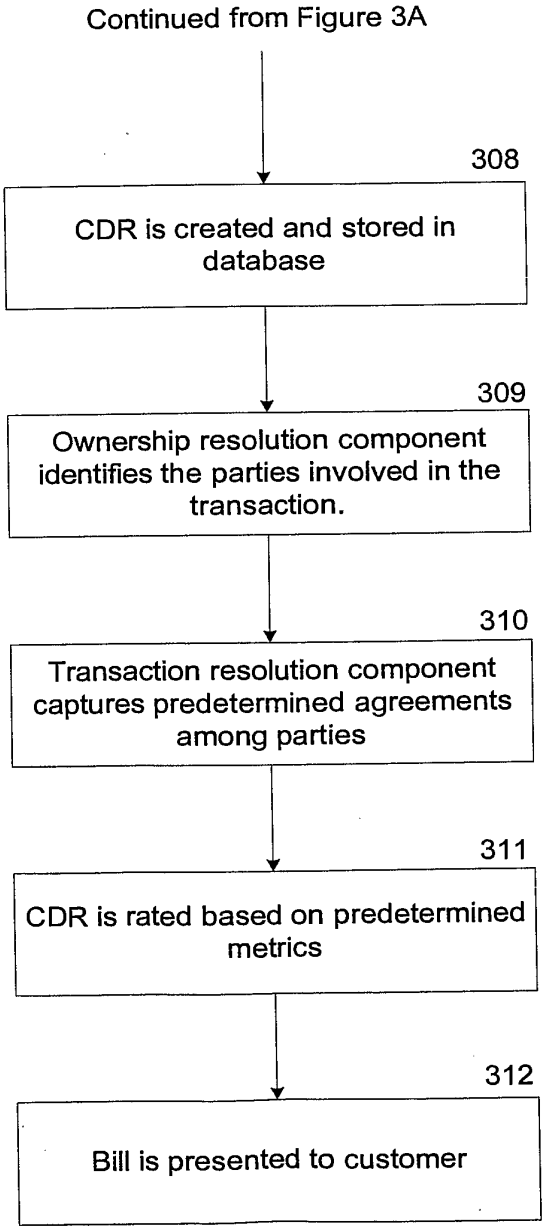

Continued from Figure 3A
308
CDR is created and stored in database
309
Ownership resolution component identifies the parties involved in the transaction.
310
Transaction resolution component captures predetermined agreements among parties
311
CDR is rated based on predetermined metrics
312
Bill is presented to customer

Figure 3B

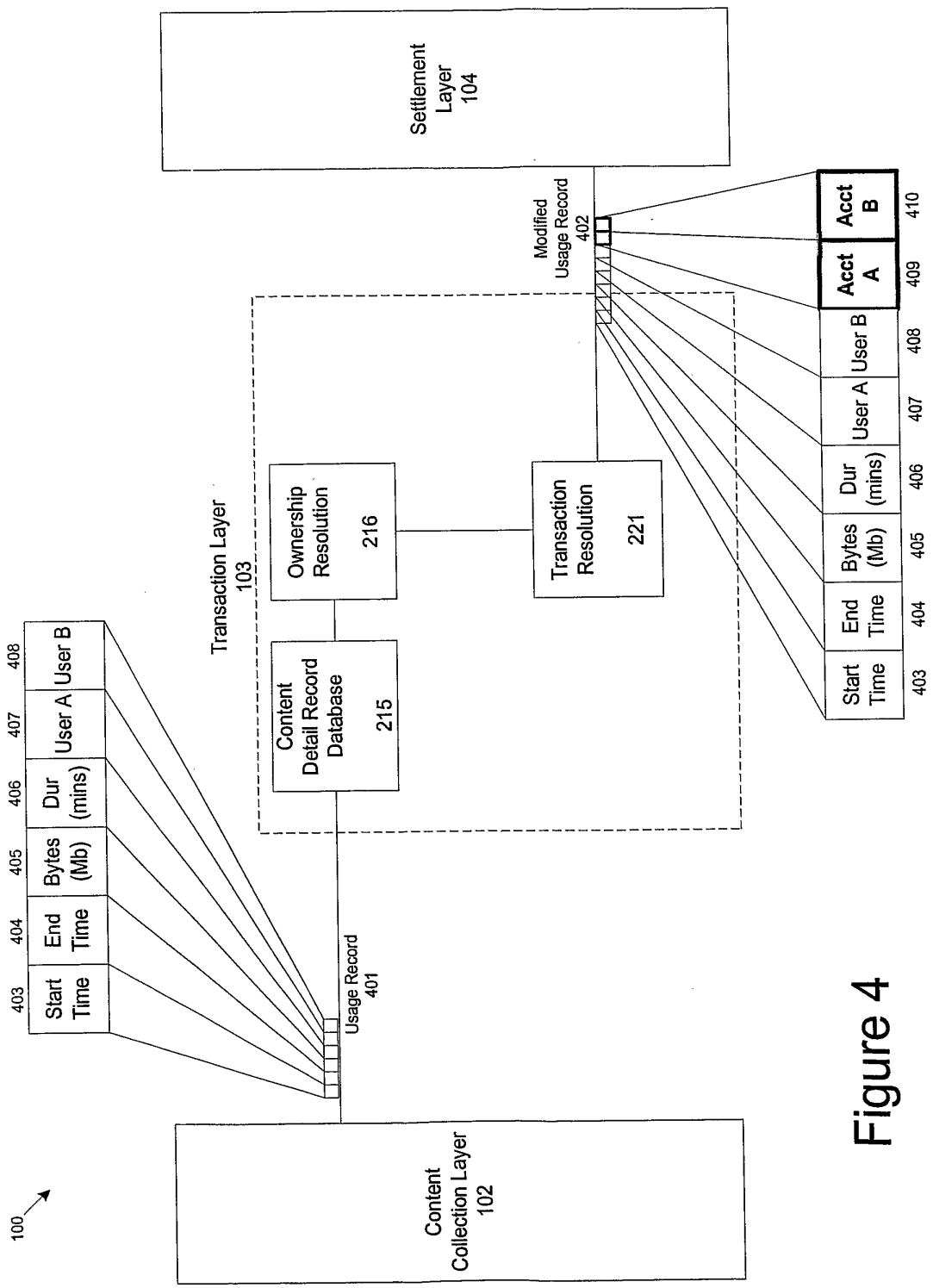

100
Content Collection Layer 102
Usage Record 401
Start Time 403
End Time 404
Bytes (Mb) 405
Dur (mins) 406
User A 407
User B 408
Transaction Layer 103
Content Detail Record Database 215
Ownership Resolution 216
Transaction Resolution 221
Modified Usage Record 402
Settlement Layer 104
Start Time 403
End Time 404
Bytes (Mb) 405
Dur (mins) 406
User A 407
User B 408
Acct A 409
Acct B 410

Figure 4

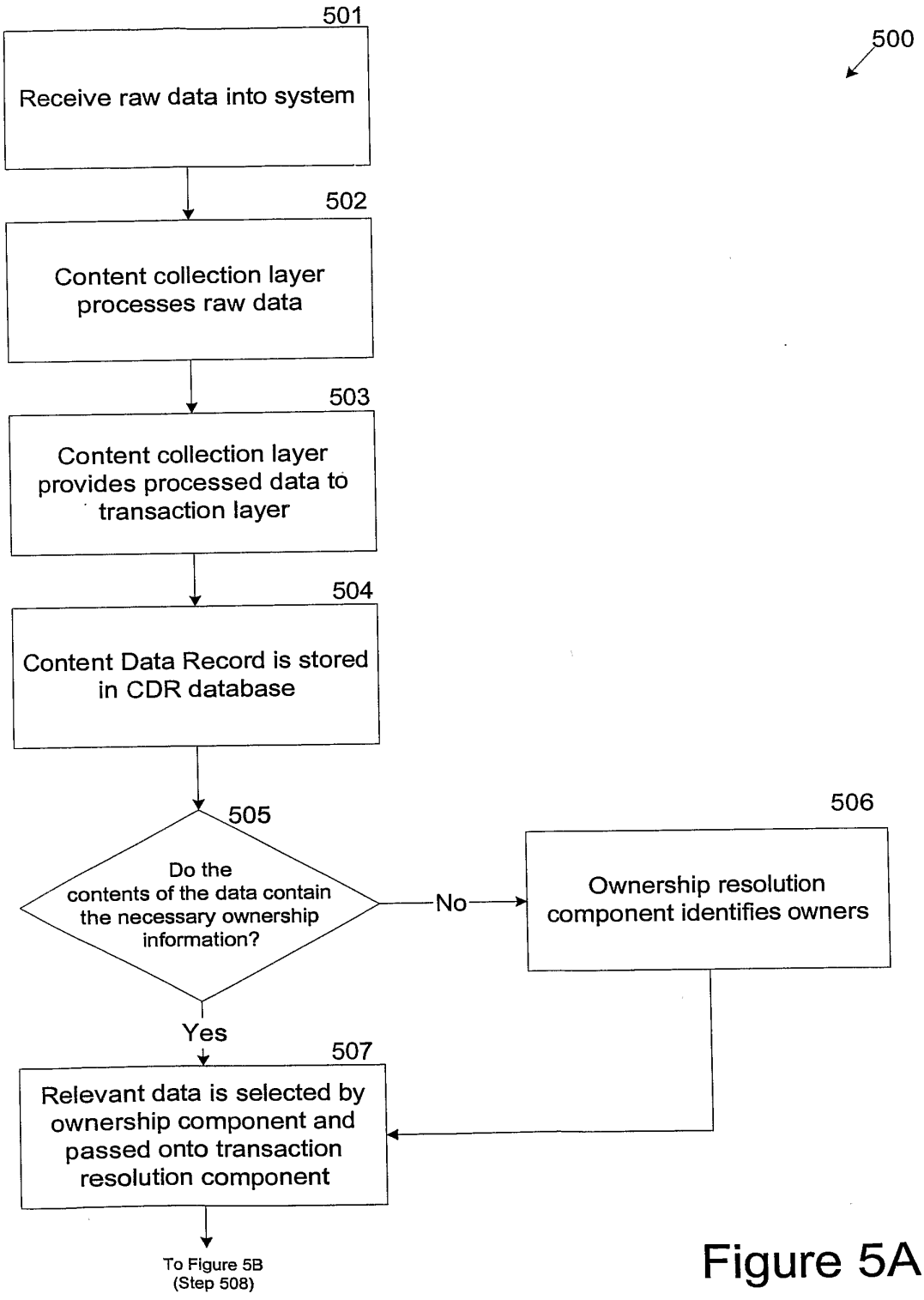

500
501
Receive raw data into system
502
Content collection layer processes raw data
503
Content collection layer provides processed data to transaction layer
504
Content Data Record is stored in CDR database
505
Do the contents of the data contain the necessary ownership information?
No
506
Ownership resolution component identifies owners
Yes
507
Relevant data is selected by ownership component and passed onto transaction resolution component
To Figure 5B (Step 508)

Figure 5A

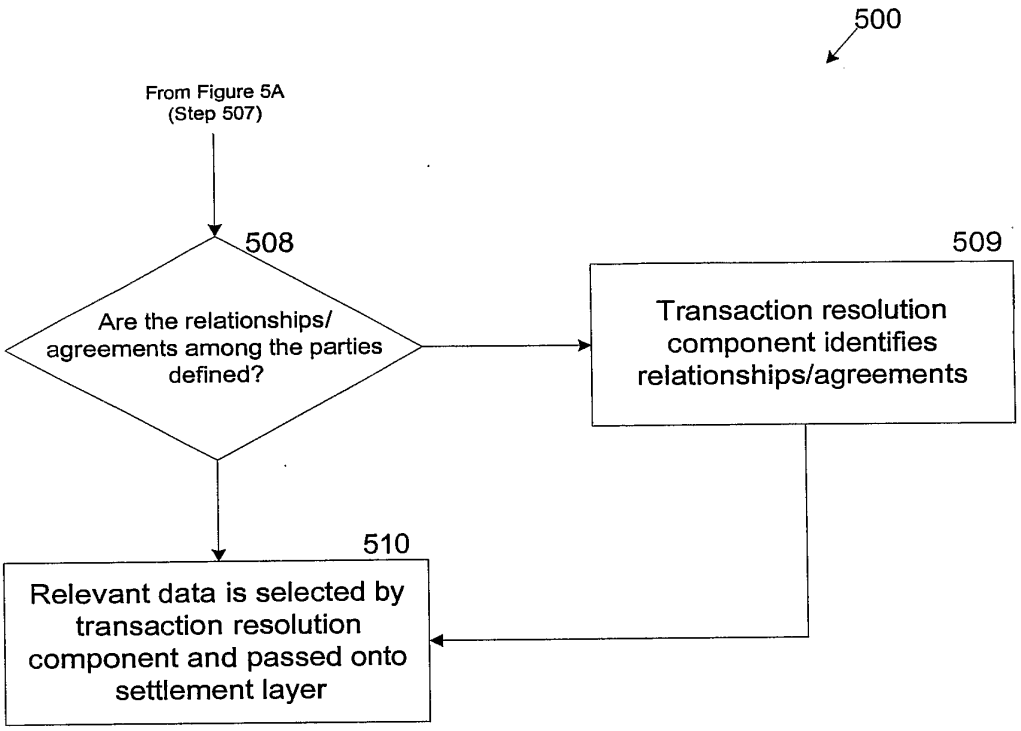

500
From Figure 5A
(Step 507)
508
Are the relationships/ agreements among the parties defined?
509
Transaction resolution component identifies relationships/agreements
510
Relevant data is selected by transaction resolution component and passed onto settlement layer

Figure 5B

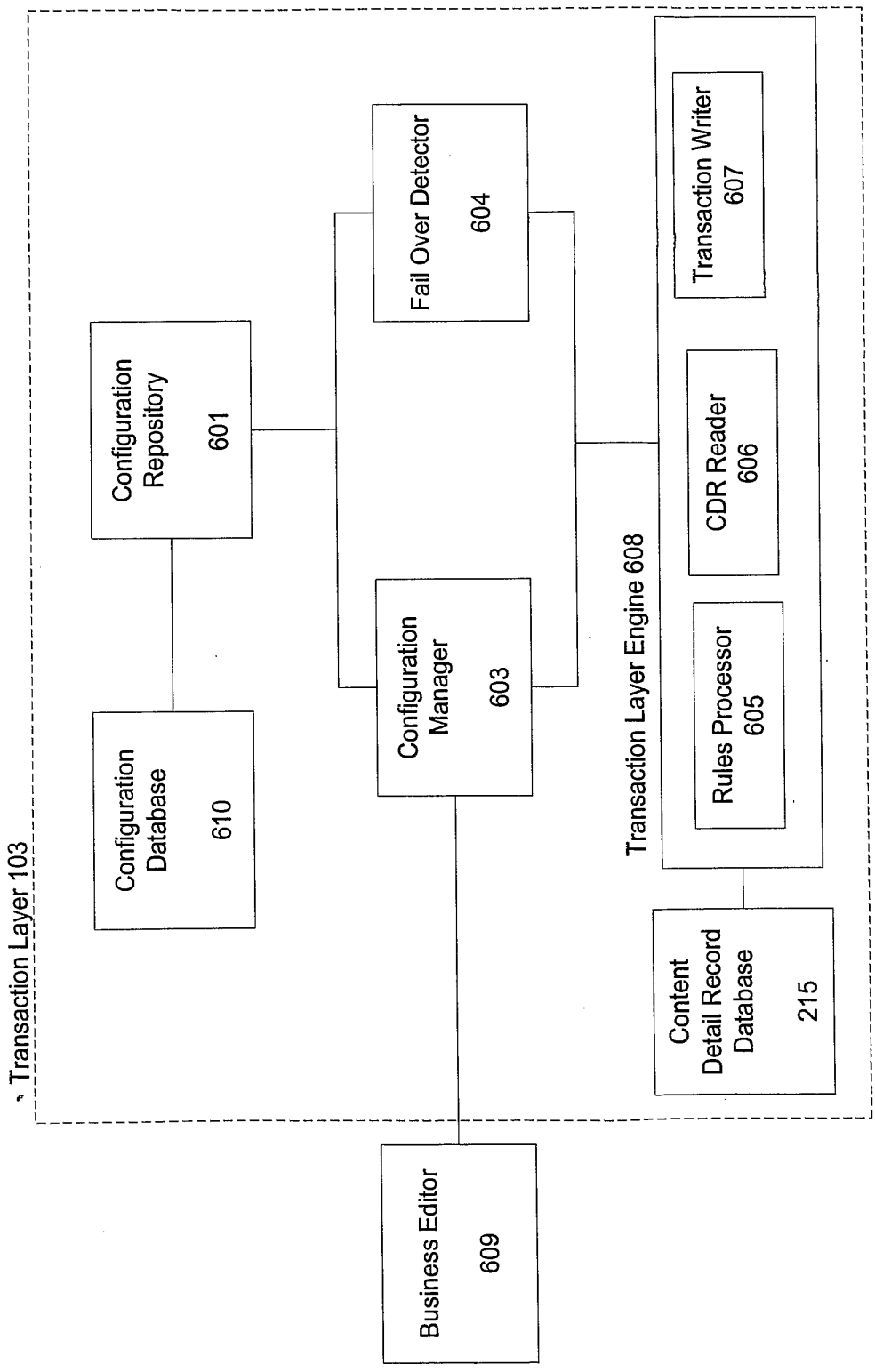

Transaction Layer 103
Configuration Repository 601
Configuration Database 610
Fail Over Detector 604
Configuration Manager 603
Business Editor 609
Transaction Layer Engine 608
Transaction Writer 607
CDR Reader 606
Rules Processor 605
Content Detail Record Database 215

Figure 6

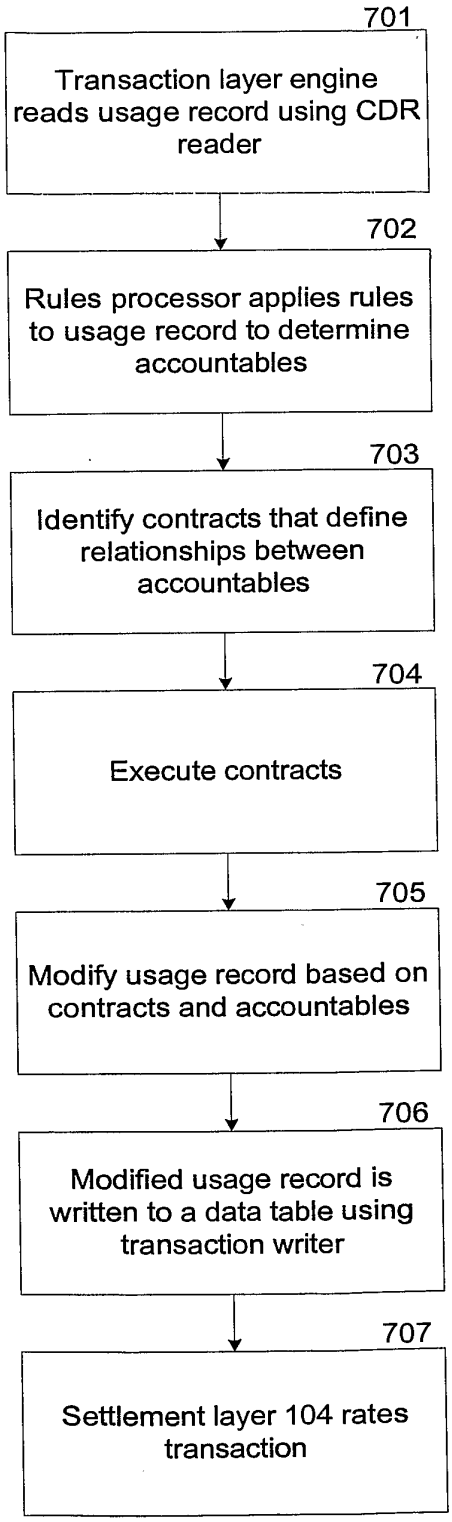

701
Transaction layer engine reads usage record using CDR reader
702
Rules processor applies rules to usage record to determine accountables
703
Identify contracts that define relationships between accountables
704
Execute contracts
705
Modify usage record based on contracts and accountables
706
Modified usage record is written to a data table using transaction writer
707
Settlement layer 104 rates transaction
700

Figure 7

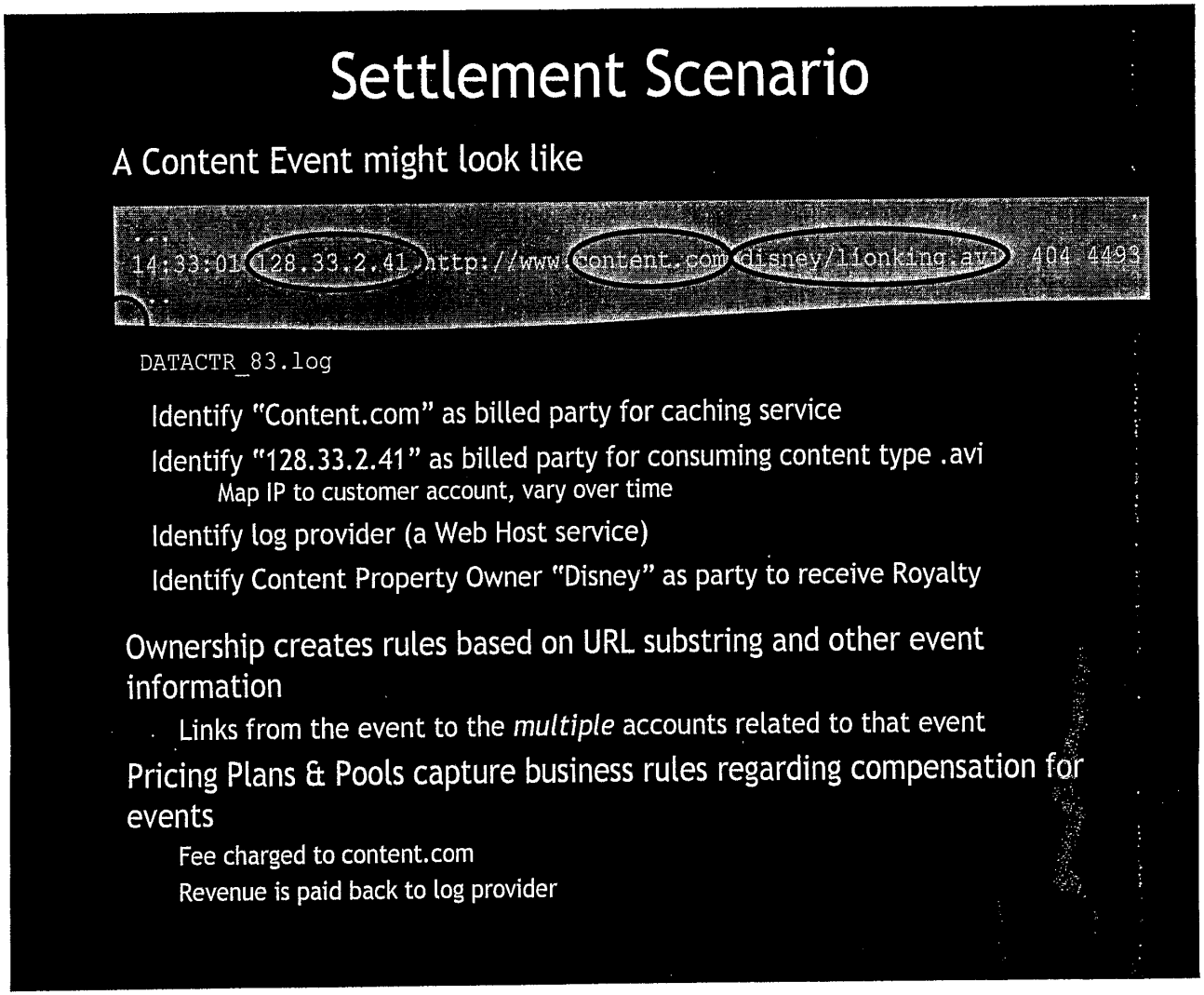

Settlement Scenario
A Content Event might look like
14:33:01 128.33.2.41 http://www.content.com disney/lionking.avi 404 4493
DATACTR_83.log
Identify "Content.com" as billed party for caching service
Identify "128.33.2.41" as billed party for consuming content type .avi
Map IP to customer account, vary over time
Identify log provider (a Web Host service)
Identify Content Property Owner "Disney" as party to receive Royalty
Ownership creates rules based on URL substring and other event information
Links from the event to the multiple accounts related to that event
Pricing Plans & Pools capture business rules regarding compensation for events
Fee charged to content.com
Revenue is paid back to log provider

Figure 8

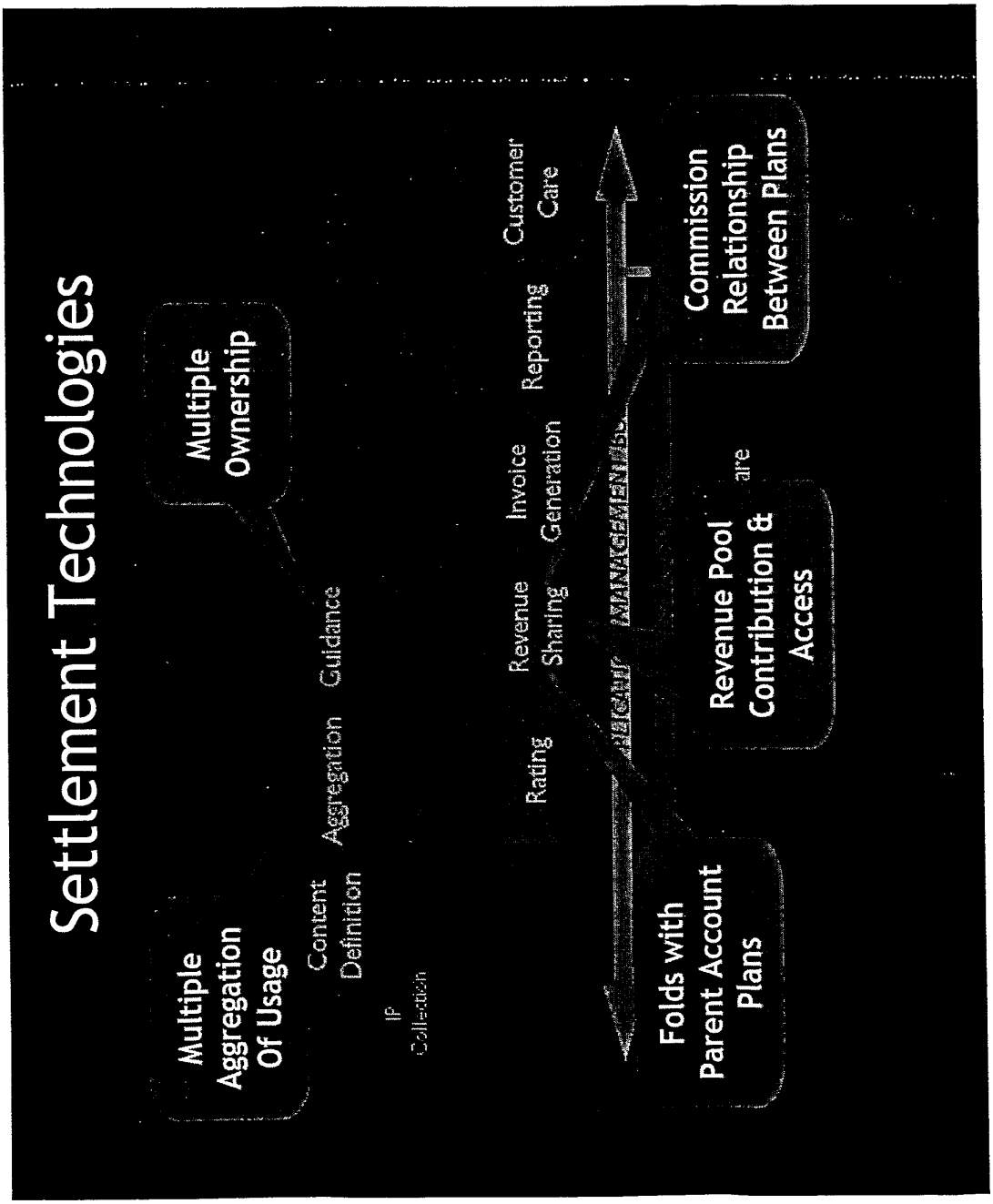

Settlement Technologies
Multiple Aggregation Of Usage
Content Definition
Aggregation
Guidance
IP Collection
Multiple Ownership
Rating
Revenue Sharing
Invoice Generation
Reporting
Customer Care
Folds with Parent Account Plans
Revenue Pool Contribution & Access
Commission Relationship Between Plans

Figure 9

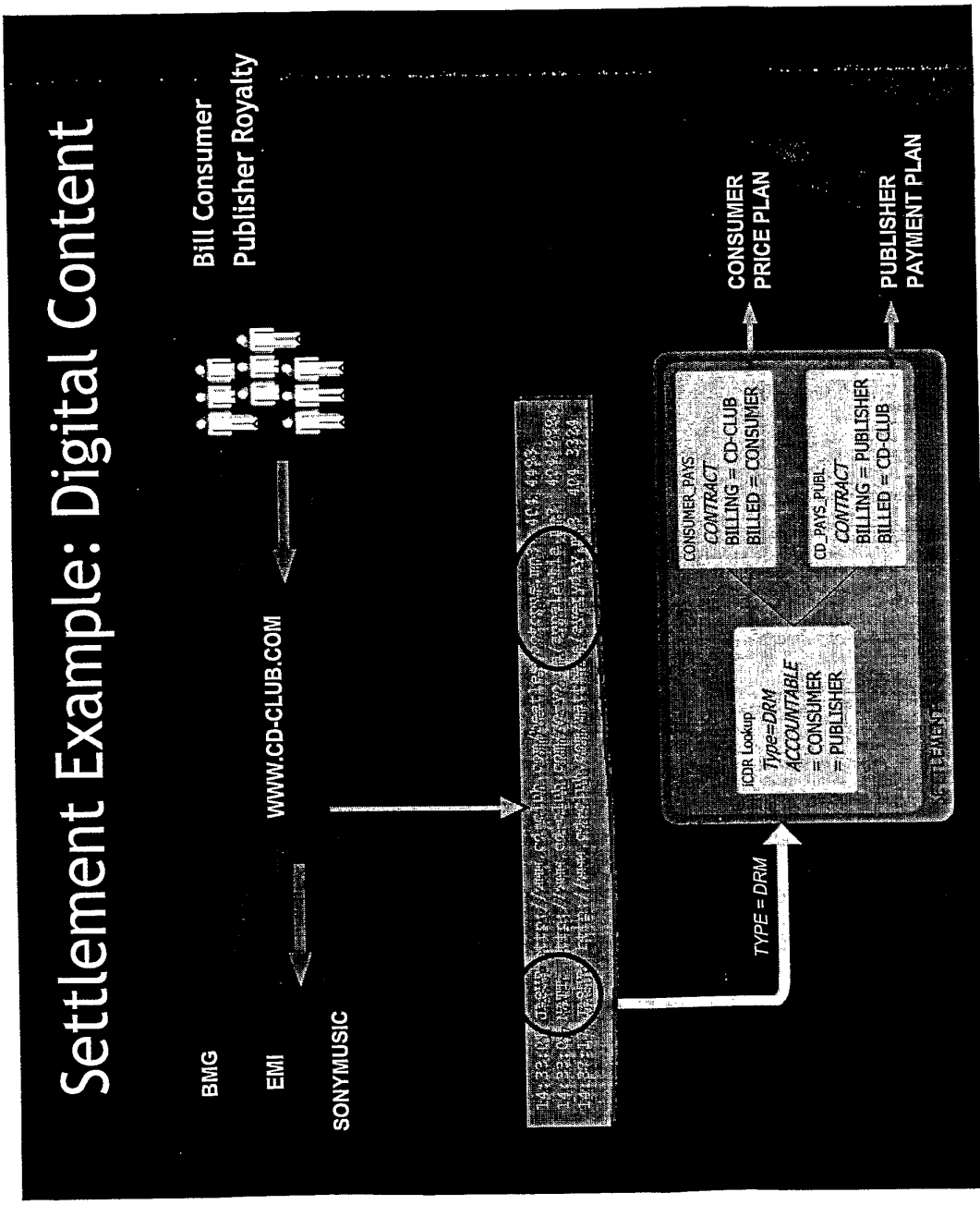

Settlement Example: Digital Content
BMG
EMI
SONYMUSIC
WWW.CD-CLUB.COM
Bill Consumer
Publisher Royalty
CONSUMER
PRICE PLAN
PUBLISHER
PAYMENT PLAN
CONSUMER_PAYS:
CONTRACT
BILLING = CD-CLUB
BILLED = CONSUMER
CD_PAYS_PUBL:
CONTRACT
BILLING = PUBLISHER
BILLED = CD-CLUB
IDR Lookup:
Type=DRM
ACCOUNTABLE
= CONSUMER
= PUBLISHER
TYPE = DRM

Figure 10

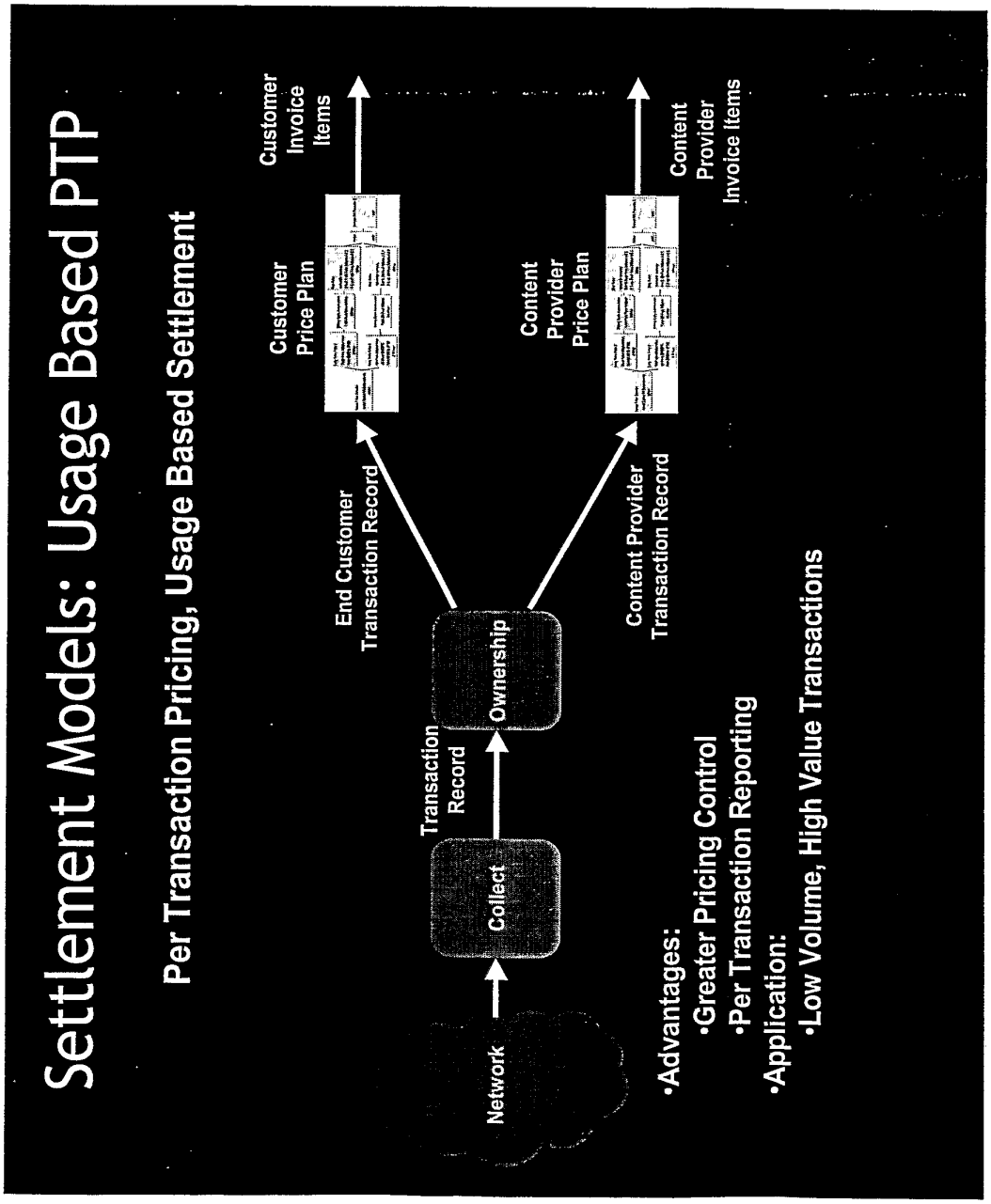

Settlement Models: Usage Based PTP
Per Transaction Pricing, Usage Based Settlement
Customer Invoice Items
Customer Price Plan
End Customer Transaction Record
Content Provider Price Plan
Content Provider Invoice Items
Content Provider Transaction Record
Transaction Record
Ownership
Collect
Network
•Advantages:
•Greater Pricing Control
•Per Transaction Reporting
•Application:
•Low Volume, High Value Transactions

Figure 11

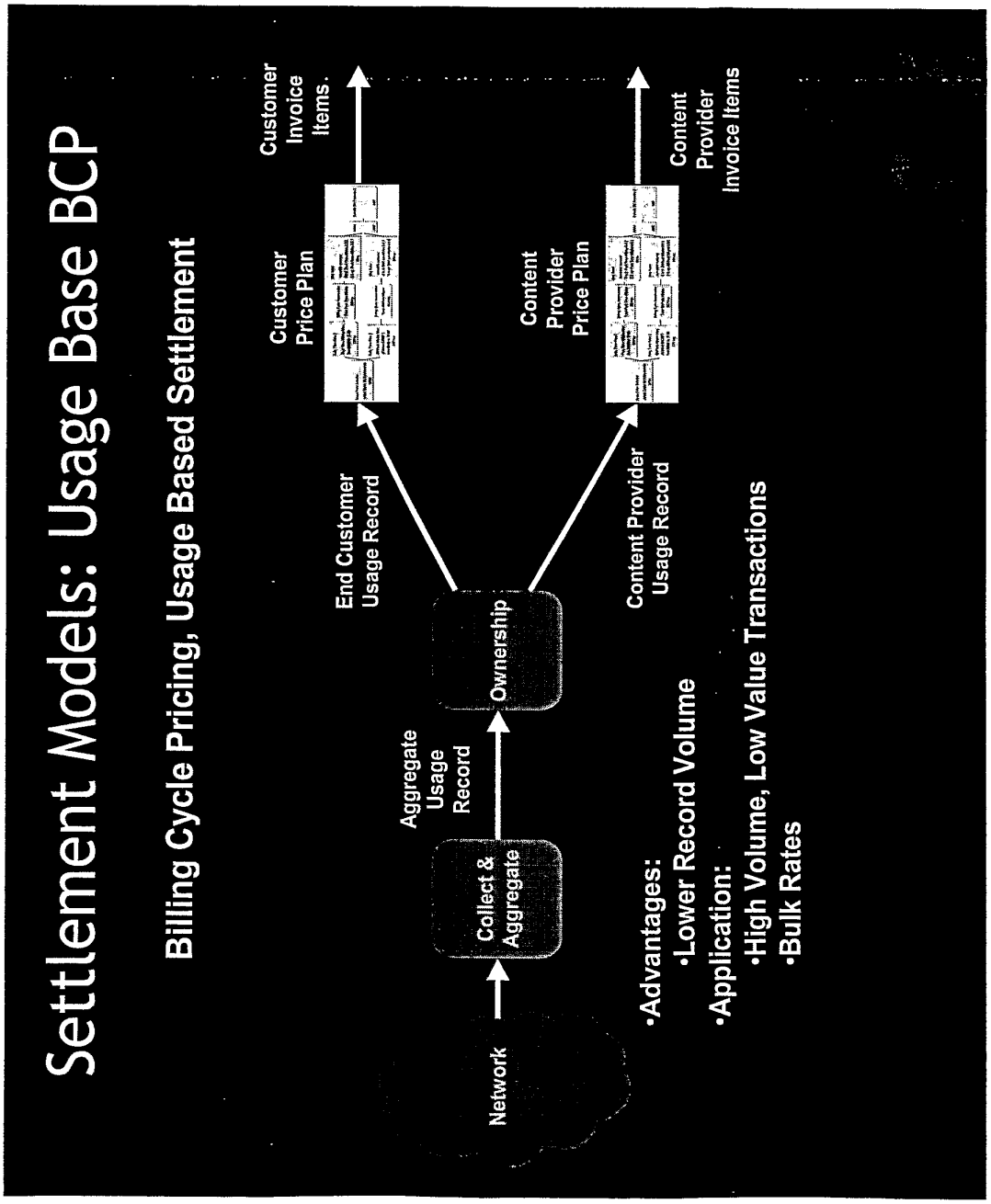

Settlement Models: Usage Base BCP
Billing Cycle Pricing, Usage Based Settlement
Customer Invoice Items.
Customer Price Plan
End Customer Usage Record
Content Provider Price Plan
Content Provider Usage Record
Content Provider Invoice Items
Aggregate Usage Record
Ownership
Collect & Aggregate
Network
•Advantages:
•Lower Record Volume
•Application:
•High Volume, Low Value Transactions
•Bulk Rates

Figure 12

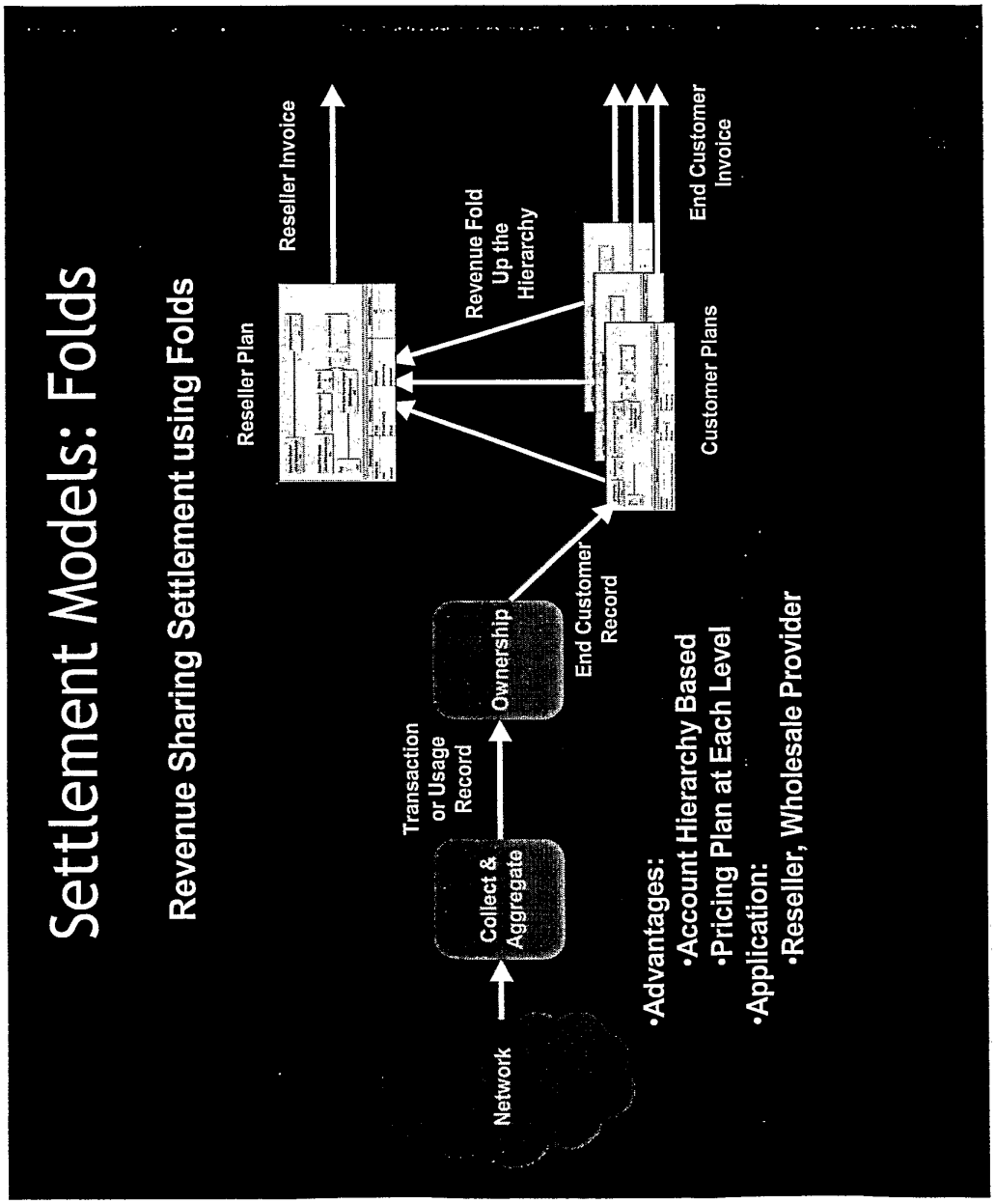

Settlement Models: Folds
Revenue Sharing Settlement using Folds
Reseller Plan
Reseller Invoice
Revenue Fold Up the Hierarchy
Customer Plans
End Customer Invoice
Transaction or Usage Record
Ownership
End Customer Record
Collect & Aggregate
Network
•Advantages:
•Account Hierarchy Based
•Pricing Plan at Each Level
•Application:
•Reseller, Wholesale Provider

Figure 13

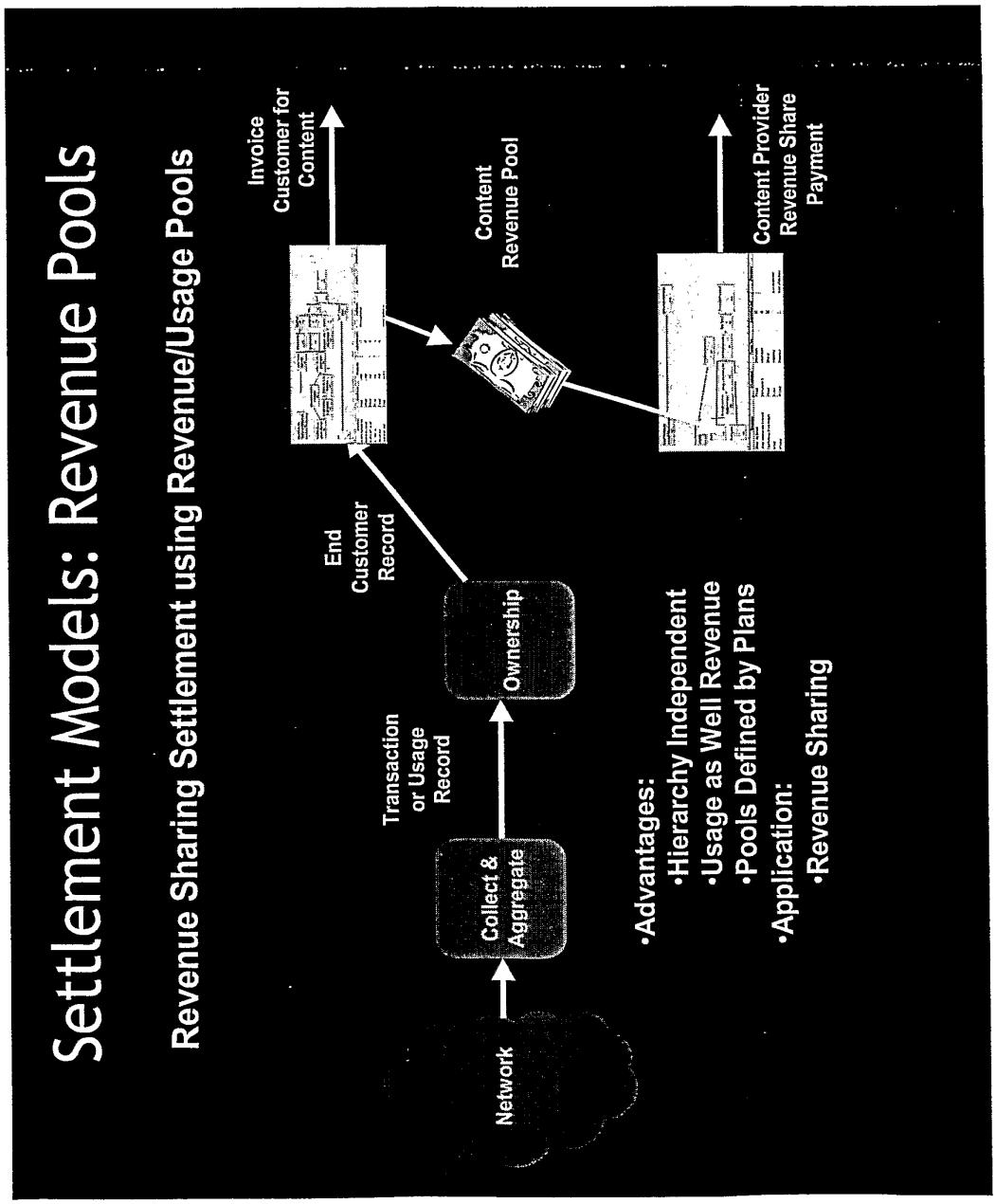

Settlement Models: Revenue Pools
Revenue Sharing Settlement using Revenue/Usage Pools
Invoice Customer for Content
Content Revenue Pool
Content Provider Revenue Share Payment
End Customer Record
Transaction or Usage Record
Ownership
Collect & Aggregate
Network
•Advantages:
•Hierarchy Independent
•Usage as Well Revenue
•Pools Defined by Plans
•Application:
•Revenue Sharing

Figure 14

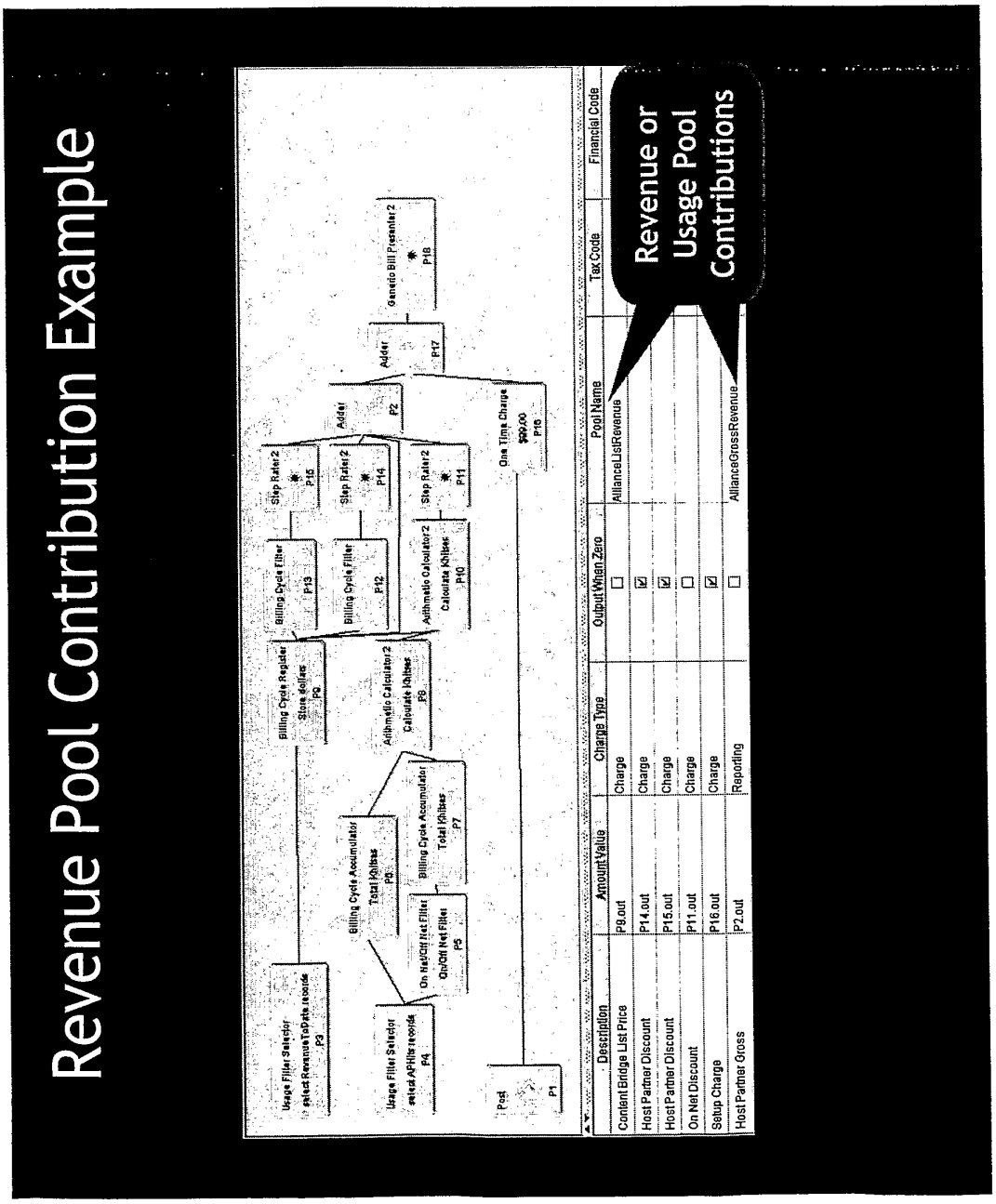

Revenue Pool Contribution Example
Revenue or Usage Pool Contributions
Post
P1
Usage Filter Selector
select APIhits records
P4
Usage Filter Selector
select RevenueToPools records
P3
On Net/Off Net Filter
On/Off Net Filter
P5
Billing Cycle Accumulator
Total Kbites
P6
Billing Cycle Accumulator
Total Kbites
P7
Arithmetic Calculator2
Calculate Kbites
P8
Billing Cycle Register
Store dollars
P9
Arithmetic Calculator2
Calculate Kbites
P10
Step Rater2
P11
Billing Cycle Filter
P12
Billing Cycle Filter
P13
Step Rater2
P14
Step Rater2
P15
One Time Charge
$99.00
P16
Adder
P2
Adder
P17
Generic Bill Presenter2
P18
Description
AmountValue
Charge Type
Output When Zero
Pool Name
Tax Code
Financial Code
Content Bridge List Price
P8.out
Charge
AllianceListRevenue
Host Partner Discount
P14.out
Charge
Host Partner Discount
P15.out
Charge
On Net Discount
P11.out
Charge
Setup Charge
P16.out
Charge
Host Partner Gross
P2.out
Reporting
AllianceGrossRevenue

Figure 15

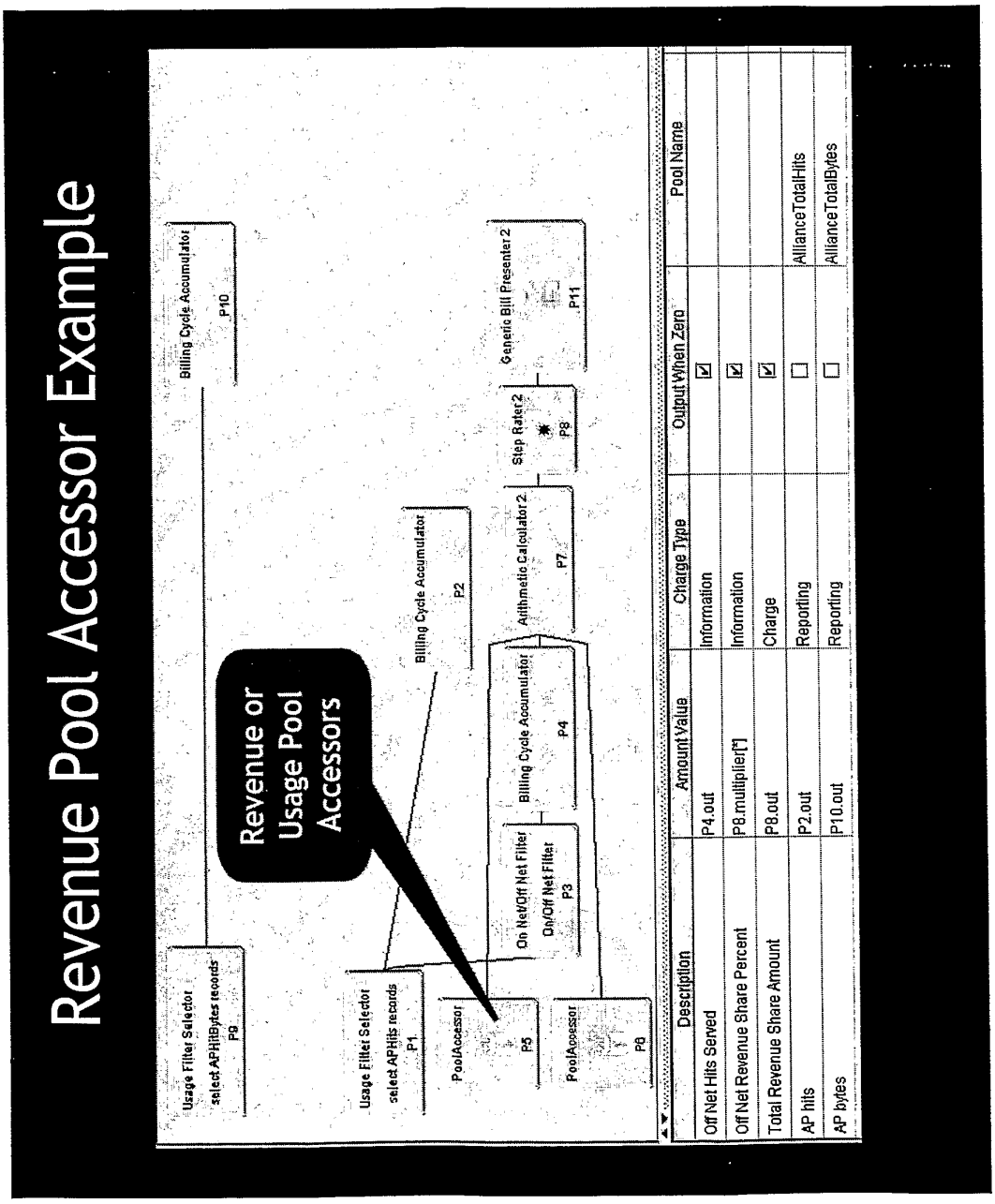

Revenue Pool Accessor Example
Revenue or Usage Pool Accessors
Usage Filter Selector select APHitBytes records P9
Billing Cycle Accumulator P10
Usage Filter Selector select APHits records P1
Billing Cycle Accumulator P2
PoolAccessor P5
On Net/Off Net Filter
On/Off Net Filter P3
Billing Cycle Accumulator P4
Arithmetic Calculator 2 P7
Step Rater 2 P8
Generic Bill Presenter 2 P11
PoolAccessor P6
Description
Amount Value
Charge Type
Output When Zero
Pool Name
Off Net Hits Served
P4.out
Information
Off Net Revenue Share Percent
P8.multiplier[1]
Information
Total Revenue Share Amount
P8.out
Charge
AP hits
P2.out
Reporting
AllianceTotalHits
AP bytes
P10.out
Reporting
AllianceTotalBytes

Figure 16

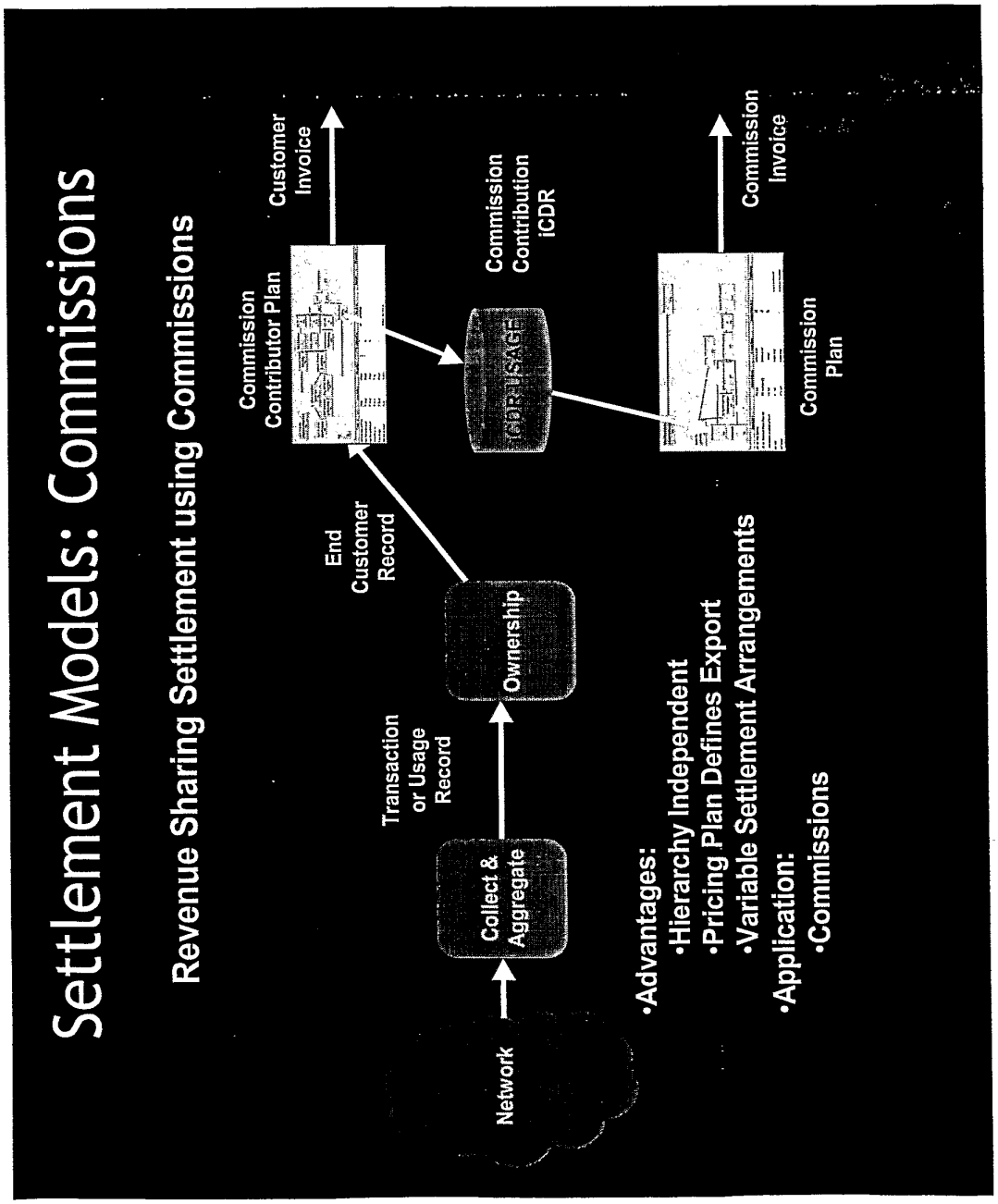

Settlement Models: Commissions
Revenue Sharing Settlement using Commissions
Network
Collect & Aggregate
Transaction or Usage Record
Ownership
End Customer Record
Commission Contributor Plan
Customer Invoice
Commission Contribution iCDR
Commission Plan
Commission Invoice
•Advantages:
•Hierarchy Independent
•Pricing Plan Defines Export
•Variable Settlement Arrangements
•Application:
•Commissions

Figure 17

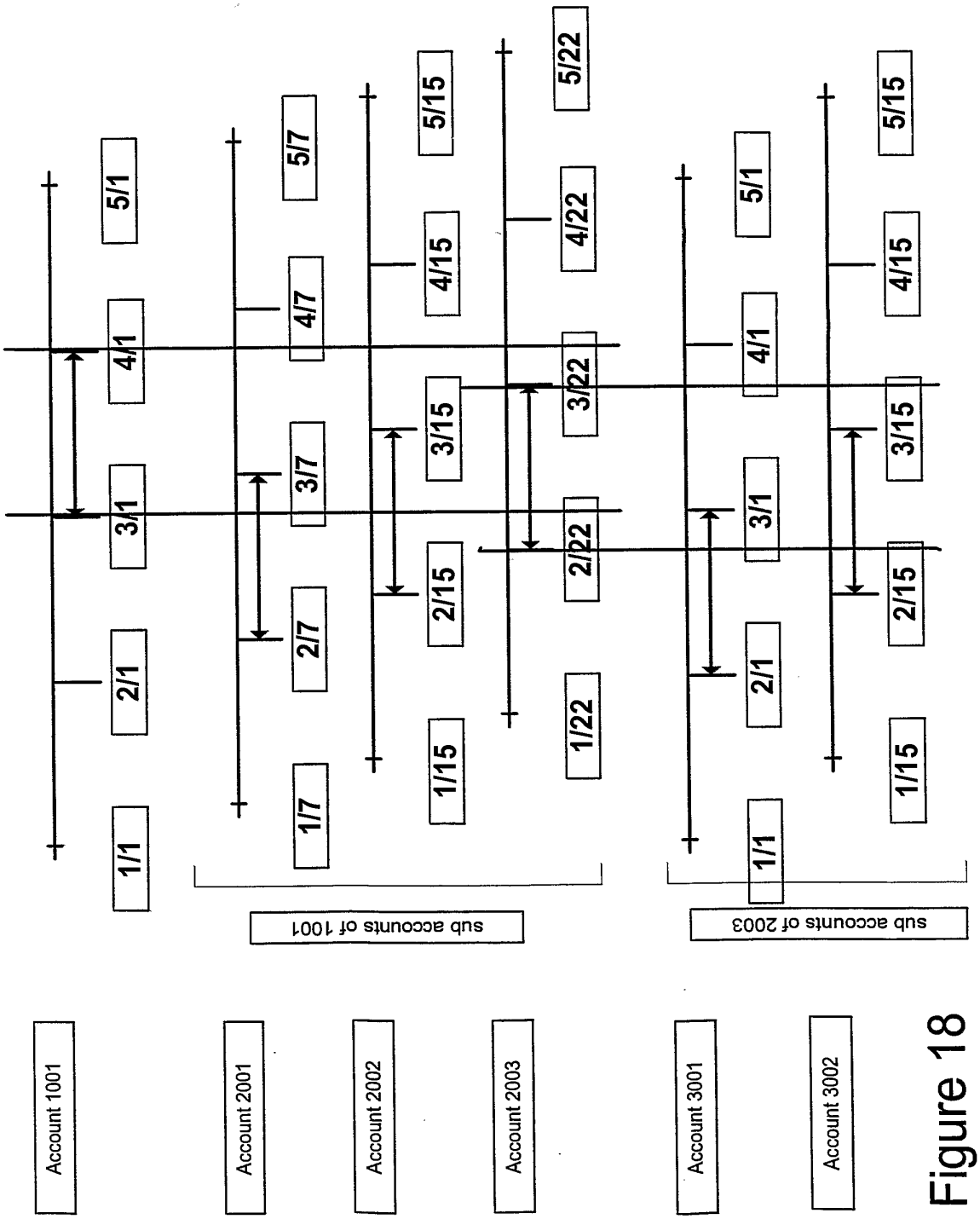

1/1
2/1
3/1
4/1
5/1
1/7
2/7
3/7
4/7
5/7
1/15
2/15
3/15
4/15
5/15
1/22
2/22
3/22
4/22
5/22
sub accounts of 1001
sub accounts of 2003
Account 1001
Account 2001
Account 2002
Account 2003
Account 3001
Account 3002

Figure 18

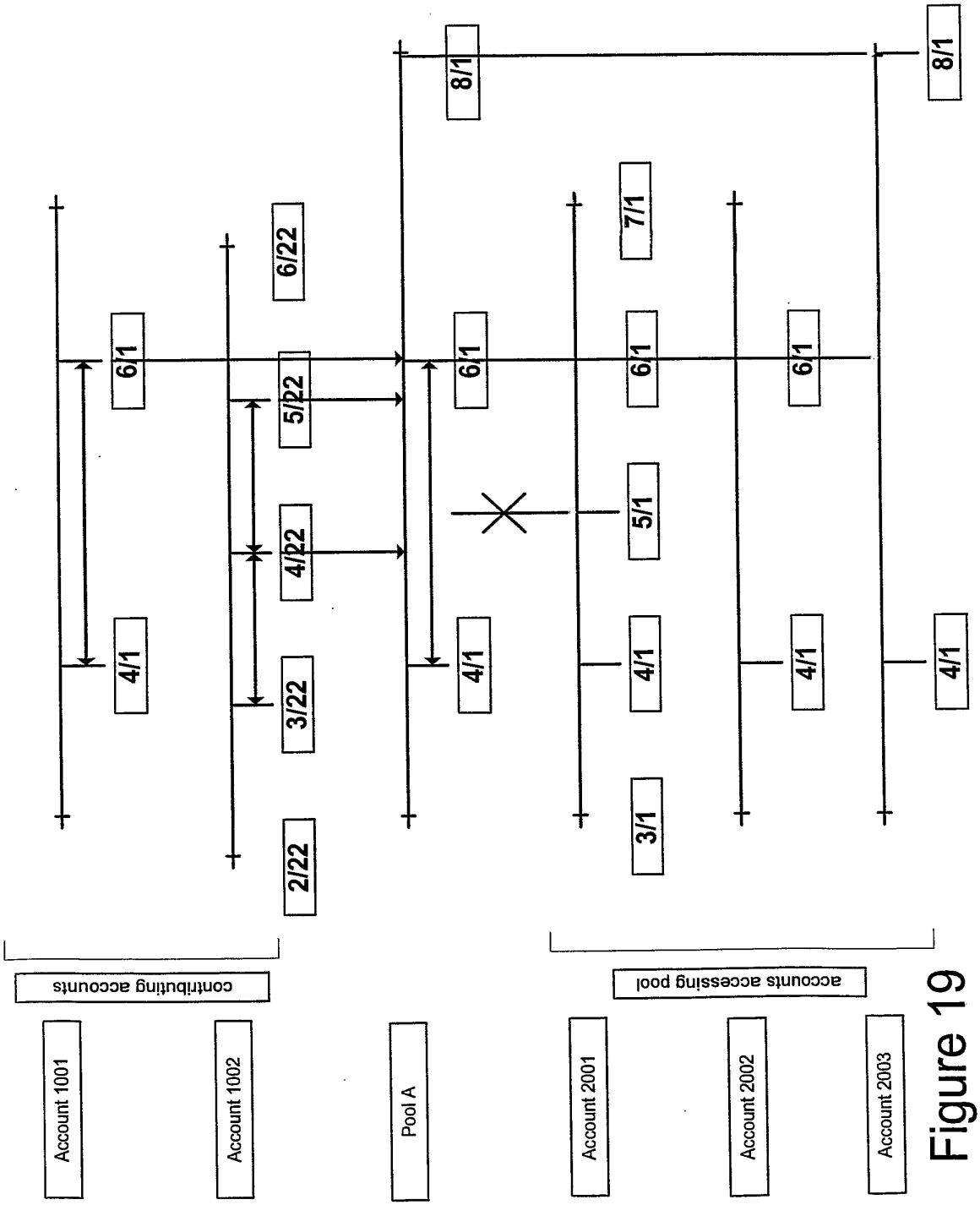

Account 1001
Account 1002
Pool A
Account 2001
Account 2002
Account 2003
contributing accounts
accounts accessing pool
8/1
8/1
6/22
7/1
6/1
6/1
6/1
6/1
5/22
5/1
4/22
4/1
4/1
4/1
4/1
4/1
3/22
3/1
2/22

Figure 19

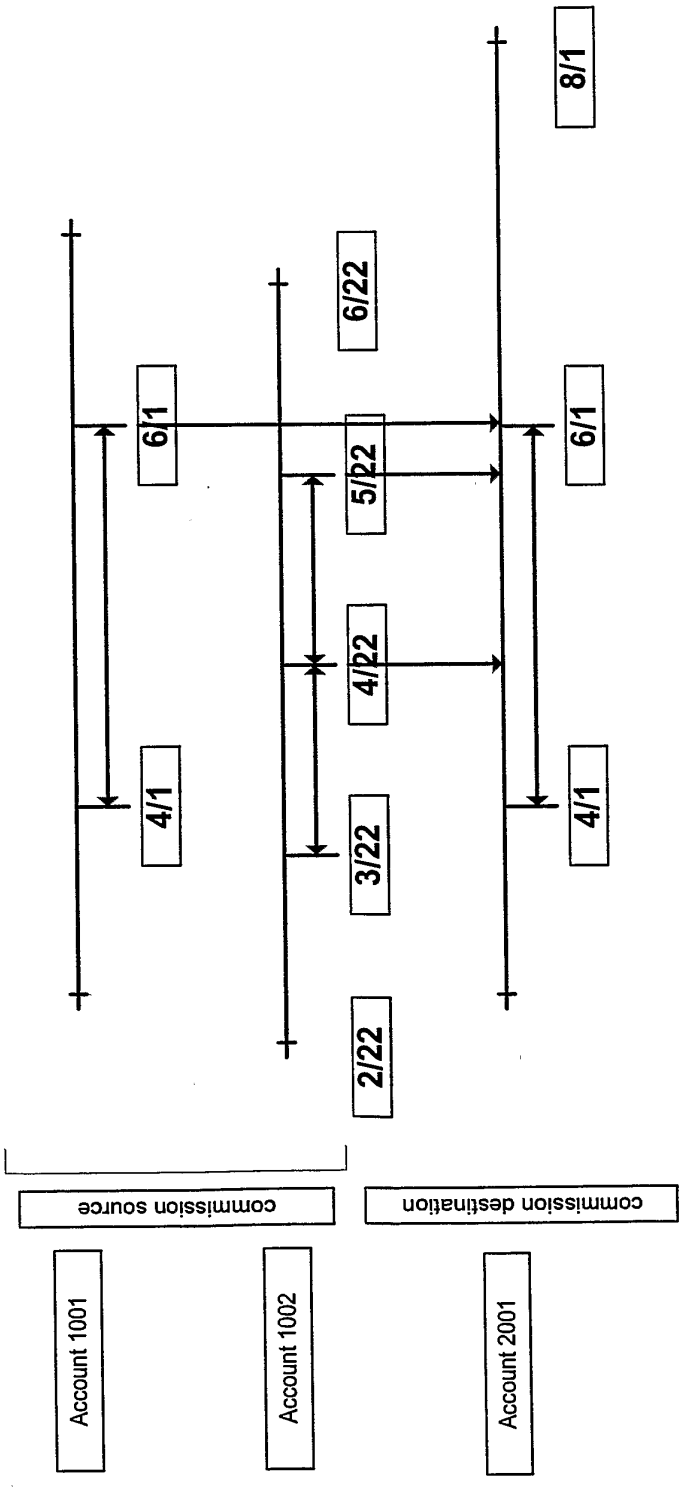

Account 1001
Account 1002
Account 2001
commission source
commission destination
6/1
4/1
6/22
5/22
4/22
3/22
2/22
8/1
6/1
4/1

Figure 20

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— *of inventorship (Rule 4.17(iv)) for US only*

**Published:**
— *with international search report*

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(54) Title: SYSTEM, METHOD AND NETWORK NODE FOR PROVIDING SERVICE-SPECIFIC BILLING IN A TELECOMMUNICATIONS SYSTEM

| P | ID | N | S1 | V | S2 | SV | BV |
|---|---|---|---|---|---|---|---|
| Elvis | PT | price_today | : | number | & | 0 | 500 |
| Elvis | EC | extra_cutback | = | number | & | 0 | 250 |
| Iiris | SP | single_payment | - | number | * | 250 | 250 |

(57) Abstract: In a multi-provider environment, where a network operator provides bearer services and a service provider provides the actual service, customizing billing for services requires accurate contracts concerning the content and structure of billing data transmitted by the service provider. In order to eliminate this problem, a billing content is determined for a service in such a manner that the content is available to the network operator and it determines parameters (N) provided in service billing data and indicates how to find the parameters from the billing data (ID, S1, S2). For determining billing data, definition rules are defined in advance to indicate at least the type of data that should be specified for each parameter.

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# System, method and network node for providing service-specific billing in a telecommunications system

## FIELD OF THE INVENTION

The invention relates to billing for a service transmitted in a telecommunications system, and particularly to providing service-specific billing.

## BACKGROUND OF THE INVENTION

Services provided in telecommunications systems are more and more often produced in a multi-provider environment, where a network operator provides bearer services and one or more service providers provide the actual services. A service provider does not maintain a network but purchases the required bearer services from the network operator. Thus, the total price of a service is a combination of the price of the connection and the price of the actual service or content. Even in a multi-provider environment the best way to charge a client is that the network operator attends to authentication and billing of the user of the service according to the user's phone number also on behalf of the service provider. An actual bill is based on billing data transmitted by the service provider in a service response, and collected and processed by a billing data collecting system of the network operator.

A problem with such billing is that the operator and the service provider must have accurate contracts concerning the content and structure of the billing data in order that a service could be billed for in the way the service provider wants. In case of a large number of service providers, the network operator does not necessarily have time or is not able to agree in detail on the contents of the billing data with each service provider, which means that either the introduction of a service into the market will be delayed, or the service provider must arrange billing in some other manner or use an existing billing method, which may not be the best for the service in question.

## BRIEF DESCRIPTION OF THE INVENTION

An objective of the invention is to develop a method and equipment implementing the method so as to solve the aforementioned problems. The objective of the invention is achieved by a method, system and network nodes, which are characterized by what is disclosed in the independent claims. The preferred embodiments of the invention are disclosed in the dependent claims.

The invention is based on detecting this problem and on solving it by providing a system of a network operator, preferably a system for process-

ing billing data, with a mechanism for informing the network operator of the form in which the billing data should be disclosed. The mechanism is preferably created by determining rules for defining billing parameters and by determining, by means of these rules, a billing content of a service, which is available to the network operator when forming a call detail record, and by storing the billing content in the system so as to be available to a process producing tickets. A billing content determines the service-specific parameters used in a call detail record, i.e. a ticket, and indicates how to locate the parameters in the billing data. The processing system can constitute a part of the system for collecting billing data.

An advantage of the invention is the ability to transmit and process billing data, which has different contents for different services since the billing parameters can be freely selected. Another advantage of the invention is that no specific service contract is needed between the network operator and the service provider, since the invention enables determining the structure of the billing data in such a manner that the network operator's system identifies the billing parameters and their values. Therefore the operator can provide user authentication and billing services globally to service providers. This even enables billing for free browsing, where a user is able to use all the services and not only the services of the operator or partners thereof.

## BRIEF DESCRIPTION OF THE FIGURES

The invention will be described below in more detail by means of the preferred embodiments and with reference to the accompanying drawings, in which

Figure 1 shows a simplified network architecture,

Figure 2 shows an example of determining a billing content according to a first preferred embodiment of the invention,

Figure 3 shows formation of a ticket according to the first preferred embodiment of the invention, and

Figure 4 shows an example of a ticket according to the first preferred embodiment of the invention.

## DETAILED DESCRIPTION OF THE INVENTION

The present invention can be applied in connection with any telecommunications system where the data required for billing a subscriber is transmitted together with service data. Such systems include for example third-

generation mobile systems, such as the Universal Mobile Telecommunications System (UMTS), and mobile systems similar to the pan-European GSM (Global System for Mobile Communications), such as the GSM 1800 and the PCS (Personal Communication System), and systems based on the aforementioned systems, such as GSM 2+ systems. GSM 2+ services include the general packet radio service (GPRS) and customized applications for mobile network enhanced logic (CAMEL). The invention can also be applied in fixed systems. The invention will be described below by using as an example the GSM providing a WAP (Wireless Application Protocol) service, without restricting the invention thereto, however. The WAP is a protocol specification that enables apparatuses utilizing wireless data transmission, such as mobile phones, to use Internet services.

Figure 1 shows a simplified network architecture of a first preferred embodiment of the invention, and it illustrates only some elements of a system architecture J. Network nodes shown in Figure 1 are logical units, the implementation of which can differ from that of the figure. It is obvious to a person skilled in the art that the system can also comprise other functions and structures, which do not have to be described in more detail herein. The description of the system is by no means restrictive but only suggestive.

The system shown in Figure 1 consists of a system of a network operator VJ and a system of a service provider PJ. In the example of Figure 1, a mobile station MS user has set up a connection to a server S providing a WAP service via the network operator's network PLMN via a WAP gateway W_GW in a previously known manner. In the first preferred embodiment of the invention, the WAP gateway W_GW picks the billing data from a service response transmitted by the server and stores it in a log file, which is retrieved by a charging gateway CG connected to the network operator's network PLMN and which is processed into call detail records, i.e. tickets. An example of a ticket is shown in Figure 4. The tickets are then transmitted to a billing centre BC, which attends to billing of a user. The picking of billing data refers to picking of data used to form a ticket, such as a part of the service response containing the data required in billing. In a service response, billing data can be located for example in an HTTP (Hyper Text Transport Protocol) header. In another embodiment of the invention, the WAP gateway W_GW does not store the billing-related data that was picked into a log file but transmits the data to the charging gateway CG for example via a real-time interface. The details of

the billing, e.g. how billing data is transmitted, collected and retrieved and where it is stored, are not significant for the invention. For example, arranging billing for the WAP service is described in more detail in Finnish Patent Application 20000589 (Arranging billing in a telecommunications system), which is incorporated herein by reference.

The charging gateway CG comprises an interface I, via which service-specific billing contents LS can be determined in the charging gateway. Examples of such billing contents are shown in Figure 2. The interface I thus provides configuring means for determining the content and structure of the billing data and the ticket and for storing them by means of the definition rules for billing parameters. Billing contents are preferably stored in a memory M of the charging gateway. The network operator has usually determined the definition rules and the service provider determines the actual billing content of the service, i.e. it determines the required parameters and provides parameter specifications. The actual billing content is input/processed into the memory M of the charging gateway via the interface I by the operator or the service provider, depending on their mutual agreement. The interface I can also be arranged to check, in connection with the input or processing of the billing content, that the parameter specifications comply with the definition rules. The definition rules are preferably the same for all the service providers, but the network operator can also customize the rules separately for each service provider. Inputting billing contents does not preferably require a service contract between the service provider and the network operator, but the service provider may be able to input billing contents for example via the Internet after having accepted certain rules and passed a log-in process. The charging gateway CG also comprises processing means, i.e. a process P, which converts the billing data into a ticket by means of the billing content specified for the service. The operation of the process P will be described in more detail in connection with Figure 3.

Depending on the embodiment, the interface I can be located in a different network node than the stored billing contents LS. Neither has to be located in the charging gateway. A network node where the billing contents LS are stored comprises means for receiving requests on billing contents and means for processing and transmitting responses.

In addition to prior art means, a system implementing the functionality of the present invention and the network nodes of the system comprise

means for creating and storing service-specific billing contents. The system and the network nodes can also comprise means for processing a billing content. The means are preferably implemented by using the present network nodes, especially the processors and memory thereof. All the modifications required to implement the invention can be carried out in the form of added or updated software routines, application-specific integrated circuits (ASIC) and/or programmable circuits.

Figure 2 shows a manner according to the first preferred embodiment of the invention of determining service-specific billing contents stored in a database table where each service-specific parameter to be taken into account in billing is provided with required data, i.e. the parameters are determined according to the definition rules. It is assumed in the first preferred embodiment of the invention that a billing ticket consists of standard data and service-specific data. Parameters for the standard data are determined generally in the first preferred embodiment, i.e. they are shared by all services. Such standard data includes for example user identifier, service name, service status data, and time. Standard data or some part of it can be transmitted with service-specific billing data, but for example in case of WAP services they are usually obtained in some other manner. Service-specific data is determined in the billing content of a service. The parameters that should be or may be specified in the billing content naturally depend on the operator, the billing system used by the operator, and the form in which billing data is transmitted. These matters are described in the definition rules. The essential fact in the billing content of an individual service is that it can be connected to a specific service and that at least one billing parameter is determined in such a manner that the billing parameter and the value thereof can be somehow separated from the billing data. However, in the first preferred embodiment of the invention it is not necessary to determine a billing content for all the services if standard data is sufficient to bill for a service.

In the example shown in Figure 2, it is assumed for the sake of clarity that the service name identifies the service sufficiently, i.e. the service cannot be confused with any other service, and different service providers do not have services with similar names. In embodiments where a mere service name does not identify a service sufficiently accurately, a service to be billed for can be identified for example based on the names of both the service provider and the service.

In the first preferred embodiment of the invention, the definition rules do not restrict in any way the ability of service providers to determine the parameters to be taken into account in billing, and the only requirement is that each parameter of a service billing content is provided with not only a name N but also the following data:

- The service P to which the parameter is related. A parameter defined by means of a service can be connected to the service billing content,
- A parameter identifier ID used in billing data to help locate the parameter and the value thereof,
- A separator S1 between an identifier and the value thereof in the billing data,
- Value type V,
- The allowed range of variation of the value indicated by means of the lowest value SV and the highest value GV, and
- A separator S2 between the identifiers.

On the basis of this data, a single ticket may contain 1 to n items of service-specific billing data, which are mutually independent. The billing data can even consist of data not used by the network operator in its own billing. For example based on the specifications shown in Figure 2, a ticket formed of a service called 'Elvis' contains the billing value of two parameters in the service-specific data, and a ticket formed of a service called 'Iiris' contains the billing value of one parameter. The same parameter can also be used in different services and with different ranges of variation. Eliminating parameters from or adding new parameters into a service is easy and simple in the first preferred embodiment of the invention. It is also easy and simple to alter parameter specifications, for example to update the allowed range of variation.

In a preferred embodiment of the invention, the operator can restrict parameter specifications for example by limiting the maximum number of parameters used in one service or by restricting the allowed value types to numbers only. The operator can also determine its own set of billing parameters, which it offers to service providers. The service providers then select from the set of billing parameters the parameters they want to use in billing for each service.

In a preferred embodiment of the invention, parameters and their values to be used in standard data are also specified in the billing content of

each service. In this way standard data can also be configured specifically for each service/service provider.

In another preferred embodiment of the invention, a common billing content is also determined and used for services with no specified billing content of their own. A common billing content can also be determined specifically for each service provider and/or service type. If a service-type-specific billing content is used, the service type is indicated in a service response either directly or indirectly in order that the correct billing content can be selected when forming a ticket. The same applies to service-provider-specific billing contents as well. The service type can be concluded for example based on the service when the system maintains data that links each service to a service type.

In a preferred embodiment of the invention, also a broader description of a parameter, such as the manner of use or the meaning in billing, can be stored in the billing content.

In another preferred embodiment of the invention, several different identifiers with different value ranges can be stored for one parameter in a billing content. In this embodiment, only one such identifier is shown in the billing data.

If the highest allowed value of the identifiers is equal to the lowest allowed value, in a preferred embodiment of the invention the billing data does not have to contain a value for the parameter, but it is possible to use the value determined in the billing content when forming a ticket.

In the other embodiments of the invention, the predetermined definition rules can differ from what is shown in Figure 2. It is sufficient that the definition rules ensure that the parameters in the billing content are known and that they will be found from the billing data.

Figure 3 shows a flowchart of how a ticket (or a part thereof, if one ticket combines the billing data of several service responses) is formed according to the first preferred embodiment of the invention from the billing data in the service response. It is assumed in the example of Figure 3 that the service provider has transmitted billing data or that the billing data field is not empty. An empty billing data field is preferably not processed at all. The example of Figure 3 does not determine at which stage the tickets should be transmitted to the billing centre. In the first preferred embodiment of the invention, service-specific billing data is transmitted in HTTP headers of a service response. Transmitting billing data as a part of an HTTP header has an advantage that

the data is not transmitted from the gateway, such as the WAP gateway, to the subscriber of the service. Furthermore, an HTTP header is an efficient channel of data transmission between a service provider and an operator.

Since it is not significant for the invention how the billing data is found for example from a log file, the starting point of Figure 3 is that in step 301 the processing of billing data is initiated. For example in the first preferred embodiment of the invention, the WAP gateway picks the billing data from the HTTP header of the service response for the WAP service on the basis of a carriage return. An example of billing data will be described below. The payer is identified first in step 302. The payer can be for example the end user or the service provider, such as a service provider providing a commercial WAP/SMS push service. A payer is identified according to the system used. In the present WAP services, a user is identified based on a phone number received during the set-up of the connection. In the future third-generation mobile systems and in general Internet-based services, the end user can be identified for example from the service log-in data transmitted by the service provider. It is also possible to identify both the payer and the user. After the payer has been identified, the service to which the billing data is related is identified in step 303. The service can be identified either directly by means of an identifier indicating the service name in the HTTP header, or by means of an analysis of a URL (Uniform Resource Locator) address. After the service has been identified, the standard data is retrieved from the billing data and stored (or the part of the standard data not received via some other route/earlier) in a ticket in step 304, and the service billing content is retrieved in step 305. The service billing content is retrieved in the first preferred embodiment of the invention by checking the database table shown in Figure 2 and by picking all the parameters with their specifications that relate to the service to be billed for. In step 306, it is checked whether a billing content was obtained. In other words, it is checked whether a billing content has been specified for the service. If a billing content was obtained (i.e. has been specified), the processing of the first parameter is initiated in step 307 and a corresponding identifier is retrieved from the HTTP header in step 308. If such an identifier was found (step 309), the value given for the identifier is retrieved in step 310. It is thereafter checked in step 311 whether the value is allowed, i.e. whether it is within predetermined limits and of a specified type. If the value was allowed, the parameter name and value are stored in the ticket in step 312, and it is checked in step 313 whether the

parameter was the last parameter of the billing content. If the parameter was not the last one, the next parameter is subjected to processing in step 314, whereafter the process proceeds from step 308 by searching the HTTP header for the corresponding identifier.

If the parameter was the last one (step 313), the processing of the billing data is terminated in step 315.

If the parameter value was not allowed (step 311), a failure report is generated to the system in step 316, and the ticket field in question is left empty. After the failure report has been generated, the process proceeds to step 313 to check whether the processed parameter was the last one in the billing content.

If a parameter identifier was not located (step 309), the process proceeds to the last step 313 to check whether the processed parameter was the last parameter in the billing content. In other words, it is assumed in the first preferred embodiment of the invention that this time the service provider did not want to use this parameter for billing. Such a parameter can be for example an additional discount parameter.

If a billing content was not obtained (step 306), it has not been determined for the service, wherefore the processing of the billing data is terminated in step 315.

In a preferred embodiment of the invention, at least some of the parameter specifications of the standard data are contained in the service billing content. In this embodiment, the billing content must be retrieved (step 306) before step 304, i.e. the retrieval and storage of the standard data.

In a preferred embodiment of the invention, all the parameters, including the parameters of the standard data transmitted in the billing data, such as a service identifier, are determined at least specifically for each service provider. In this embodiment, the processing of the billing data is initiated by first identifying the service provider, whereafter the database table is checked in order to retrieve the service-provider-specific parameters, such as a service identifier and possibly at least some of the standard data. After the service has been identified, the parameters specified for the service are retrieved. This provides the billing content, and the parameter values thereof are retrieved in the manner described above.

The steps of Figure 3 are not in an absolute order of time. Some of the aforementioned steps can take place simultaneously or in another order,

such as steps 304 and 305. Some steps can be skipped, or steps not shown in Figure 3 can be implemented between the steps. Some steps can also be replaced with a corresponding step. For example in an embodiment where the log file only comprises notes containing billing data and where a service-type-specific billing content is used for each service, step 306 can be skipped and step 303 can be replaced with a step of identifying the service type.

Figure 4 shows an xml (eXtendable Mark up Language) ticket CDR according to the first preferred embodiment of the invention, where the WAP service 'Elvis' has been subscribed to from mobile phone number 040555555. The billing content of the service has been specified as shown in Figure 2 and the billing data is indicated as follows in the HTTP header of the service response:

X-up-billing-Info:SN=elvis&PT:67&EC=15

In the first preferred embodiment, the ticket comprises standard data 1 and a part 2 that changes according to the service. The service-specific part 2 is determined according to the billing content defined for the service. In the first preferred embodiment of the invention, the standard data 1 includes a calling party identifier 11, billing data 12 in the HTTP header, a service name 13, and a service price class 14, which is used to distribute different services of the same service provider to different price classes. The standard data is followed by the changing part 2 of the ticket, which is not found in tickets related to a service for which a billing content has not been specified. By means of the definitions shown in Figure 2, the process forming a ticket is able to retrieve from the billing data an identifier and a value corresponding to each parameter specified for the service 'Elvis'.

Even though the above description relates to the use of the billing content for altering a ticket, it can also be applied to other functions related to billing, such as selecting what to store in a log file.

It is obvious to a person skilled in the art that as the technology develops, the basic idea of the invention can be implemented in several manners. The embodiments of the invention described above or the individual characteristics thereof can be combined to provide new embodiments. Thus, the invention and the embodiments thereof are not restricted to the above examples, but they may vary within the scope of the claims.

CLAIMS

1. A method of providing service-specific billing in a telecommunications system, where a system of a network operator transmits services of at least one service provider to a subscriber, and forms call detail records to be used in billing and containing at least one billing parameter and the value thereof, **characterized** in that the method comprises at least the following steps of:

determining rules for defining billing parameters,

determining, by means of the definition rules, a billing content for at least one service, the content containing at least one service-specific billing parameter and indicating how the parameter is found from billing data transmitted during the use of the service, and

storing the billing content in the telecommunications system such that it is available to the system of the network operator.

2. A method according to claim 1, **characterized** in that the method also comprises a step of forming, from the billing data, a call detail record, which contains at least a service-specific part comprising service-specific billing parameters and their values defined in the billing content.

3. A method according to claim 1 or 2, **characterized** in that the method also comprises the steps of

determining at least one set of billing parameters, and

selecting the billing parameters to be used in the billing content from the set of billing parameters.

4. A method according to claim 1, 2 or 3, **characterized** by determining a billing content for one service.

5. A method according to claim 1, 2 or 3, **characterized** by determining a billing content for a service type, and indicating the service type in the billing data.

6. A telecommunications system (J) comprising

a system of a service provider (PJ) for transmitting at least one service to a subscriber and for providing billing data related to the service, and

a system of a network operator (VJ) for transmitting the service from the service provider's system to the subscriber of the service, and for providing a call detail record to be used in billing of the subscriber by means of the billing data, and

a memory (M) for storing different specifications,

**characterized** in that

the system of the network operator (VJ) comprises an interface (I) for storing a billing content (LS) in the memory (M) for the service, the billing content determining at least one service-specific billing parameter of the billing data according to the predetermined definition rules, such that the billing parameter is found from the billing data transmitted during the use of the service.

7. A system according to claim 6, **characterized** in that the system of the network operator (VJ) is arranged to utilize the specifications of the billing content in forming a call detail record from the billing data related to the service.

8. A system according to claim 6, **characterized** in that the system of the network operator (VJ) is arranged to form a call detail record (CDR) for the service from standard data (1) containing the same parameters for all the services, and from service-specific data (2) according to the billing content defined for the service.

9. A system according to claim 6, 7 or 8, **characterized** in that the interface (I) is also arranged to alter the specifications of the billing content.

10. A system according to claim 6, 7, 8 or 9, **characterized** in that the interface (I) is also arranged to check, in connection with said storage, whether the parameter specifications comply with the definition rules.

11. A system according to claim 6, 7, 8, 9 or 10, **characterized** in that the system (J) is based on a GPRS system.

12. A system according to claim 6, 7, 8, 9 or 10, **characterized** in that the system (J) is based on a UMTS.

13. A network node (CG) in a telecommunications system where a system of a network operator transmits services of at least one service provider to a subscriber and provides call detail records used in billing, and where the service provider transmits billing data in connection with a service,

**characterized** in that

the network node comprises configuring means (I) for specifying parameters contained in the service billing data according to predetermined definition rules, such that the system of the network operator can use the specifications in forming a call detail record related to the service.

14. A network node according to claim 13, **characterized** in

that the configuring means (I) are arranged to alter the parameter specifications.

15. A network node according to claim 13 or 14, **characterized** in that the network node also comprises processing means (P) for forming a call detail record from the billing data related to the service, such that at least a part of the call detail record is formed according to the parameter specifications for the service.

16. A network node (CG) in a telecommunications system, where a system of a network operator transmits services of at least one service provider to a subscriber, and where the service provider transmits billing data in connection with a service, the network node comprising processing means (P) for forming a call detail record from the billing data related to the service,

**characterized** in that

the processing means (P) are arranged to determine a billing content specified for the service according to predetermined definition rules in the system of the network operator, the billing content containing at least service-specific billing parameters and indicating how the parameters can be found from the billing data, the processing means being also arranged to form a call detail record in such a manner that at least a part of the call detail record complies with the billing content.

17. A network node (CG) according to any one of claims 13 to 16, **characterized** in that the means (I, P) are implemented by software routines.

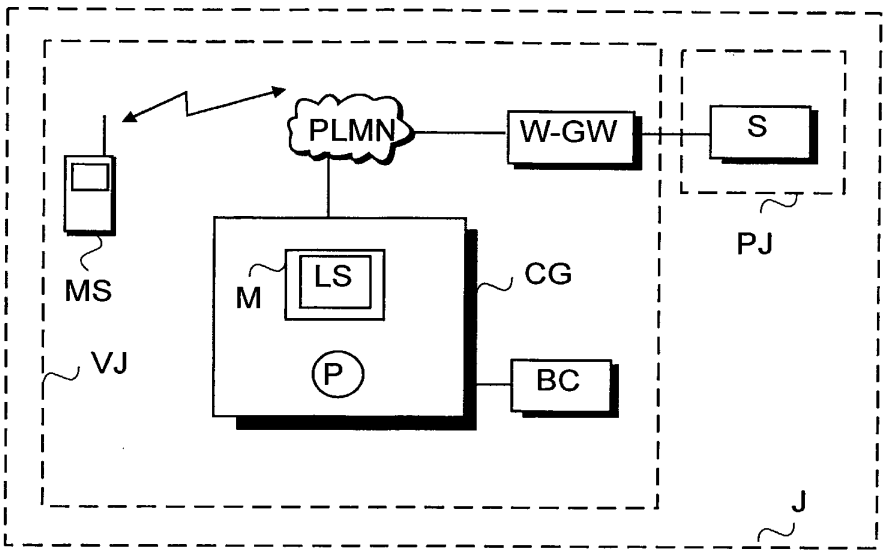



FIG.1

| P | ID | N | S1 | V | S2 | SV | BV |
|---|---|---|---|---|---|---|---|
| Elvis | PT | price_today | : | number | & | 0 | 500 |
| Elvis | EC | extra_cutback | = | number | & | 0 | 250 |
| Iiris | SP | single_payment | - | number | * | 250 | 250 |

FIG.2

CDR

<user_msisdn>040555555</user_msisdn>

11 <header>SN=elvis&RC=99&PT:67&EC=15</header>

12 <service_name>ELVIS</service_name>

13 <rate_category>99</rate_category>

1

<psd>
<price_today>67</price_today>
<extra_cutback>15</extra_cutback>
</psd>

2

FIG.4

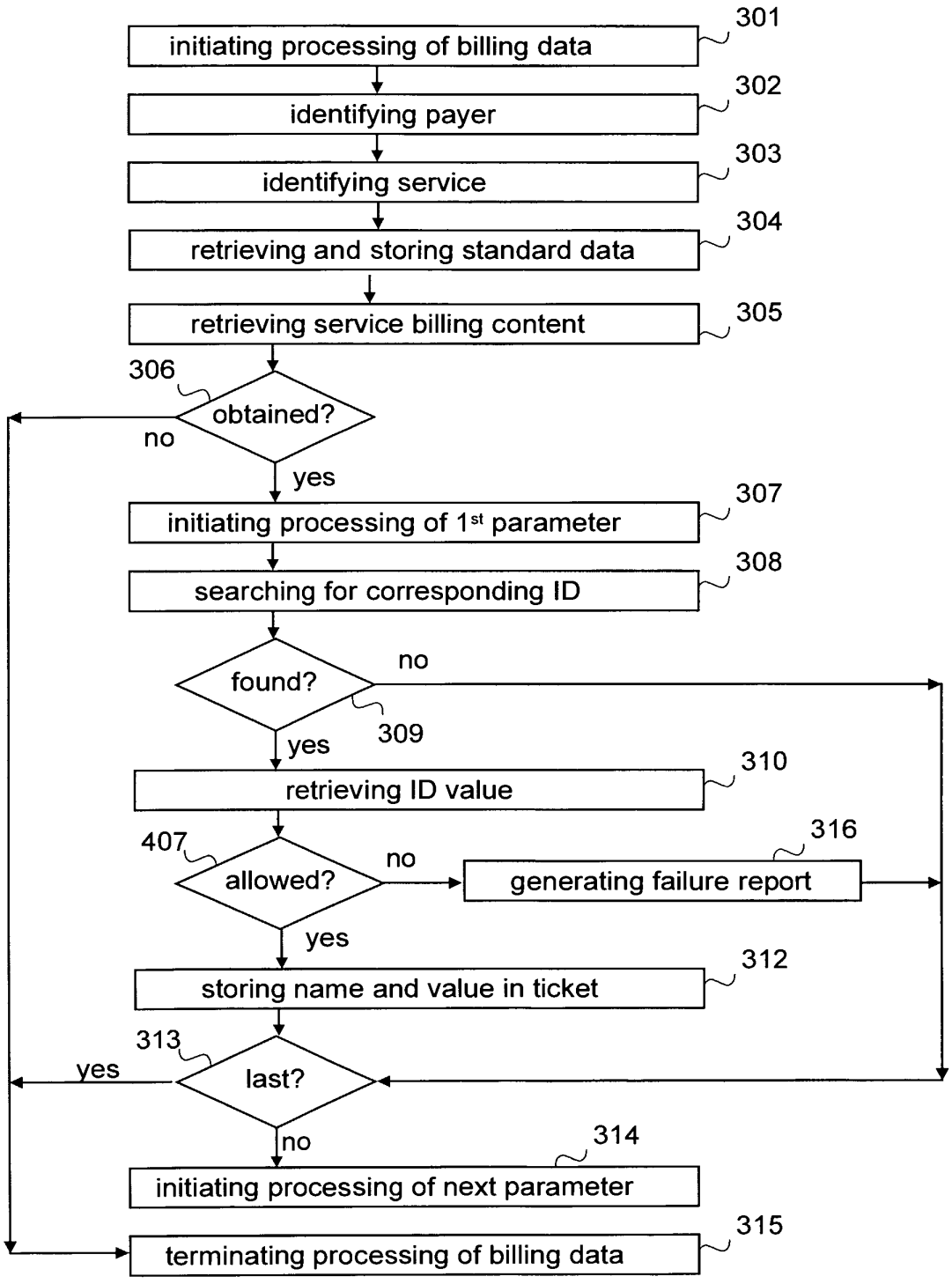

initiating processing of billing data
301
identifying payer
302
identifying service
303
retrieving and storing standard data
304
retrieving service billing content
305
306
obtained?
no
yes
initiating processing of 1st parameter
307
searching for corresponding ID
308
found?
no
309
yes
retrieving ID value
310
407
allowed?
no
316
generating failure report
yes
storing name and value in ticket
312
313
yes
last?
no
314
initiating processing of next parameter
315
terminating processing of billing data

FIG.3

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 02/00128

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04Q 7/38, H04M 15/00
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | US 5982864 A (JAGADISH ET AL), 9 November 1999 (09.11.99), column 3, line 48 - column 4, line 18, figure 1b, column 7, line 28 - line 32, column 5, line 19 - line 22 | 1-9,11-17 |
| A | abstract | 10 |
| | -- | |
| A | US 6047051 A (GINZBOORG ET AL), 2 April 2000 (02.04.00), abstract | 1-17 |
| | -- | |
| P,A | WO 0191003 A2 (ZTANGO, INC), 29 November 2001 (29.11.01), claim 3, abstract | 1-17 |
| | -- | |

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 23 May 2002 | 06 -06- 2002 |
| Name and mailing address of the ISA/<br>Swedish Patent Office<br>Box 5055, S-102 42 STOCKHOLM<br>Facsimile No. +46 8 666 02 86 | Authorized officer<br>Malin Söderman /js<br>Telephone No. +46 8 782 25 00 |

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 02/00128

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
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Information on patent family members

01/05/02

International application No.
PCT/FI 02/00128

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| | | EP 1117340 A | 25/07/01 |
| | | EP 1180297 A | 20/02/02 |
| | | NO 20015022 A | 18/12/01 |
| | | SE 9901509 A | 28/10/00 |

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(74) Agent: **BORNSEN, Brett**; Alcatel-Lucent Usa Inc, Docket Administrator - Room 2F-192, 600-700 Mountain Avenue, Murray Hill, New Jersey 07974-0636 (US).

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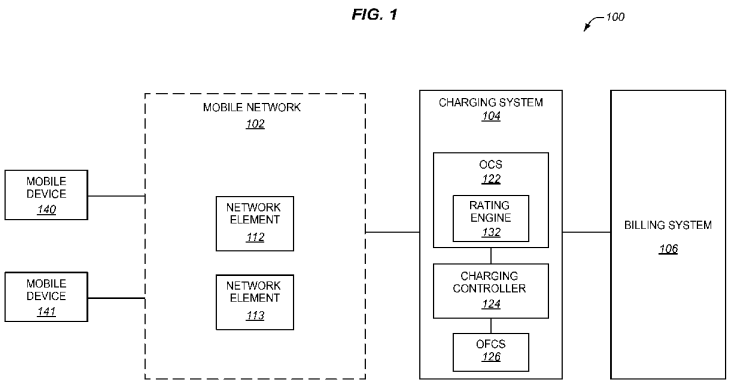
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**Published**:

— *with international search report (Art. 21(3))*

(54) **Title**: FRONT-END CHARGING SYSTEM THAT GENERATES CHARGING DATA PER ENTITY HAVING A REVENUE SHARE

FIG. 1




(57) **Abstract**: Charging systems and methods are disclosed for determining the share of call revenue for multiple entities. One embodiment comprises a charging controller that is coupled to a mobile network and an online charging system. The charging controller receives charging data for a call in the mobile network, and processes the charging data and charging rules to identify entities that have a share in revenue for the call. The charging controller generates a charging request message indicating the entities having a revenue share in the call, and transmits the charging request message to the online charging system to cause the online charging system to determine the revenue share for each of the entities.

WO 2011/002450 A1

# FRONT-END CHARGING SYSTEM THAT GENERATES CHARGING DATA PER ENTITY HAVING A REVENUE SHARE

## Background

*1. Field of the Invention*

The invention is related to the field of communication networks and, in particular, to charging and billing in communication networks.

*2. Statement of the Problem*

When a phone call is placed over a communication network, there may be multiple entities that share in the revenue received for the call. For instance, the network operator that actually operates and maintains the network over which the call is placed shares in the revenue. If the call extends to a foreign communication network, such as for an international call, then the network operator of the foreign communication network shares in the revenue for the call. If a call extends to a roaming mobile user, then the network operator of the mobile network in which the user is roaming shares in the revenue. The process of determining which entities share in the revenue of a call is sometimes referred to as mediation.

In traditional communication networks, charging functions for calls are performed by network components, such as switches. Switches collect charging data for the calls, and generate Charging Detail Records (CDR) that include the charging data. Switches all over the entire network forward the CDRs to a billing system in service provider's IT system (often referred to as a back-end or back-office billing system). The back-office billing system stores information that may be used for the mediation process. For example, the billing system stores agreements that a network operator may have with a foreign network operator for international calls, stores agreements that a network operator may have with mobile networks for roaming scenarios, etc. The billing system also performs settlement processes to invoice customers for the telephone services, and to provide vouchers or credits to other entities.

In more recent charging architectures, postpaid charging is implemented through an Offline Charging System (OFCS) and an associated billing system. Similarly, prepaid charging is implemented through an Online Charging System (OCS) and an associated billing system. To provide offline and online charging, the OCS and the billing systems

each maintain their own rating engine. Also, the billing systems each maintain profiles for the subscribers, profiles for the wholesale customers, and profiles for other network operators having contractual agreements. The overlap of the rating engines and the profiles wastes significant resource in the network. Operational inefficiencies and technical overhead for maintaining two separate charging systems may lead to the drawback in marketing and business activities for a network operator. Presently, the network operators are subject to great pressures to reduce the operational costs.

## Summary

Embodiments described herein are able to manage the flow of revenue to the appropriate entities for a call using a converged charging system. The converged charging system centralizes prepaid charging, postpaid charging, interconnect charging, wholesale charging, content charging, roaming charging, etc. Thus, revenues for a call may be divided among multiple entities based on the applicable charging types. This will significantly reduce the work in the back office, and create near real-time billing. The converged charging system also enables the rating or billing-related activity to share a common rating engine and a common account balance management function, which reduces the cost for system deployment, operation, and maintenance.

One embodiment comprises a charging controller that is coupled to a mobile network and an online charging system. The charging controller is operable to receive charging data for a call in the mobile network, and to process the charging data for the call and charging rules to identify entities that have a share in revenue for the call. The charging controller is further operable to generate a charging request message indicating the entities having a revenue share in the call, and to transmit the charging request message to the online charging system to cause the online charging system to determine the revenue share for each of the entities.

In another embodiment, the online charging system is operable to receive the charging request message from the charging controller, and to identify a profile for each of the entities having a revenue share. The online charging system is further operable to determine a revenue share amount for each of the entities based on their profile and a rating, to generate charging records indicating the revenue share amount for each of the entities, and to transmit the charging records to the charging controller.

In yet another embodiment, the charging controller is further operable to receive the charging records, to correlate the charging records to generate a consolidated charging record that indicates the revenue share amount for each of the entities, and to transmit the consolidated charging record to a billing system.

Other exemplary embodiments may be described below.

## Description of the Drawings

Some embodiments of the present invention are now described, by way of example only, and with reference to the accompanying drawings. The same reference number represents the same element or the same type of element on all drawings.

FIG. 1 illustrates a communication network in an exemplary embodiment.

FIG. 2 is a flow chart illustrating a method of charging for a call by generating charging data for each entity having a revenue share in an exemplary embodiment.

FIG. 3 is a flow chart illustrating a method of determining the revenue share for multiple entities in an exemplary embodiment.

FIG. 4 is a flow chart illustrating a method of correlating charging records in an exemplary embodiment.

FIG. 5 illustrates another communication network in an exemplary embodiment.

FIG. 6 illustrates how the revenue for a call is divided among entities in an exemplary embodiment.

FIG. 7 is a message diagram illustrating how revenue for a call is divided in an exemplary embodiment.

## Description of Embodiments

The figures and the following description illustrate specific exemplary embodiments of the invention. It will thus be appreciated that those skilled in the art will be able to devise various arrangements that, although not explicitly described or shown herein, embody the principles of the invention and are included within the scope of the invention. Furthermore, any examples described herein are intended to aid in understanding the principles of the invention, and are to be construed as being without limitation to such specifically recited examples and conditions. As a result, the invention is not limited to the specific embodiments or examples described below, but by the claims and their equivalents.

FIG. 1 illustrates a communication network 100 in an exemplary embodiment. Communication network 100 includes a mobile network 102, a charging system 104, and a billing system 106. Mobile network 102 may comprise a circuit-based network, such as a CDMA network or a GSM network, may comprise a packet-based network, such as an IP Multimedia Subsystem (IMS) network, or a mix of the two. Mobile network 102 is able to provide service to mobile devices 140-141 to place voice calls, to initiate data sessions, to send or receive text messages or multimedia messages, etc. Mobile network 102 includes a plurality of network elements 112-113 that are operable to serve a session/call or provide a service for a session/call within mobile network 102. For example, network element 112 may comprise a Serving-Call Session Control Function (S-CSCF) while network element 113 may comprise an application server (AS) in an IMS network. Alternatively, network element 112 may comprise a Mobile Switching Center (MSC) while network element 113 may comprise an SGSN of a UMTS network.

Charging system 104 comprises any system, server, or function operable to provide online and/or offline charging for sessions/calls in mobile network 102. For the online/offline charging, charging system 104 is able to generate consolidated charging records for sessions/calls within mobile network 102, and send the CDRs to billing system 106. Charging system 104 includes an online charging system (OCS) 122, a charging controller 124, and an offline charging system (OFCS) 126. OCS 122 includes a common rating engine 132 that may be shared by OCS 122 and OFCS 126, and may include other functions that are not shown. OFCS 126 may also include a variety of functions that are not shown for the sake of brevity, such as a Charging Data Function (CDF)/Charging Gateway Function (CGF) as defined by the 3GPP in Release 6, or a Charging Collector Function (CCF) as defined by the 3GPP in Release 5.

Billing system 106 comprises any system, server, or function operable to receive a consolidated charging record for a session/call, and to invoice one or more customers for the session/call based on the consolidated CDR or issue a voucher or credit.

For a call, there may be a variety of different types of charging involved. Some common types of charging are as follows. One type of charging is referred to as retail charging. Retail charging occurs between a mobile network operator (MNO) or a mobile virtual network operator (MVNO) and an end user. Thus, retail charging defines how end users pay for services provided by the MNO (or MVNO).

Another type of charging is referred to as wholesale (or MVNO) charging. Wholesale charging occurs between an MVNO and an MNO. A wholesale customer purchases mobile products and services from an MNO for resale. Wholesale charging defines how the MVNO pays for services provided by the MNO.

Another type of charging is referred to as content charging. Content charging occurs between a content provider and an MNO (or MVNO). The content provider supplies some content/service to end users via the MNO/MVNO network. Thus, content charging defines how the MNO/MVNO pays for the content supplied by the content provider.

Another type of charging is referred to as interconnect charging. Interconnect charging occurs between an MNO and another network operator. When a call is originated in the MNO's network but is terminated in network of the other operator (or vice-versa), interconnect charging defines how the MNO pays for services provided by the other network operator.

Another type of charging is referred to as roaming charging. Roaming charging occurs between an MNO and other MNO that is serving a roaming user. When an end user of one MNO (visiting MNO) is roaming in the network of another MNO (visited MNO), roaming charging defines how the visiting MNO pays for services provided by the visited MNO.

There may be other types of charging that apply to the description provided below. One common thread for each of these charging types is that multiple entities will share in the revenue of a call. Thus, the revenue has to be divided at some point and allocated appropriately to each of the entities. In a traditional charging architecture, a charging system generates CDRs that include charging data for a call. A back-office billing system then processes the charging data from the CDRs to divide the revenue for the call to entities that have a share. Thus, the revenue is divided in back-office systems instead of in the actual charging system. In the embodiments described below, a new charging controller 124 is implemented in the charging architecture to divide the revenue. Thus, revenue sharing entities for a call are identified in charging system 104 instead of in back office systems.

Assume for this embodiment that mobile device 140 is involved in a call over mobile network 102. One or both of network elements 112-113 may provide a service for the call, and generate charging data for providing the service. Those skilled in the art will appreciate that other mobile networks (not shown) and other fixed networks (not shown)

may also be involved in the call. Network elements 112-113 then transmit the charging data to charging system 104. For example, if prepaid charging applies for the call, then network elements 112-113 may transmit a Diameter Ro Credit Control Request (CCR) to charging system 104. If postpaid charging applies for the call, then network elements 112-113 may transmit a Diameter Rf Accounting Request (ACR) to charging system 104. Charging controller 124 manages charging for the call as is illustrated in FIG. 2.

FIG. 2 is a flow chart illustrating a method 200 of charging for a call by generating charging data for each entity having a revenue share in an exemplary embodiment. The steps of method 200 will be described with reference to communication network 100 in FIG. 1, but those skilled in the art will appreciate that method 200 may be performed in other networks and systems. The steps of the flow charts described herein are not all inclusive and may include other steps not shown. The steps may also be performed in an alternative order.

In step 202, charging controller 124 receives charging data for the call in mobile network 102. The charging data may be received in a charging request message from mobile network 102, such as a Diameter Ro CCR or a Diameter Rf ACR. Alternatively, the charging data may be received in a CDR from OCS 122 or OFCS 126. In step 204, charging controller 124 processes the charging data for the call and charging rules to identify entities that have a share in revenue for the call. Charging controller 124 stores charging rules that define conditions for different types of charging. For example, the charging rules may include retail rules defining conditions for retail charging. The charging rules may include wholesale rules defining conditions for wholesale charging. The charging rules may include interconnect rules defining conditions for interconnect charging. The charging rules may include content rules defining conditions for content charging. The charging rules may include roaming rules defining conditions for roaming charging.

As an example, charging controller 124 may process the calling party number and wholesale rules to determine that wholesale charging applies, and to determine the identity of the wholesale entity. Charging controller 124 may also process the called party number and interconnect rules to determine that interconnect charging applies, and to determine an identity of the network operator entity providing the interconnect service. Based on the charging data, charging controller 124 is able to generate a list of entities that have a share in the revenue for the call.

In step 206, charging controller 124 generates a charging request message indicating the entities having a revenue share in the call. For example, charging controller 124 may generate a Diameter Ro CCR, and insert the identities of the revenue sharing entities in the CCR. In step 208, charging controller 124 transmits the charging request message to OCS 122. Charging controller 124 may transmit a separate charging request message for each of the identified revenue sharing entities, or may transmit a single charging request message for all of the identified revenue sharing entities. Based on the data included in the charging request message, OCS 122 is able to determine the revenue share for each of the entities, which is further illustrated in FIG. 3.

FIG. 3 is a flow chart illustrating a method 300 of determining the revenue share for multiple entities in an exemplary embodiment. The steps of method 300 will be described with reference to communication network 100 in FIG. 1, but those skilled in the art will appreciate that method 300 may be performed in other networks and systems. In step 302, OCS 122 receives the charging request message from charging controller 124. In step 304, OCS 122 identifies a profile for each of the entities having a revenue share as indicated in the charging request message. OCS 122 may maintain a database of profiles for each entity. For example, OCS 122 may maintain a profile for mobile device 140 that indicates a service plan subscription of its end user. OCS 122 may maintain a profile of other MNO's having a roaming agreement with the operator of mobile network 102. OCS 122 may maintain a profile of fixed networks having an interconnect agreement with the operator of mobile network 102. OCS 122 may also maintain a profile of content providers having an agreement to supply content to end users of mobile network 102. Alternatively, the profiles may be maintained on an external database that is accessible to OCS 122.

In step 306, OCS 122 determines a revenue share amount for each of the entities based on their profile and a rating provided by rating engine 132. For example, assume that overall charging for a call is $30. Based on the profiles and the ratings, OCS 122 may determine that entity 1 shares $10 of the revenue, entity 2 shares $10 of the revenue, and entity 3 shares $10 of the revenue. In step 308, OCS 122 generates charging records, such as a CDR, indicating the revenue share amount for each of the entities. For example, OCS 122 may generate an individual charging record for each of the entities indicating the amount the entity is owed or the amount payable to the entity. OCS 122 then transmits the charging records to charging controller 124 in step 310.

The charging records generated by OCS 122 include a new set of data for each revenue sharing entity. The new set of data includes an entity ID, which may be an end user subscriber ID, an MNO ID, an MVNO ID, a content provider ID, another network operator ID, etc. The new set of data also includes a charging type, such as retail charging, wholesale charging, content charging, interconnect charging, roaming charging, etc. The new set of data also includes a revenue share amount. The revenue share amount indicates the monetary amount of service usage owed by each entity or payable to each entity. The revenue share amount may be an accumulated amount per payment billing cycle, or a special call charge amount. For retailing charging, the revenue share amount represents the service units the end user pays to the MVNO/MNO. For wholesale charging, the revenue share amount represents the service units the MVNO pays to the MNO for network/service usage. For content charging, the revenue share amount represents the service units the MNO pays for the content supplied by the content provider. For interconnect charging, the revenue share amount represents the service units the MNO pays for the other network operator that interconnects the call. For roaming charging, the revenue share amount represents the service units the visiting MNO pays to the visited MNO for a local user to roam in a foreign network.

FIG. 4 is a flow chart illustrating a method 400 of correlating charging records in an exemplary embodiment. The steps of method 400 will be described with reference to communication network 100 in FIG. 1, but those skilled in the art will appreciate that method 400 may be performed in other networks and systems. In step 402, charging controller 124 receives the charging records for the entities having a revenue share. In step 404, charging controller 124 correlates the charging records to generate a consolidated charging record that indicates the revenue share amount for each of the entities. The consolidated charging record also includes the new set of data for each revenue sharing entity, such as entity ID, charging type, and revenue share amount. In step 406, charging controller 124 transmits the consolidated CDR to billing system 106.

Billing system 106 may then perform a settlement process based on the data included in the consolidated charging record to generate billing invoices and generate vouchers or credits for each revenue sharing entity. Because charging controller 124 has already divided the revenue for the call in the consolidated charging record, billing system 106 does not need to perform this process. Billing system 106 only needs to issue the

vouchers to the proper entities for the revenue share amounts indicated in the consolidated charging record.

Examples

FIG. 5 illustrates another communication network 500 in an exemplary embodiment. Communication network 500 includes a mobile network 502, a charging system 504, and a billing system 506. Mobile network 502 is able to provide service to mobile device 540 to place voice calls, to initiate data sessions, to send or receive text messages or multimedia messages, etc. Charging system 504 includes an online charging system (OCS) 522, a charging controller 524, and an offline charging system (OFCS) 526.

OCS 522 handles online charging (or prepaid) for calls in mobile network 502. OCS 522 includes an online charging function (OCF) 530, an account balance management function (ABMF) 531, a rating engine 532, a profile database 533, and a tariff database 534. OCS 522 is enhanced to perform multiple-event charging based on one request event (i.e., a CCR). OCS 522 will use the different subscription IDs of the request to access each account profile separately, so OCS 522 will rate the call charge for each entity. After charging is finished, OCS 522 will generate a CDR indicating each entity's call cost, such as for retail charging, wholesale charging, content charging, interconnect charging, roaming charging, etc.

OCF 530 comprises any system, server, or function operable to manage online charging in OCS 522 by accessing ABMF 531 and rating engine 532, exchanging charging messages with network elements in mobile network 502, and performing other functions. ABMF 531 comprises any system, server, or function operable to maintain accounts for users, and more particularly to maintain an amount of service units in the accounts of the users. Rating engine 532 comprises any system, server, or function operable to determine the cost of service usage according to a tariff defined by the network operator. Rating engine 532 will perform tariff plan determination by accessing the tariff index of each entity, such as a unit determination, a price determination, a tariff determination, a counter, etc.

Rating engine 532 will not only hold the retail tariff plan for end user's service usage, but also holds the tariff plan for MNO's partnership, such as the price plan with MVNO, content provider, or other operators based on the service level agreement. OCF

530 will use the price plan index in each retail/partner's account profile to access the tariff to determine each entity's call charge.

Profile database 533 comprises any database or data structure operable to store profiles for retail customers, wholesale customers, content providers, interconnect operators, roaming operators, etc. Profile database 533 may alternatively store addresses for the profiles in order to remotely access the profiles. Tariff database 534 comprises any database or data structure operable to store a tariff plan or tariff plan index. Rating engine 532 is able to perform a tariff plan determination by accessing the tariff plan data of an entity, such as a unit determination, a price determination, a tariff determination, a counter, etc. OCF 530 will use the price plan index in each retail/partner's account profile to access the rating tariff index to determine each entity's call charge.

OFCS 526 handles offline charging (or postpaid) for calls in mobile network 502. OFCS 526 may include a Charging Data Function (CDF), a Charging Gateway Function (CGF), or other charging elements which are not specifically shown in FIG. 5.

Charging controller 524 comprises any system, server, or function operable to control overall charging for calls in mobile network 502. Charging controller 524 processes charging rules to determine which entities share in revenue for calls in mobile network 502. Charging controller 524 then generates a separate Diameter Ro CCR for each of the revenue sharing entities, and transmits CCRs to OCS 522 to determine the cost or the amount payable to the entity.

Assume for example that an end user of mobile device 540 subscribes to a service offered by OnStar Corporation, which is an in-vehicle service providing in-vehicle security, hands free calling, turn-by-turn navigation, remote diagnostics, etc. OnStar may be considered an MVNO in this example. OnStar leases its mobile services from mobile network 502, which is operated by Verizon Wireless (or some other mobile service provider). Verizon Wireless may thus be considered the MNO for the end user in this example. Assume further that the end user of mobile device 540 places a call (through the OnStar service) to another end user. The called end user subscribes to a service offered by another service provider, such as Vodafone in England. Vodafone may thus be considered the MNO for the called end user in this example.

Assume further that the overall charge for the call from the calling end user to the called end user is $30, and that the calling end user is responsible for payment for the call. FIG. 6 illustrates how the revenue for the call is divided among the entities in an exemplary

embodiment. According to the retail agreement between the calling end user 602 and OnStar (MNVO 604), calling end user 602 pays $30 to MVNO 604 for the call. This is an example of retail charging. MVNO 402 (OnStar) leases its mobile services from Verizon Wireless (MNO 606). According to the wholesale agreement between MVNO 604 and MNO 606, MVNO 604 pays $20 to MNO 606 for the mobile services. This is an example of wholesale charging. To connect the call to called end user 610, MNO 606 needs to connect to a foreign network operated by Vodafone (MNO 608). According to the interconnect agreement between MNO 606 and MNO 608, MNO 606 pays $10 to MNO 608 for the interconnect fees. This is an example of interconnect charging. Thus, the revenue for the call is divided between MVNO 604 (OnStar), MNO 606 (Verizon Wireless), and MNO 608 (Vodafone). In the embodiments provided herein, the dividing of the revenue is performed in the charging system instead of in back office systems. FIG. 7 further illustrates how this is done.

FIG. 7 is a message diagram illustrating how revenue for a call is divided in an exemplary embodiment. Mobile network 502 transmits a Diameter Ro CCR to OCS 522. The CCR includes charging data for the call in mobile network 502, such as a calling party number, a called party number, time stamps, etc. Although a Diameter Ro CCR is received in this example, other charging messages may be received in other examples, such as INAP messages. OCS 522 processes a subscription ID (subscription ID = MSISDN of the end user of mobile device 540) to access to the account profile for the end user. OCS 522 then calculates the overall charge for the call, which is $30 that is owed from the end user to OnStar. OCS 522 also generates a rated CDR (CDR1) indicating the call charge of $30, and sends the rated CDR to a mediation device (such as CDF or CGF) in OFCS 526. OFCS 526 then sends the rated CDR to charging controller (CC) 524. Those skilled in the art will appreciate that OCS 522 may send the rated CDR to charging controller (CC) 524 directly.

In response to receiving the rated CDR having charging data for the call, charging controller 524 processes charging rules to identify which entities are entitled to share in the revenue for the call. The following illustrates some exemplary rules for the different types of charging that may apply to the call.

Retail Rules:

Rule 1: CDR is not rated AND calling party number belongs to local operator AND call direction = originated call THEN:

Retail chargeable entity = calling party;

Trigger a Diameter Ro CCR [subscription ID = MSISDN of calling party, subscription type = retail charging,…] to OCS to determine the call cost for the calling party.

Rule 2: CDR is not rated AND called party number belongs to local operator AND call direction = terminate call AND subscriber location in home zone THEN:

Terminated local call is free to hear/accept;

Set the CDR as free call.

Rule 3: CDR is not rated AND called party number belongs to local operator AND call direction = terminate call AND subscriber location in roaming zone THEN:

Retail chargeable entity = called party

Trigger a Diameter Ro request [Subscription ID = MSISDN of called party, Subscription Type = retail charging,…] to OCS to determine the call cost for the called party.

Wholesale Rules:

Rule 1: Calling party number belongs to local operator AND call direction = originated call AND the prefix number of the calling party number is an MVNO call number THEN:

Map out the MVNO ID based on prefix number of the calling party number;

Wholesale chargeable entity = MVNO;

Trigger a Diameter Ro CCR [Subscription ID = MVNO ID, Subscription Type = wholesale charging,…] to OCS to determine the call cost for the MVNO.

Rule 2: Called party number belongs to local operator AND call direction = terminated call AND the prefix number of the called party number is an MVNO call number AND subscriber location in roaming zone THEN:

Map out the MVNO ID based on prefix number of the called party number;

Wholesale chargeable entity = MVNO;

Trigger a Diameter Ro CCR [Subscription ID = MVNO ID, Subscription Type =wholesale charging,…] to OCS to determine the call cost for the MVNO.

Interconnect Rules:

Rule 1: Calling party number belongs to the local operator AND called party number doesn't belong to local operator AND call direction = originated call THEN:

Map out the Interconnect Partner ID based on prefix number of the called party number;

Interconnect Partner entity = Interconnect Operator ID;

Trigger a Diameter Ro CCR [Subscription ID = Interconnect Operator ID, Subscription Type = interconnect charging,… ] to OCS to determine the call cost for the interconnect partner.

Roaming Rules:

Rule 1: Calling party number doesn't belong to the local operator AND calling party's visited PLMN belongs to local operator THEN:

Map out the Inbound Partner ID based on prefix number of the calling party number;

Inbound Partner entity = Inbound Partner ID;

Trigger a Diameter Ro CCR [Subscription ID = Inbound Partner ID, subscription type = inbound roaming charging,…] to OCS to determine the call cost for inbound roaming partner.

Content Rules:

Rule 1: Calling party number belongs to the local operator AND (Service ID = *xxx* OR Merchant ID = *yyy* OR Content Provider = *zzz*) THEN:

Map out the Content Provider ID based on Service ID, Content ID, or Merchant ID;

Trigger a Diameter Ro CCR [Subscription ID = Content Provider ID, subscription type = content revenue sharing charging,…] to OCS to determine the call cost for the content provider.

In this example, charging controller 524 processes the wholesale rules and the prefix number of mobile device 540 that is included in the CDR. Based on the wholesale rules, charging controller 524 determines that this is an MVNO number of Verizon Wireless. Thus, charging controller 524 maps out the MVNO ID based on IMSI prefix, wherein the

MVNO ID is the identifier for OnStar. Charging controller 524 then transmits a Diameter Ro CCR (with subscription ID = MVNO ID) to OCS 522.

OCS 522 uses the MVNO ID in the CCR to access the OnStar account profile in profile database 533. OCS 522 then determines the call charge for the MVNO, which is the amount OnStar pays to Verizon Wireless ($20). OCS 522 then generates the rated CDR (CDR2) that includes the wholesale charge amount of $20, and transmits the rated CDR to OFCS 526.

Charging controller 524 also processes the interconnect rules and the prefix number of called party number in the CDR. Based on the interconnect rules, charging controller 524 determines that the call is an interconnect call. Charging controller 524 maps out the MNO ID based on called party number prefix, wherein in MNO ID is the identifier for Vodafone. Charging controller 524 then transmits a Diameter Ro CCR (with subscription ID = MNO ID) to OCS 522.

OCS 522 uses the MNO ID in the CCR to access the Vodafone account profile in profile database 533. OCS 522 then determines the call charge for the MNO, which is the amount Verizon Wireless pays to Vodafone ($10). OCS 522 then generates the rated CDR (CDR3) that includes the interconnect charge amount of $10, and transmits the rated CDR to OFCS 526.

OFCS 526 correlates the three rated CDRs to generate a consolidated CDR that indicates the revenue share amount for each of the entities. In this example, the consolidated CDR indicates the retail charge of $30, the wholesale charge of $20, and the interconnect charge of $10. The consolidated CDR includes the new set of data for each revenue sharing entity, such as entity ID, charging type, and revenue share amount. OFCS 526 then transmits the consolidated CDR to billing system 506. Although OFCS 526 is shown as correlating the CDRs in this embodiment, charging controller 524 may correlate the CDRs in other embodiments.

Billing system 506 may then perform a settlement process based on the data included in the consolidated CDR to generate billing invoices and generate vouchers or credits for each revenue sharing entity. In the above example, Verizon Wireless will receive a $20 voucher from OnStar, and Vodafone will receive a $10 voucher from Verizon Wireless for this call. Because charging controller 524 has already divided the revenue for the call in the consolidated CDR, billing system 506 does not need to perform this process.

Billing system 506 only needs to issue the vouchers to the proper entities for the revenue share amounts indicated in the consolidated CDR.

Any of the various elements shown in the figures or described herein may be implemented as hardware, software, firmware, or some combination of these. For example, an element may be implemented as dedicated hardware. Dedicated hardware elements may be referred to as "processors", "controllers", or some similar terminology. When provided by a processor, the functions may be provided by a single dedicated processor, by a single shared processor, or by a plurality of individual processors, some of which may be shared. Moreover, explicit use of the term "processor" or "controller" should not be construed to refer exclusively to hardware capable of executing software, and may implicitly include, without limitation, digital signal processor (DSP) hardware, a network processor, application specific integrated circuit (ASIC) or other circuitry, field programmable gate array (FPGA), read only memory (ROM) for storing software, random access memory (RAM), non volatile storage, logic, or some other physical hardware component or module.

Also, an element may be implemented as instructions executable by a processor or a computer to perform the functions of the element. Some examples of instructions are software, program code, and firmware. The instructions are operational when executed by the processor to direct the processor to perform the functions of the element. The instructions may be stored on storage devices that are readable by the processor. Some examples of the storage devices are digital or solid-state memories, magnetic storage media such as a magnetic disks and magnetic tapes, hard drives, or optically readable digital data storage media.

Although specific embodiments were described herein, the scope of the invention is not limited to those specific embodiments. The scope of the invention is defined by the following claims and any equivalents thereof.

CLAIMS:

We claim:

1. A charging system comprising:

a charging controller coupled to a mobile network and an online charging system, the charging controller operable to receive charging data for a call in the mobile network, to process the charging data for the call and charging rules to identify entities that have a share in revenue for the call, to generate a charging request message indicating the entities having a revenue share in the call, and to transmit the charging request message to the online charging system to cause the online charging system to determine the revenue share for each of the entities.

2. The charging system of claim 1 further comprising:

the online charging system operable to receive the charging request message from the charging controller, to identify a profile for each of the entities having a revenue share, to determine a revenue share amount for each of the entities based on their profile and a rating, to generate charging records indicating the revenue share amount for each of the entities, and to transmit the charging records to the charging controller.

3. The charging system of claim 2 wherein the charging records each include an entity ID, a charging type, and the revenue share amount.

4. The charging system of claim 3 wherein the revenue share amount indicates a monetary amount owed to another entity.

5. The charging system of claim 2 wherein:

the charging controller is further operable to receive the charging records, to correlate the charging records to generate a consolidated charging record that indicates the revenue share amount for each of the entities, and to transmit the consolidated charging record to a billing system.

6. The charging system of claim 1 wherein the charging rules include retail rules defining conditions for retail charging.

7. The charging system of claim 1 wherein the charging rules include wholesale rules defining conditions for wholesale charging.

8. The charging system of claim 1 wherein the charging rules include interconnect rules defining conditions for interconnect charging.

9. The charging system of claim 1 wherein the charging rules include content rules defining conditions for content charging.

10. The charging system of claim 1 wherein the charging rules include roaming rules defining conditions for roaming charging.

11. A method of determining the share of call revenue for a call, the method comprising:

receiving charging data for a call placed over a mobile network in a charging controller that is coupled to the mobile network and to an online charging system;

processing the charging data for the call and charging rules to identify entities that have a share in revenue for the call;

generating a charging request message indicating the entities having a revenue share in the call; and

transmitting the charging request message to the online charging system to cause the online charging system to determine the revenue share for each of the entities.

12. The method of claim 11 further comprising:

receiving the charging request message in the online charging system from the charging controller;

identifying a profile for each of the entities having a revenue share;

determining a revenue share amount for each of the entities based on their profile and a rating;

generating charging records indicating the revenue share amount for each of the entities; and

transmitting the charging records from the online charging system to the charging controller.

13. The method of claim 12 wherein the charging records each include an entity ID, a charging type, and a revenue share amount.

14. The method of claim 13 wherein the revenue share amount indicates a monetary amount owed to another entity.

15. The method of claim 12 further comprising:

receiving the charging records in the charging controller from the online charging system;

correlating the charging records to generate a consolidated charging record that indicates the revenue share amount for each of the entities; and

transmitting the consolidated charging record from the charging controller to a billing system.

16. The method of claim 11 wherein the charging rules include retail rules defining conditions for retail charging.

17. The method of claim 11 wherein the charging rules include wholesale rules defining conditions for wholesale charging.

18. The method of claim 11 wherein the charging rules include interconnect rules defining conditions for interconnect charging.

19. The method of claim 11 wherein the charging rules include content rules defining conditions for content charging.

20. The method of claim 11 wherein the charging rules include roaming rules defining conditions for roaming charging.

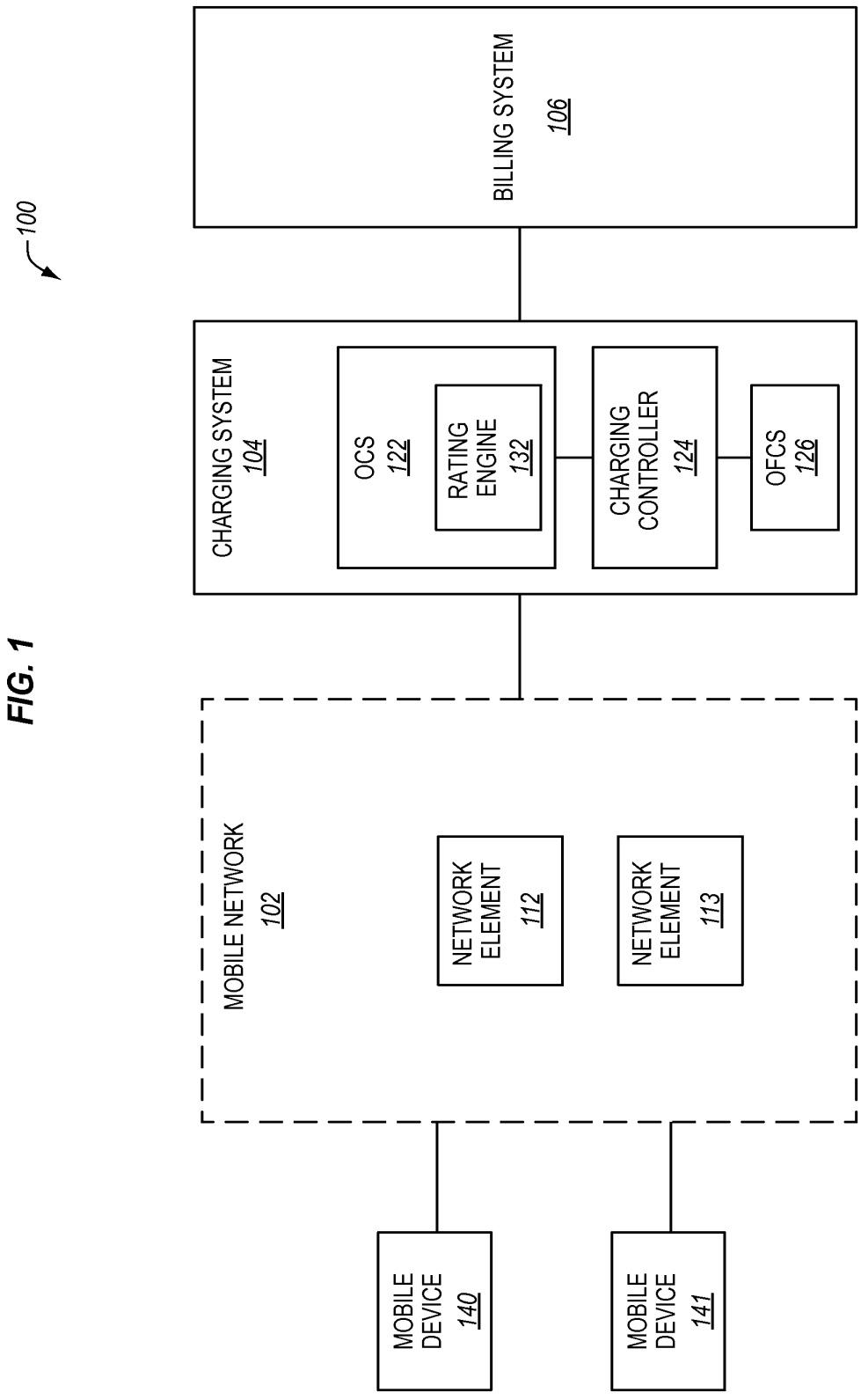

100
BILLING SYSTEM
106
CHARGING SYSTEM
104
OCS
122
RATING
ENGINE
132
CHARGING
CONTROLLER
124
OFCS
126
MOBILE NETWORK
102
NETWORK
ELEMENT
112
NETWORK
ELEMENT
113
MOBILE
DEVICE
140
MOBILE
DEVICE
141

FIG. 1

***FIG. 2***

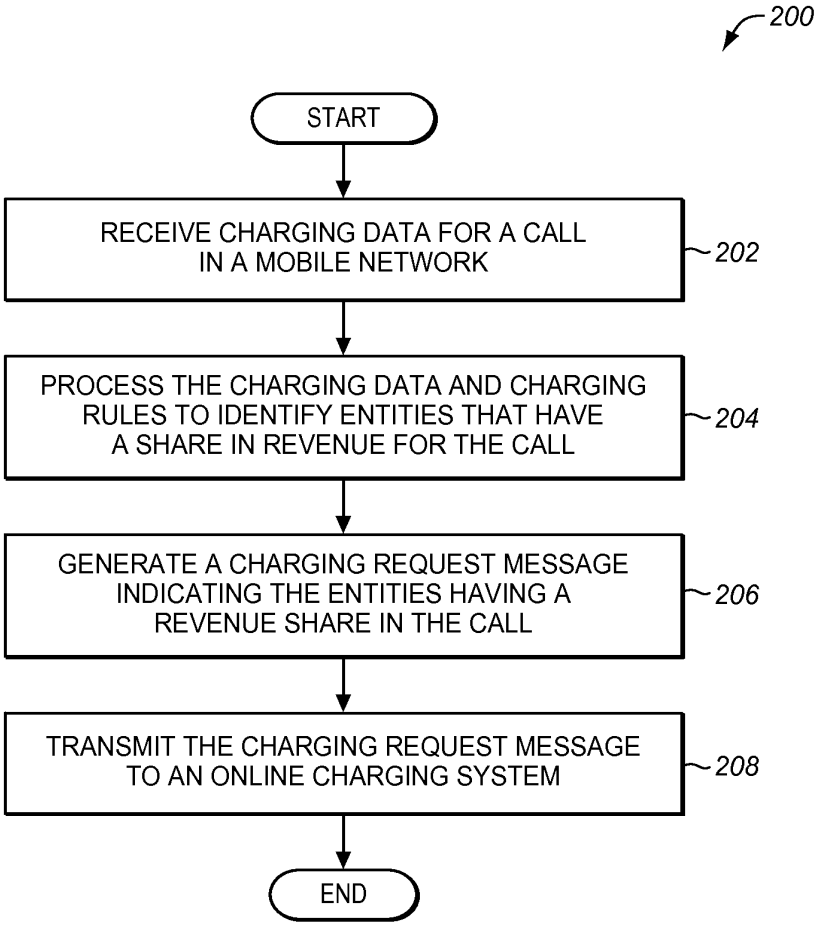

200
START
RECEIVE CHARGING DATA FOR A CALL IN A MOBILE NETWORK
202
PROCESS THE CHARGING DATA AND CHARGING RULES TO IDENTIFY ENTITIES THAT HAVE A SHARE IN REVENUE FOR THE CALL
204
GENERATE A CHARGING REQUEST MESSAGE INDICATING THE ENTITIES HAVING A REVENUE SHARE IN THE CALL
206
TRANSMIT THE CHARGING REQUEST MESSAGE TO AN ONLINE CHARGING SYSTEM
208
END

*FIG. 3*

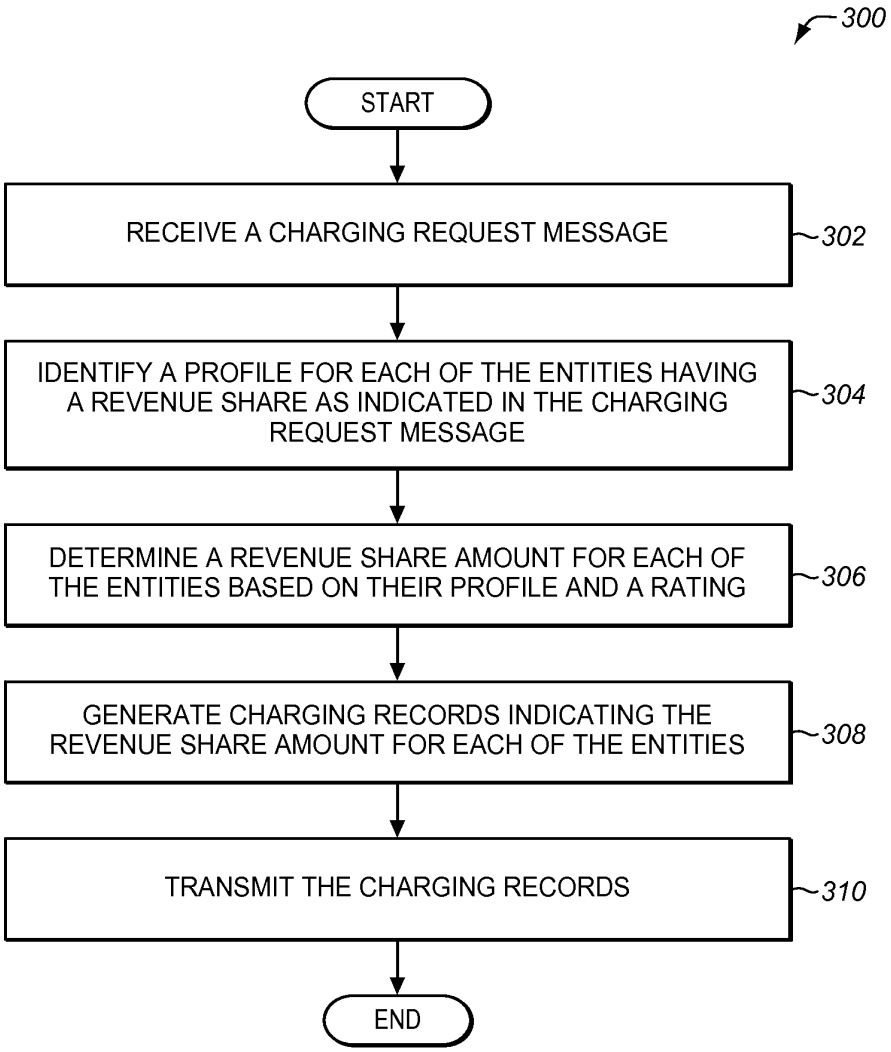

300
START
RECEIVE A CHARGING REQUEST MESSAGE
302
IDENTIFY A PROFILE FOR EACH OF THE ENTITIES HAVING A REVENUE SHARE AS INDICATED IN THE CHARGING REQUEST MESSAGE
304
DETERMINE A REVENUE SHARE AMOUNT FOR EACH OF THE ENTITIES BASED ON THEIR PROFILE AND A RATING
306
GENERATE CHARGING RECORDS INDICATING THE REVENUE SHARE AMOUNT FOR EACH OF THE ENTITIES
308
TRANSMIT THE CHARGING RECORDS
310
END

*FIG. 4*

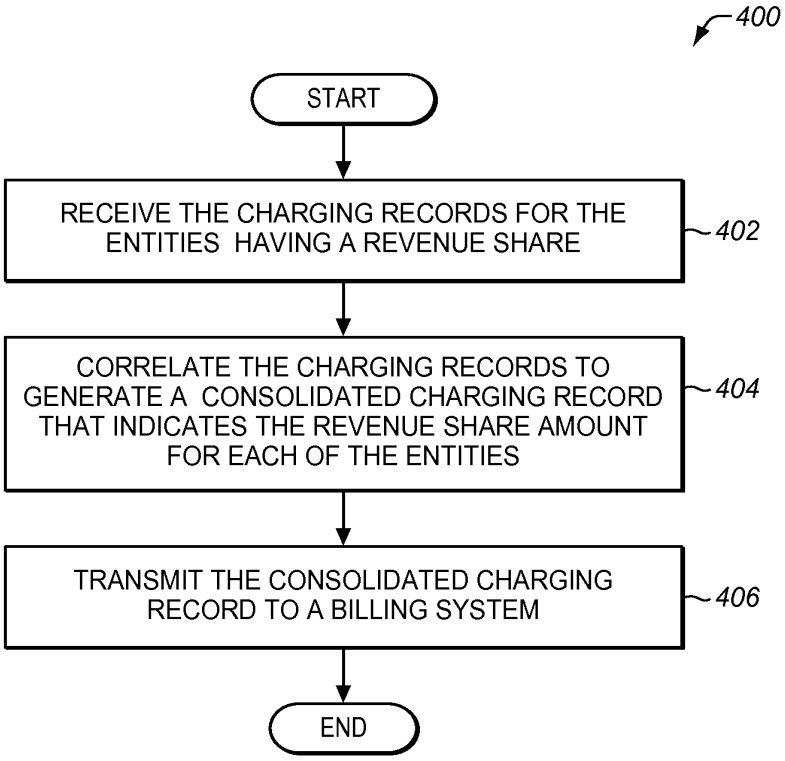
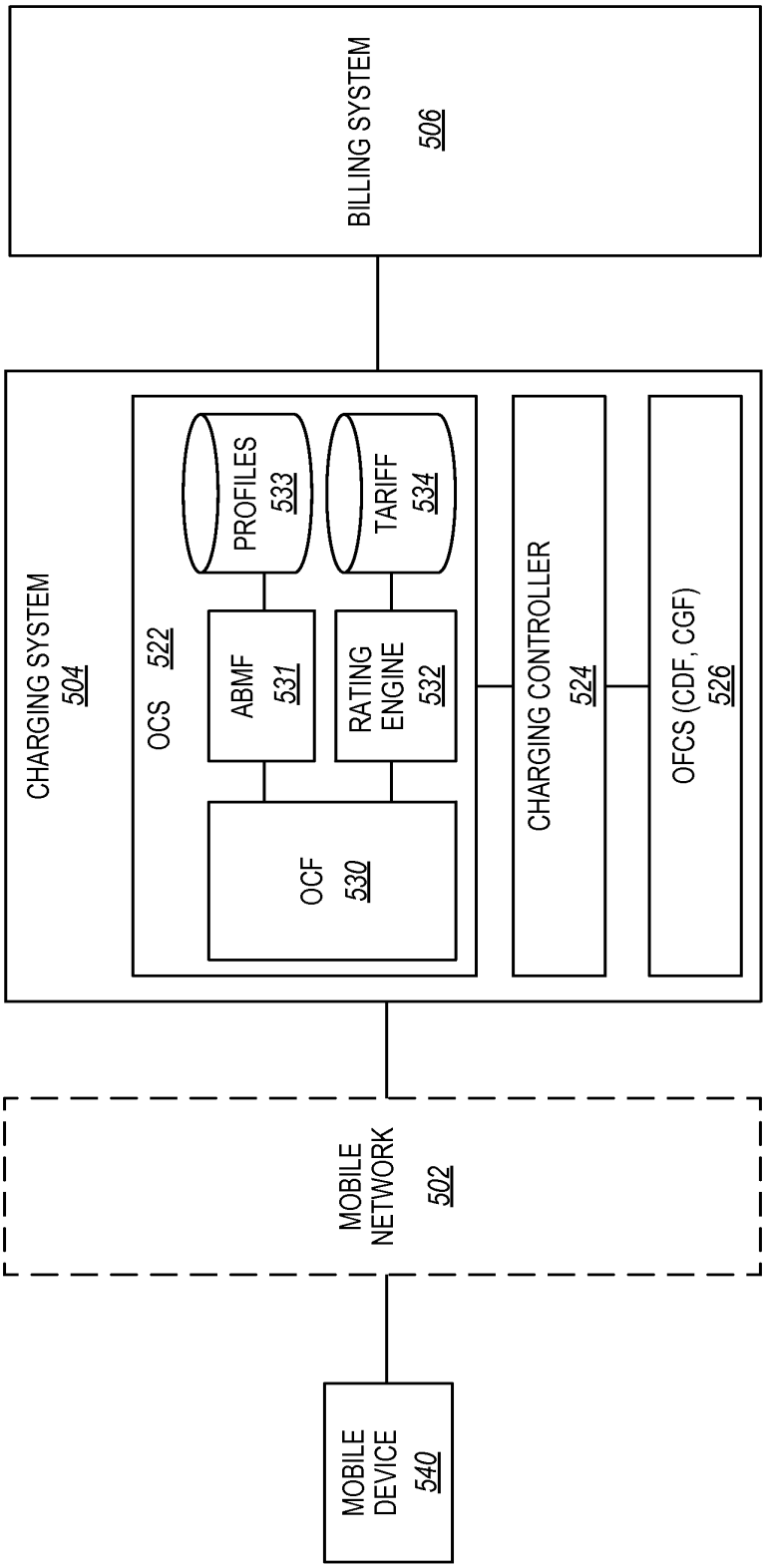

400
START
RECEIVE THE CHARGING RECORDS FOR THE ENTITIES HAVING A REVENUE SHARE
402
CORRELATE THE CHARGING RECORDS TO GENERATE A CONSOLIDATED CHARGING RECORD THAT INDICATES THE REVENUE SHARE AMOUNT FOR EACH OF THE ENTITIES
404
TRANSMIT THE CONSOLIDATED CHARGING RECORD TO A BILLING SYSTEM
406
END

FIG. 5


500
BILLING SYSTEM
506
CHARGING SYSTEM
504
OCS
522
PROFILES
533
TARIFF
534
ABMF
531
RATING ENGINE
532
OCF
530
CHARGING CONTROLLER
524
OFCS (CDF, CGF)
526
MOBILE NETWORK
502
MOBILE DEVICE
540

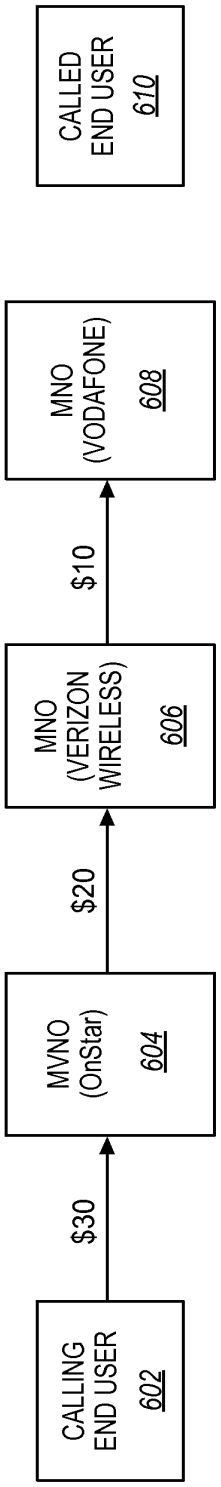
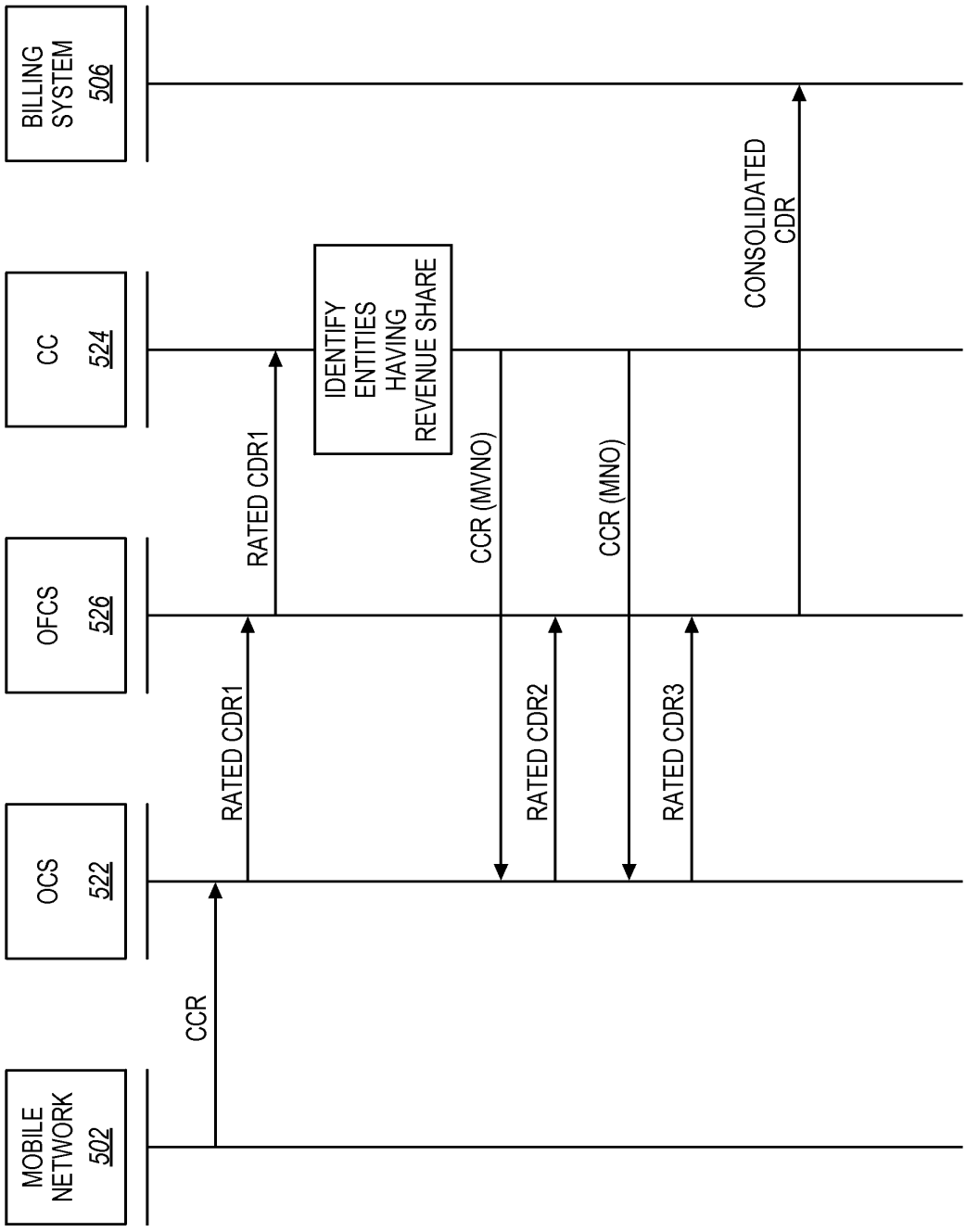

CALLING END USER 602
$30
MVNO (OnStar) 604
$20
MNO (VERIZON WIRELESS) 606
$10
MNO (VODAFONE) 608
CALLED END USER 610

FIG. 6

FIG. 7


MOBILE NETWORK 502
OCS 522
OFCS 526
CC 524
BILLING SYSTEM 506
CCR
RATED CDR1
RATED CDR1
IDENTIFY ENTITIES HAVING REVENUE SHARE
CCR (MVNO)
RATED CDR2
CCR (MNO)
RATED CDR3
CONSOLIDATED CDR

# INTERNATIONAL SEARCH REPORT

International application No
PCT/US2009/049255

A. CLASSIFICATION OF SUBJECT MATTER
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ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04M H04W

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y | XIANG YANG LI ET AL: "Converged network common charging controller function" BELL LABS TECHNICAL JOURNAL, WILEY, CA, US, vol. 13, no. 2, 21 June 2008 (2008-06-21), pages 161-183, XP001514359 ISSN: 1089-7089 page 167 - page 179 figures 4-15 ----- -/-- | 1-20 |

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 30 March 2010 | 09/04/2010 |

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| European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040,<br>Fax: (+31-70) 340-3016 | Patlaka, Efi |

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# INTERNATIONAL SEARCH REPORT

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PCT/US2009/049255

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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| A | EP 1 545 114 A1 (CIT ALCATEL [FR] ALCATEL LUCENT [FR]) 22 June 2005 (2005-06-22)<br>claims 1-10<br>paragraph [0028]<br>----- | 1-20 |
| A | ANONYMOUS: "Telecommunications and Internet Converged Services and Protocols for Advanced Networking (TISPAN); NGN Management; Charging specification for Release 1; Draft ETSI DTS 02032"<br>ETSI STANDARDS, LIS, SOPHIA ANTIPOLIS CEDEX, FRANCE,<br>vol. TISPAN, no. Version 1,<br>1 October 2005 (2005-10-01), XP014031462<br>ISSN: 0000-0001<br>the whole document<br>----- | 1-20 |
| A | US 2004/224662 A1 (O'NEIL DOUGLAS R [US] ET AL) 11 November 2004 (2004-11-11)<br>claim 8<br>claims 12, 13<br>claims 19, 20<br>----- | 1-20 |
| A | WO 03/017065 A2 (APOGEE NETWORKS [US]; DESHMUKH ABHI [US]; HERNANDEZ MILTON [US]; GUHA) 27 February 2003 (2003-02-27)<br>the whole document<br>----- | 1-20 |
| A | EP 1 320 214 A1 (MARKPORT LTD [IE])<br>18 June 2003 (2003-06-18)<br>paragraph [0044]<br>paragraph [0047]<br>paragraph [0051]<br>----- | 1-20 |

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## INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2009/049255

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
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| | | CN 1630239 A | 22-06-2005 |
| | | US 2005135577 A1 | 23-06-2005 |
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| EP 1320214 A1 | 18-06-2003 | NONE | |

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(75) Inventors/Applicants *(for US only)*: **DESHMUKH, Abhi** [IN/US]; 253A, Kinderkamack Road, River Edge, NJ 07661 (US). **HERNANDEZ, Milton** [DM/US]; Apt. D, 1 Cononial Court, River Edge, NJ 07661 (US). **GUHA, Jayanta** [—/US]; 860 Main Street, Apt. 5B, Hackensack, NJ 07601 (US).

(74) Agents: **DUNNAM, Michael, P.** et al.; Woodcock Washburn LLP, One Liberty Place, 46th Floor, Philadelphia, PA 19103 (US).

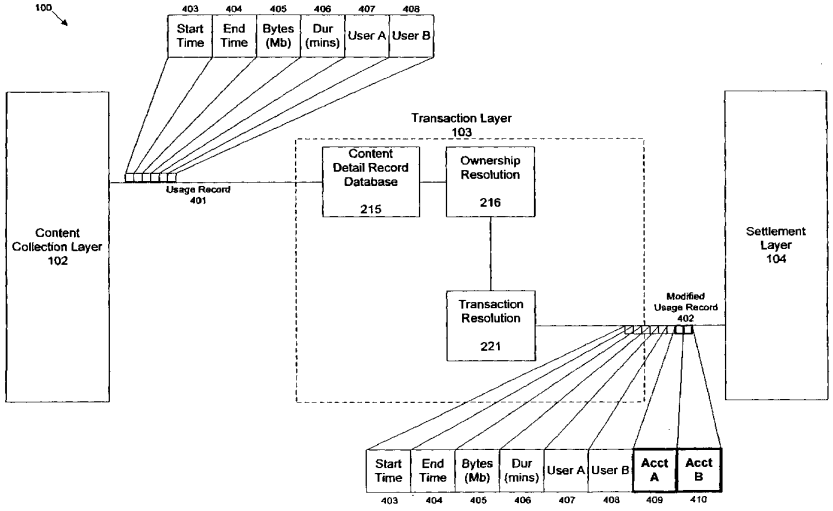
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(54) Title: CONTENT OWNERSHIP RESOLUTION




(57) Abstract: The invention describes a method, system, and computer-readable medium having computer-executable instructions for determining parties to a transaction. The inventive method includes receiving data related to an event, where the data includes one or more data elements. The inventive method also includes selecting the data elements that identify the parties to the transaction, determining whether additional data elements are required to identify the parties to the transaction, and identifying the additional data elements. The event may be an exchange of data between the parties over a communication network, and the data related to the event may be stored in a usage record. The additional data element may identify an owner or party to the transaction, called an accountable. The party may have direct or indirect association in the transaction and may not be obvious from the record of the transaction itself.

WO 03/017065 A2

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

# CONTENT OWNERSHIP RESOLUTION

## Technical Field

The invention relates generally to the processing of data, and more particularly to efficiently and generically aggregating data available on a communication network.

## Background of the Invention

Recently, the collection and processing of data transmitted over communication networks, like the Internet, has moved to the forefront of business objectives. In fact, with the advent of the Internet, new revenue generating business models have been created to account for the consumption of content received from a data network (*i.e.*, content-based billing). For example, content distributors, application service providers (ASPs), Internet service providers (ISPs), and wireless Internet providers have realized new opportunities based on the value of the content and services that they deliver. As a result of this content-and-services-billing initiative, it has become increasingly important to resolve intelligently and flexibly the corresponding transactions according to the business needs of the customer.

Often, even in traditional commerce streams, there a many different participants between the maker and the consumer of the goods. Some of these so-called "middlemen" simply may facilitate access to the good, while others may add useful characteristics to the good. This is especially true in a distributed network environment, like the Internet,

that impose additional burdens on capturing the transaction process because of the unlimited number of data sources and the correspondingly unlimited number of data types. As a result, adequately describing the transacting of the goods and services in such an environment, or even across any of the traditional environments requires a technique that is capable of understanding and processing the participants and the various types of data.

To date, resolving the characteristics of a transaction has been accomplished over data-specific environments using certain application-specific (*i.e.*, "non-generic" or custom) methods. For example, a typical telephone bill captures the characteristics of a voice-based telecommunications transaction. In particular, the participants may be identified as the party initiating the call (*i.e.*, the "calling party" telephone number), the party receiving the call (*i.e.*, the "called party" telephone number), and one or more parties connecting the communication (*i.e.*, the "local" or "long distance carrier"). This simple example adequately captures all of the necessary aspects of the telephone call to properly account for the transaction by requiring payment from certain parties (*e.g.*, the calling and/or the called party) to certain other parties (*e.g.*, the local and/or long distance carrier). While these "hard-coded" transaction resolution techniques are sufficient to accommodate only specific environments involving well-defined participants (e.g., the telecommunications network), they are correspondingly too rigid to efficiently satisfy the ever-changing face of a communication network like the Internet. Also, these "hard-

coded" techniques are too specific to operate across the many and varied transaction environments and domains that exist throughout the business world.

Therefore, there exists a need to provide a flexible technique that can capture and resolve transactions of any type in any business domain involving any number and kind of participants without requiring modification of the technique for each type. Such a technique would serve to accommodate multi-faceted networked environments like the Internet, as well as to provide a single solution that would apply to any business environment.

## Summary of the Invention

The invention describes a method, system, and computer-readable medium having computer-executable instructions for determining parties to a transaction. The inventive method includes receiving data related to an event, where the data includes one or more data elements. The inventive method also includes selecting the data elements that identify the parties to the transaction, determining whether additional data elements are required to identify all or some of the parties to the transaction, and identifying the additional data elements. The event may be an exchange of data between the parties over a communication network, and the data related to the event may be stored in a usage record. The additional data element may identify an owner or party to the transaction, called an accountable. Determining whether additional elements are required may be a function of the received data, and/or a function of the requirements of a customer

settlement system. The customer settlement system may be a data security system, a network capacity planning system, a content monitoring system, and/or a billing application, for example. The identifying of additional data elements or accountables may be initiated by a building block known as a primitive that includes multiple specific methods, including a database lookup, a direct value assignment, a regular expression parsing or match, a CDR database lookup, hard-coded, network address, area code, substring manipulation or a custom code execution. All or some of the inventive method steps may be conducted on a computer-readable medium using computer-executable instructions.

The inventive system for determining parties to a transaction includes an instrumentation layer, a content collection layer in communication with the instrumentation layer, and a transaction layer in communication with the content collection layer. The instrumentation layer provides raw data, while the content collection layer generically processes the raw data, and the transaction layer identifies one or more parties to the transaction. Also, the content collection layer may provide the raw data to the transaction layer in a usage record, and the transaction layer may modify the usage record as a function of identifying the parties to the transaction. The inventive system may further include a settlement layer in communication with the transaction layer, wherein the settlement layer rates the modified usage record. The transaction layer may include a database for storing the data processed by the content collection layer.

## Brief Description of the Drawings

Other features of the invention are further apparent from the following detailed description of the embodiments of the invention taken in conjunction with the accompanying drawings, of which:

Figure 1 is a block diagram of a system for analyzing content transmitted over a communication network, according to the invention;

Figure 2 is a block diagram further describing the components of the system described in Figure 1;

Figures 3A and 3B provide a flow diagram further detailing the operation the system described in Figure 1;

Figure 4 provides a block diagram of the system described in Figure 1, providing greater detail of a configuration and operation of a transaction layer;

Figures 5A and 5B provide a flow diagram of a method for identifying the characteristics of a transaction, according to the invention;

Figure 6 is a block diagram further detailing the operation and configuration of the transaction layer, according to the invention; and

Figure 7 is a flow diagram that details the operation and configuration of the transaction layer of transaction layer, according to the invention.

## Detailed Description of the Invention

System Overview

Figure 1 is a block diagram of a system 100 for analyzing content transmitted over a communication network. Although the following description will be discussed in the context of collecting, processing and billing for data transmitted over the Internet, it should be appreciated that the invention is no so limited. In fact, the invention may be applied to any type of network, including a private local area network, for example. Also, the invention may be used for purposes other than billing for the usage of content. For example, the invention may be used to analyze the type of data transmitted over a particular network, or to determine the routing patterns of data on a network. Furthermore, the invention may be used to facilitate the intelligent collection and aggregation of data relevant to a particular industry. In addition, the invention may be used to track specific Internet protocol (IP) network resources and to detect fraud, for example. It should also be appreciated that the invention may contemplate non-network and non-computer related business domains like commodity trading (*e.g.,* grains, crude oil) where multiple parties are involved. Therefore, although the invention is often described in the context of the Internet, it should be appreciated that the invention may equally applied to traditional business environments.

In addition, it should be appreciated that the term "content" may be defined as data that is transmitted over the network. In the context of the Internet, content may include .mp3 files, hypertext markup language (html) pages, videoconferencing data, and streaming audio, for example. The terms "content provider" and "customer" will be used throughout the description as well. Content provider may refer to the primary creator or

provider of the content, while customer is the primary recipient of the content. Both the producer and customer may be a human or a computer-based system.

As shown in Figure 1, an instrumentation layer 101 provides raw data to a content collection layer 102. Instrumentation layer 101 may consist of various data sources, for example, network routers. The network routers may provide information regarding the various types of routed data, including for example, data format, originating Internet protocol (IP) address, and destination IP address. One example of such information is Cisco System's NetFlow™.

Content collection layer 102 collects information about the delivery of the content, as well as the substance of the content itself. Content collection layer 102 also may sort, filter, aggregate, correlate and store the content according to the particular needs of the end user. In effect, content collection layer is responsible for extracting meaningful information about IP traffic, and so it is provided with an understanding of the data sources in instrumentation layer 101. Content collection layer 102 also may transform the data from the plurality of sources in instrumentation layer 101 into standard formats for use in a transaction layer 103.

Content collection layer 102 is in communication with transaction layer 103. Generally, content collection layer 102 reports to transaction layer 103 that a relevant communication event has occurred and should be considered by the remainder of system 100. A communication event may be defined as any transfer of data between systems. Transaction layer 103 captures the predetermined agreements among all of the parties

involved in system 100 regarding the value of the transferred content, as well as the value added by each of the individual parties in transferring such content. Therefore, transaction layer 103 is charged with understanding the nature of the parties, as well as the understanding the actions that one or more parties perform and the influence of such action on the respective parties.

Transaction layer 103 is in communication with a settlement layer 104. Settlement layer 104 captures the operations that are necessary to understand the significance of the transaction defined by transaction layer 103. For example, settlement layer 104 may rate a particular transaction by assigning a monetary value to the transaction. Settlement layer 104 also may divide the burdens and benefits of the monetary value among the relevant parties. In this way, settlement layer 104 ensures that certain parties receive a particular portion of the payment made by the other parties. Settlement layer 104 also may be responsible for delivering this burden and benefit information to the appropriate parties with the appropriate identifiers (*e.g.*, account numbers).

Figure 2 is a block diagram further describing the components of system 100. As shown in Figure 2, instrumentation layer 101 includes data sources 201-203 that each provide raw data 204-206, respectively, to collection layer 102. As discussed, data sources 201-203 may include various internetworking devices like routers, bridges, and network switches. Data sources 201-203 provide raw data to an input data adapter 207. Accordingly, input data adapter 207 understands the operation of and the data provided

by data sources 201-203. Although one input data adapter is shown in Figure 2, it should be appreciated that more than one input data adapter may be used in system 100. For example, each data source may have a dedicated input data adapter.

Input data adapter 207 understands the incoming data and extracts the data into the appropriate fields. This field-delimited data, called flow objects 208, are sets of attributes. The attributes may be any characteristics that are provided by, or can be derived from, raw data 204-206 provided by data sources 201-203, respectively. For example, flow objects 208 may include a set of attributes describing the source and destination, including source IP address, destination IP address, source interface, and destination interface. Because input data adapter 207 is charged with understanding raw data 204-206 from data sources 201-203, as well as the required flow objects 208 of system 100, it is capable of transforming the raw data to the flow objects, where the flow objects may all be of a standard format.

Input data adapter 207 provides flow objects 208 to a content data language 209. Content data language 209 may transform the attributes in flow objects 208 into other attributes that are desired by a particular customer. For example, content data language 209 may derive a network identifier attribute that is not readily available from a data source, from a source address attribute and a destination address attribute that are provided by flow object 208 attributes from input data adapter 207. This derivation may be based on a customer's desire to determine which network conveyed the transaction between the source and the destination. Therefore, following this example, content data

language 209 will know to extract the source address attribute and the destination address attribute from flow objects 208.

Content data language 209 may perform other functions as well. For example, content data language 209 may perform a generic lookup function 219 that is built into content data language 209. Generally, generic lookup 219 describes a technique for mapping any number of attributes to any number of other derived attributes. For example, generic lookup 219 may be used to map a unique resource locator (URL) attribute to a particular content-type attribute.

Content data language 209 also is in communication with a correlator 211. Generally, correlator 211 connects the many daily network content events from various network devices, like routers for example. Often, the connected data may come from distinctly different data sources at distinctly unrelated times. Correlator 211 allows this data to be intelligently connected to each other, regardless of how different the sources or of how disparate the time received. For example, a Netflow™ enabled router and a Radius™ enabled network access switch may each provide certain data that is relevant to one particular transaction. However, because portions of the data come from different devices, the data may arrive at system 100 at different times, and in different formats. Also, because each provides data that is necessary to complete one transaction, the data from each cannot be considered separately. Correlator 211 allows this data to be intelligently grouped regardless of the format of the data or of the time the data pieces are received.

Furthermore, correlator 209 may rearrange the order of the received flow objects 208 to suit the needs of the remainder of system 100. By performing such correlation without having to first store all of the data on a disk (*e.g.*, a database), significantly faster processing is achieved. Correlator 209 may perform this correlation in real-time, for example.

Although system 100 has been described using content data language 209 and correlator 211, it should be appreciated that flow objects 208 may proceed directly to a filter 212, if no correlation is required and if no attribute derivation is required, for example. Filter 212 analyzes flow objects 208 to ensure that the provided attributes are desired by system 100. If flow objects 208 are not needed (*i.e.*, a mismatch), filter 212 may prevent flow objects 208 from passing to an aggregator 213. Also, although filter 212 has been shown as a separate device in system 100, it should be appreciated that the functionality of filter 212 may be incorporated into aggregator 213.

Filter 212 passes the matching flow objects to aggregator 213. Aggregator 213 may provide additional filtering and classification of the multitude of daily network content transactions, based on user criteria. Aggregator 213 may perform such filtering and classification in real-time. Aggregator 213 will be discussed in greater detail with reference to Figures 4-7. Aggregator 213 provides the filtered and classified information to an output data adapter 214. Output data adapter 214 may convert the data from aggregator 213 into one or more content detail records for storage in CDR database 215. Therefore, CDR database 215 stores a complete description of a content event.

Transaction layer 103 includes CDR database 215, an ownership resolution component 216, and a transaction resolution component 221. CDR database 215 passes the CDR onto ownership resolution component 216. A proper accounting of a communication event, for any purpose including billing, requires both identifying the participants and defining the relationships among those participants. These tasks are accomplished by ownership resolution component 216 and transaction resolution component 221.

Ownership resolution component 216 serves to define the direct and indirect participants of the communication event. In particular, because raw data 204-206 may not provide sufficient "ownership" data relating to the parties involved in the content transaction, such "ownership" data must be provided by system 100 to properly account for the entire transaction. Ownership resolution component 216 operates to provide such ownership-based data to system 100.

Ownership resolution component 216 is in communication with transaction resolution component 221. Transaction resolution component 221 serves to capture the predetermined relationships and/or agreements among the parties defined by ownership resolution component 216 regarding the value of the transferred content, as well as the value added by each of the individual parties in transferring such content. Such predetermined relationships may be previously agreed upon by the participants, or may be created and agreed upon with the implementation of system 100. Therefore, transaction component 103 understands the nature of the parties, the actions that one or

more parties perform, and the influence of such action on the respective parties. Ownership resolution component 216 and transaction resolution component 221 will be discussed in greater detail.

Transaction component 216 provides the transaction information to a rating component 217. Rating component 217 provides a weight or significance (*e.g.*, a price) to the transaction, so as to provide a tangible value to the transaction. Rating component 217 may make this determination based on various metrics including the type of the content, the quantity of content consumed, the place and time delivered, or the quality of the content for example. Therefore, rating component 217 allows system 100 to provide some contextual value, indicting the significance or relevance that certain content or information has to the individual customer.

Rating component 217 provides the rated transaction to a presentment component 218. Presentment component 218 may provide the capability for a customer 220 to view their real-time billing information, for example, over the network. Presentment component 218 also may attach relevant identifiers to the bill (*e.g.*, account numbers, etc.).

Figures 3A and 3B provide a flow diagram further detailing the operation 300 of system 100. As shown in Figure 3A, in step 301, raw data 204-206 is received from data sources 201-203. In step 302, input data adapter 207 converts raw data 204-206 to flow objects 208, where flow objects 208 are sets of attributes, determined from raw data 204-206. In step 303, it is determined whether there is a need to derive new attributes from

the existing attributes found in flow objects 208. If there is such a need, in step 304, CDL 209 is used to derive new attributes from existing attributes. Also, as discussed above, attributes may be correlated by correlator 211.

In step 305, flow objects 208 are filtered by filter 212. In step 306, the matching flow objects (*i.e.*, those passed by filter 212) are further filtered and classified by aggregator 213 (as discussed more fully with reference to Figures 4-7). In step 307, output data adapter 214 converts the data aggregated by aggregator 213 to a format compatible with transaction layer 103.

As shown in Figure 3B, in step 308, output adapter 214 may format the aggregated data into one or more content data records for storage in CDR database 215. In step 309, ownership resolution component 216 identifies the parties involved in the transaction. In step 310, transaction resolution component 221 captures the predetermined agreements among the parties, as well as the value added by each of the individual parties. In step 311, the CDR is rated based on predetermined metrics (*e.g.*, time of transmission, quality of content). In step 312, a bill is presented to the customer.

Content Transaction Layer

A transaction, including a business transaction for example, may be any activity between two or more participants that affects certain parties. The affected parties may be considered the participants to the transaction, although parties and participants may be mutually exclusive entities. It should be appreciated that the terms "parties" and "owners" may be used interchangeably throughout. Also, a transaction may include one or more events, where an event may be some action (*e.g.*, the transfer of a service or good) that the participants conduct with each other. Such events may be the exchange of data over a communication network, for example. Also, it should be appreciated that the same event or action may take place in any direction (*e.g.*, from party A to party B or from party B to party A). The "subject" of the action is the party who performs the activity, while the "object" of the action is the party who is affected or influenced in any way by the action.

Transaction layer 103 is responsible for capturing the characteristics of the transaction, including the parties, participants, subject, object, event/action type, direction of the action, for example. The scope of the characteristics captured by transaction layer 103 will vary with the nature of instrumentation layer 101, the capability of content collection layer 102, and the requirements of settlement layer 104. Generally, transaction layer 103 captures the predetermined agreements among all of the parties involved in system 100 regarding the value of the transferred content, as well as the value added by each of the individual parties in transferring such content. Therefore, transaction layer

103 is charged with understanding the nature of the parties, as well as the understanding the actions that one or more parties perform and the influence of such action on the respective parties.

Transaction layer 103 includes CDR database 215, an ownership resolution component 216, and a transaction resolution component 221. CDR database 215 is a data store that holds each CDR for further processing by ownership resolution component 216 and transaction resolution component 221. In the context of a billable electronic business transaction, a proper accounting of a communication event, for any purpose including billing, requires both identifying the participants and defining the relationships among those participants. As discussed, ownership resolution component 216 serves to define the participants of the communication event, while transaction resolution component 221 serves to capture the predetermined relationships and/or agreements among the parties defined by ownership resolution component 216.

Transaction layer 103 is generic in that it operates without requiring an understanding of instrumentation layer 101 and content collection layer 102. Instead, transaction layer 103 takes the relevant characteristics of the transaction provided by instrumentation layer 101 and content collection layer 102, and selects and generates those characteristics required by settlement layer 104.

Although the operation of transaction layer 103 will be described in the context of an electronic event over a communication network for the purposes of billing for the event, it should be appreciated that the invention is not so limited, but is so described the

purpose of clarity. For example, it should be appreciated that the invention may include functions other than billing, including security, network capacity planning, and content monitoring, for example. Also, the generic techniques described may be applied beyond the context of an electronic event over a communication network.

Figure 4 provides a block diagram of system 100 providing greater detail of the configuration and operation of transaction layer 103. As shown in Figure 4, content collection layer 102 provides a usage record 401 to transaction layer 103. A series of fields 403-408 comprise usage record 401. Although fields 403-408 will be identified by certain labels for the purpose of clarity, it should be appreciated that fields 403-408 may identify any of the many possible characteristics of the transaction.

In the example provided by Figure 4, fields 403 and 404 identify the parties or participants to the transaction. In particular, field 403 identifies "User A" and field 404 identifies "User B." User A may be the subject party and User B may be the object party. For example, in the context of a telecommunication event, User A may be the "calling" party and User B may be the "called" party. Field 405 and field 406 identify a measurable quantity of the event. In particular, following the example of the telecommunications event, field 405 identifies a duration (in minutes) of the event and field 406 identifies the quantity of data exchanged during the event (in megabytes). Field 407 and field 408 may identify a "start time" and an "end time," respectively, of the communication event.

Although fields 403-408 provide just one example, in any case, it should be appreciated that user record 401 will include certain characteristics provided by instrumentation layer 101 and/or derived by content collection layer 102. These characteristics typically are provided to transaction layer 103 because they have some particular significance to identifying the characteristics necessary to allow settlement layer 104 to provide some accounting of the transaction. Therefore, usage record 401 may not necessarily include all of the characteristics provide by instrumentation layer 101 and/or derived by content collection layer 102, because certain characteristics may not relevant to the settlement of the transaction (*e.g.*, network type). Yet, usage record 401 will include those available characteristics that pertain to permitting settlement layer 104 to properly account for the transaction.

Once usage record 401 passes through transaction layer 103, a modified usage record 402 may be provided to settlement layer 104. Modified usage record 402 may be modified by transaction layer 103 to include additional details of the transaction event required by settlement layer 104 and/or required by the customer's system to which the usage record applies (*e.g.*, a usage billing system). As shown for modified usage record 402, an account A field 409 and an account B field 410 may be added to further identify the transaction. In one example, account A field 409 may include an alphanumeric designator that identifies the account number that has been assigned by the customer's billing system for User A. In the context of the telecommunications system, account A field 409 may hold User A's ten-digit home telephone number, for example.

In any case, the components of transaction layer 103 operate to identify these additional fields, based on the requirements of the customer's system and of settlement layer 104. In particular, ownership resolution component 216 operates to ensure that the necessary participants or parties to the transaction are identified, while transaction resolution component 221 operates to ensure that the relationships among the parties or participants are identified.

Identification of the relevant entities and their relationships may be accomplished using "lookups" in data stores located within ownership resolution component 216 or user-defined actions specified on external systems and applications and transaction resolution component 221, for example. For example, a data table may have a "User" data field and an associated "Account" data field. When User A is received by ownership resolution component 216, it will conduct a lookup in the data table and identify Account A as the appropriate account associated with User A. Also, transaction resolution component 221 may have a data table that permits a lookup of the relationship between User A and User B, identified in usage record 401. For example, upon receiving field 407 designating User A and field 408 designating User B, transaction resolution component 221 may conduct a lookup of an algorithm that identifies the appropriate burdens and benefits (*e.g.*, debit and credit of money) assigned to each of the users with respect to each other.

It also should be appreciated that transaction layer 103 may not provide additional characteristics to usage record 401, as described but may select the relevant

characteristics (*i.e.*, those characteristics needed by settlement layer 104) from the characteristics made available by instrumentation layer 101 and/or derived by content collection layer 102. In fact, usage record 401 may include all of the necessary characteristics to properly account for the transaction. In this case, ownership resolution component 216 and transaction resolution component 221 select the relevant characteristics from the available characteristics.

Figures 5A and 5B provide a flow diagram of a method 500 for identifying the characteristics of a transaction using system 100. As shown in Figure 5A, in step 501, raw data 204-206 is received into system 100. Raw data 204-206 includes certain characteristics provided by data sources 201-203, respectively, in instrumentation layer 101. In step 502, content collection layer 102 processes (*e.g.*, aggregates, correlates and filters) raw data 204-206. In step 503, content collection layer 102 provides the processed data to CDR database 215 in transaction layer 103. CDR database 215 stores the data for further processing by transaction layer 103.

In step 505, it is determined whether the contents of the data provided to transaction layer 103 already include the needed ownership data. If the data includes the needed ownership data, the relevant data is selected by ownership resolution component 216 and provided to transaction resolution component 221, in step 507. If, on the other hand, the data provided to transaction layer 103 does not already include the needed ownership data, the required data is identified (*e.g.*, using database lookups, accountable primitives) by ownership resolution component 216, in step 506. Once ownership

resolution component 216 identifies the required ownership data, the relevant data is selected by ownership resolution component 216 and provided to transaction resolution component 221, in step 507.

As shown in Figure 5B, in step 508 it is determined whether the contents of the data provided to transaction layer 103 already include the needed relationship data (*i.e.*, data defining the burdens and benefits encountered by the parties/participants to the transaction). If the data includes the needed relationship data, the relevant data is selected by transaction resolution component 221 and provided to settlement layer 104, in step 510. If, on the other hand, the data provided to transaction layer 103 does not already include the needed relationship data, the required data is identified (*e.g.*, using database lookups) by transaction resolution component 221, in step 509. Once ownership resolution component 216 identifies the required ownership data, the relevant data is selected by ownership resolution component 216 and provided to transaction resolution component 221, in step 510.

Ownership and Transaction Resolution

Figure 6 is a block diagram further detailing the operation and configuration of transaction layer 103. It should be appreciated that elements described for transaction layer 103 are not exclusive, but provide just one example of a configuration for transaction layer 103. In particular, the functionality of the previously described ownership resolution component 216 and transaction resolution component 221 will be

descried in greater detail in the various components described with reference to Figure 6. In practice, however, it should be appreciated that transaction layer 103 may comprise of any number of components that ensure that the necessary parties to a transaction are identified generically.

As shown in Figure 6, transaction layer 103 includes a configuration repository 601, a configuration database 610, a configuration manager 603, and a fail over detector 604. In addition, transaction layer 103 includes a transaction layer engine 608 in communication with configuration repository 601, configuration manager 603, and fail over detector 604.

Transaction layer engine 608 includes a rules processor 605, a CDR reader 606, and a transaction writer 607. Transaction layer engine 608 processes raw data 204-206 in usage record 401 and creates a modified usage record 402, based upon the requirements of settlement layer 104. It should be appreciated that there may be more than one transaction layer engine 608 for each transaction layer 103. However, a single transaction layer engine 608 is shown for the purpose of clarity and brevity.

CDR reader 106 understands the nature of the transaction and operates to read a particular usage record 401 stored in CDR database 215. CDR reader 106 then submits usage record 401 to rules processor 605. Rules processor 605 applies rules (*e.g.,* written in XML) to usage record 401 so as to determine ownership and the relationships among the ownership, for each individual usage record 401. Rules processor 605 may then generate one or more modified usage records 402, based on the application of the rules to

usage record 401. Once rules processor 605 generates the modified usage record 402, transaction writer 607 operates to write a transaction (based on the modified usage record 402) to CDR database 215. Modified usage record 402 is then used by settlement layer 104 to further process the transaction (*e.g.*, rate the transactions monetarily).

Fail over detector 604 operates to provide fault tolerance and initiate a fail over engine (not shown) for a failed transaction layer engine, in accordance with one or more mathematical algorithms, the discussion of which is beyond the scope of the invention. Configuration manager 603 provides an external interface to transaction layer 103 using a business editor 609. Business editor 609 may be manipulated by a user or customer using a graphics user interface (GUI). In particular, the GUI of business editor 609 receives commands from a user and translates them into actions to be performed on usage record 401, for example, by rules processor 605. Configuration repository 601 operates to provide an abstraction to configuration database 610. Configuration database 610 may be a relational database or a set of extensible markup language (XML) computer-readable files, for example.

Figure 7 is a flow diagram that details the operation of transaction layer 103, as shown in Figure 6. As discussed, it should be appreciated that multiple transaction engines may be used to implement a process. Where the invention is instituted using computer-readable instruction, transaction layer engine 608 may be implemented as a computer-executable instruction or thread. Therefore, multiple transaction layer engines may be implemented by having multiple computer-readable instructions.

In step 701, transaction layer engine 608 reads usage record 401 using CDR reader 606. In step 702, rules processor 605 applies one or more rules to usage record 401 read by CDR reader 606, so as to determine one or more "accountables." Accountables are labels that are used to facilitate identifying the parties or owners to a transaction. Accountables may be defined and/or modified by an external user (*e.g.*, a customer) using the graphical user interface provided by business editor 609. Also, it should be appreciated that accountables may be defined for a new usage types for which no rules in rules processor 605 are provided. The identification of accountables is the function of ownership resolution component 216, as described with reference to Figure 4.

In step 703, "contracts" are identified that define the relationships or agreements between one or more accountables. In the context of a billing system, a contract identifies which party pays (*i.e.*, the billed party) and which party receives payment (*i.e.*, the billing party). A particular contract may be identified and executed when one based on "conditions" are satisfied, however, such conditions may not be required. The identification of contracts is conducted by transaction resolution component 221, as described with reference to Figures 2 and 4. A condition is an expression of a logical assertion that can be evaluated as true or false. In transaction layer 103, for example, a condition may be true if a certain data element is present and false if the data element is not present. The following is an example of a condition in XML:

<condition name="condition1" function="IsPresent" outcome="true" type="Accountable" id="ColoProvider"/>

In step 704, once the contracts are determined, they are executed. In step 705, usage record 401 is changed to modified usage record 402 based upon the execution of the contract and the identification of the accountables. In step 706, modified usage record 402 may be written to a data table using transaction writer 607, so that settlement layer 104 can rate it, in step 707. Therefore, a transaction may be represented as modified usage record 402, where modified usage record may include the elements of usage record 401 in addition to the accountable and contract elements (*e.g.*, fields 409-410 as discussed with reference to Figure 4).

Although the discussion provided an example of a single contract and two accountables for a single usage record, it should be appreciated that many contracts and many accountables (*i.e.*, and therefore many "transactions") may be derived from a single usage record, because there may be multiple transactions implicated from a single usage record 401. For example, usage record 401 may involve three parties each having a contract with the other respective parties. In this example, therefore, there may be three separate contracts for a single usage record 401, and three individual accountables for each party or owner.

In addition to requiring a certain accountable, it may be necessary to determine a value of the accountable. For example, transaction layer 103 may determine not only that the "called party" accountable be a part of the transaction, but also that a value for the

called party (*e.g.*, "856-555-1212" or "John Doe") be identified. Also, it may be necessary to transform one accountable into another accountable to satisfy the requirement of settlement layer 104. For example, settlement layer 104 may require the called party accountable (either determined by transaction layer 103 or provided in usage record 401) be transformed into a network identifier accountable.

In either case, the value or transformation of accountables or contracts may be determined using certain predetermined functions or "primitives." A primitive allows the user to specify how to find the value of a particular accountable or how to find billing and/or billed account numbers associated with a particular contract. As discussed, transformations may allow a value of an accountable to be determined using another accountable (*i.e.*, called "linked accountables"), for example. Primitives define and direct such transformations. The input to a primitive can be one of fields 403-408 from usage record 401 or a previously determined accountable, for example.

Primitives may be described and distinguished based on their prescribed functionality. For example, one type of primitive may be an external database lookup. A database lookup is a primitive that operates to transform one accountable or contract to another accountable or contract. Also, a database lookup primitive may function to assign a value to an accountable or contract, as a result of conducting a lookup of the accountable or contract in a database. It should be appreciated that the database lookup primitive also allows flexibility in that any database that has Java Database Connectivity (JDBC) drivers (*e.g.*, Oracle, Microsoft SQL Server, Sybase, Database 2) can be used to

perform complex lookups. For native databases that do not have JDBC connectivity, however, it should be appreciated that native methods for native databases may be accommodated through the primitives. In this way, therefore, previous accountable or contact transformations can be linked to find new accountables or contracts, respectively.

Other types of primitives may include direct value assignment, and a function primitive. A function primitive provides flexibility and extensibility by allowing a third party based library (*e.g.*, Java-based or native libraries) to be used. The arguments of a function primitive may be text strings. Also, the arguments of a function primitive may be expressed in terms of fields in CDR database 215 (*i.e.*, string-based fields in usage record 401), and other previously determined accountables. Therefore, function primitives permit the integration of proprietary and domain-specific algorithms to be implemented to perform ownership related processing.

Another primitive may be a "regular expression" based primitive that allows parsing of complex text-based fields with a full feature (*e.g.*, PERL5 compliant) pattern specification. Common used techniques would include parsing URLs, filenames and paths, calling/called telephone numbers, email address, for example. In addition, a CDR database 215 lookup primitive allows holding on to an ownership entity if no further processing is required. This primitive is used where usage record 401 provides the information needed by settlement layer 104 without any need for more data correlation and/or manipulation by transaction layer 103.

A default primitive may be a hard-coded primitive that is used where the value is known and/or is not dependent on usage record 401. For example, such a primitive may be used where a party is always present in a consumption event, regardless of the other relevant parties. A network address primitive allows determination of a network entity given an arbitrary string. An area code primitive may be used to determine an area code of a telephone number given the complete telephone number. This primitive may be relevant for a Voice-over-IP application. These examples primitives are not exclusive, but are meant to provide a few examples of the manipulation and correlation that may be achieved by the primitives on the accountables and contracts.

The following is an example of an accountable primitive in XML:

```
<accountable>
<name> ColoProvider </name>
<role> ServiceProvider </role>
<usageType> RMONHost </usageType>
<valid from="past" to="present" />
<primitive type="default">
<value> Exodus </value>
</primitive>
</accountable>
```

Each accountable that is involved in a contract will have an assigned "role." It follows, therefore, that an accountable that is not involved in a contract may not need to have an assigned role. The role associates the particular accountable for integration with settlement layer 104. This means that the concept of a role is used for the TL/AMI integration.

Similar to the accountable, a contract is implemented using a set of primitives. The following is an example of a contract primitive in XML, and is provided to further describe the invention. In the example, a Web hosting scenario is present where a content provider (*e.g.,* CNN) places content on one or more Web servers and pays a Web Hoster for doing so based on some predefined pricing plan.

In order to define the accountables, certain elements of usage record 401 may be assumed as follows: Web Hit Time, Web Server Name/IP address, Client IP address, bytes, Mime type, and URL. In this example, if a rule in the business world requires the "Content Provider" of the Web Server (*e.g.,* CNN) to pay to the Web Hoster, there are two accountables: Web Hoster and Content Provider. The XML definition of a contract that captures this business rule may be as follows:

```
01  <contract>
02  <name> ContentProvider-Pays-WebHoster </name>
03  <usageType> WebHosting </usageType>
04  <valid from="past" to="present" />
05  <condition function="IsPresent" type="Accountable"
    name="condition1"  id=" ContentProvider " />
06  <condition function="IsPresent" type="Accountable"
    name="condition2" id="WebHoster" />

07  <billedFunction>
08  <status> enabled </status>
09  <primitive type="internal-account-lookup">
10  <database name="GlobalDB"/>
11  <argument order="1" type="Accountable"
    name="ContentProvider"/>
12  </primitive>
13  </billedFunction>
```

```
14    <billingFunction>
15    <status> disabled </status>
16    <primitive type="internal-account-lookup">
17    <database name="GlobalDB"/>
18    <argument order="1" type="Accountable" name="WebHoster"/>
19    </primitive>
20    </billingFunction>
21    </contract>
```

In this example, a contract has a name defined in line 02 as "ContentProvider-Pays-WebHoster." The contract also defines an element or usage type called "WebHosting" in line 03. The contract also has two sets of conditions in lines 05 and 06, called "IsPresent," which consider whether "ContentProvider" and "WebHoster" elements are present, respectively. Therefore, this particular contract will be selected and executed by transaction layer 103 if these elements are present.

Also, in this contract example, there are two primitives that are specified. There is a first primitive for finding the account number of the billed entity "ContentProvider," which begins on line 07 and ends on line 13, and there is a primitive for determining the account of the billing entity "WebHoster" beginning on line 14 and ending on line 20. Therefore, the example contract contemplates the "who pays to whom" logic, and results in the execution of a contract that creates a modified usage record 402, which captures the transaction. Notably, in lines 09 and 16, both primitives are defined as database lookups.

The invention is directed to a system and method for of determining of direct and/or indirect parties involved in a transaction. The invention often was described in the context of the Internet, but is not so limited to the Internet, regardless of any specific description in the drawing or examples set forth herein. For example, the invention may be applied to wireless networks, as well as non-traditional networks like Voice-over-IP-based networks, private networks, and/or non-technology related business environments, like commodity trading for example. It will be understood that the invention is not limited to the use of any of the particular components or devices herein. Indeed, this invention can be used in any application that requires the determining of direct or indirect parties involved in a transaction. Further, the system disclosed in the invention can be used with the method of the invention or a variety of other applications.

While the invention has been particularly shown and described with reference to the embodiments thereof, it will be understood by those skilled in the art that the invention is not limited to the embodiments specifically disclosed herein. Those skilled in the art will appreciate that various changes and adaptations of the invention may be made in the form and details of these embodiments without departing from the true spirit and scope of the invention as defined by the following claims.

**What is Claimed is:**

1. A method of determining parties to a transaction, comprising:

receiving data related to an event, wherein said data comprises one or more data elements;

selecting said data elements that identify the parties to the transaction;

determining whether additional data elements are required to identify the parties to the transaction; and

identifying the additional data elements.

2. The method of claim 1, wherein said event is an exchange of data between the parties over a communication network.

3. The method of claim 1, wherein said data related to said event is stored in a usage record.

4. The method of claim 1, wherein the parties include at least one of the following: a subject party and an object party.

5. The method of claim 1, wherein said determining is a function of the received data.

6. The method of claim 1, wherein said determining is a function of the requirements of a customer settlement system.

7. The method of claim 6, wherein said customer settlement system includes at least one of the following: a data security system, a network capacity planning system, and a content monitoring system.

8. The method of claim 1, wherein said data element is an accountable.

9. The method of claim 1, wherein said identifying of additional data elements is initiated by a primitive.

10. The method of claim 9, wherein said primitive includes at least one of the following: a database lookup, direct value assignment, regular expression, CDR database lookup, hard-coded, network address, substring manipulation, area code, and a user-specified action.

11. A system for determining parties to a transaction, comprising:

an instrumentation layer, wherein the instrumentation layer provides raw data;

a content collection layer in communication with the instrumentation layer, wherein the content collection layer generically processes the raw data; and

a transaction layer in communication with the content collection layer, wherein the transaction layer identifies one or more parties to the transaction.

12. The system of claim 11, wherein said content collection layer provides said raw data to said transaction layer in a usage record.

13. The system of claim 12, wherein said transaction layer modifies said usage record as a function of identifying the parties to the transaction.

14. The system of claim 11, further comprising a settlement layer in communication with said transaction layer, wherein the settlement layer rates the modified usage record.

15. The system of claim 12, wherein said transaction layer comprises a data base for storing said data processed by said content collection layer.

16. A computer-readable medium having computer-executable instructions for:

receiving data related to an event, wherein said data comprises one or more data elements;

selecting said data elements that identify the parties to the transaction;

determining whether additional data elements are required to identify the parties to the transaction; and

identifying the additional data elements.

17. The computer-readable medium of claim 16, wherein said computer-executable instructions are extensible.

18. The computer-readable medium of claim 16, wherein said event is an exchange of data between the parties over a communication network.

19. The computer-readable medium of claim 16, wherein said data related to said event is stored in a usage record.

20. The computer-readable medium of claim 16, wherein the parties include at least one of the following: a subject party and an object party.

21. The computer-readable medium of claim 16, wherein said determining is a function of the received data.

22. The computer-readable medium of claim 16, wherein said determining is a function of the requirements of a customer settlement system.

23. The computer-readable medium of claim 22, wherein said customer settlement system includes at least one of the following: a data security system, a network capacity planning system, and a content monitoring system.

24. The computer-readable medium of claim 16, wherein said data element is an accountable.

25. The computer-readable medium of claim 16, wherein said identifying of additional data elements is initiated by a primitive.

26. The computer-readable medium of claim 25, wherein said primitive includes at least one of the following: a database lookup, direct value assignment, regular expression, CDR database lookup, hard-coded, network address, substring manipulation, area code, and user-specified action.

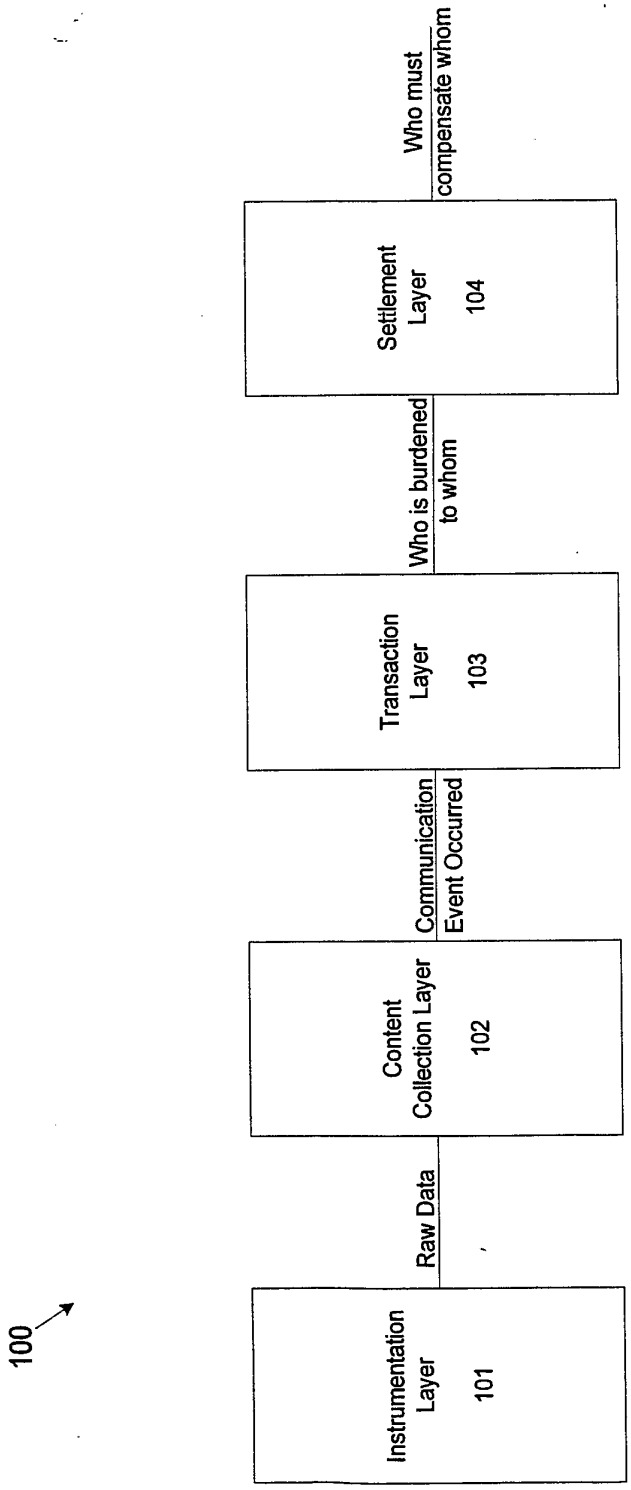

100
Instrumentation Layer 101
Raw Data
Content Collection Layer 102
Communication Event Occurred
Transaction Layer 103
Who is burdened to whom
Settlement Layer 104
Who must compensate whom

Figure 1

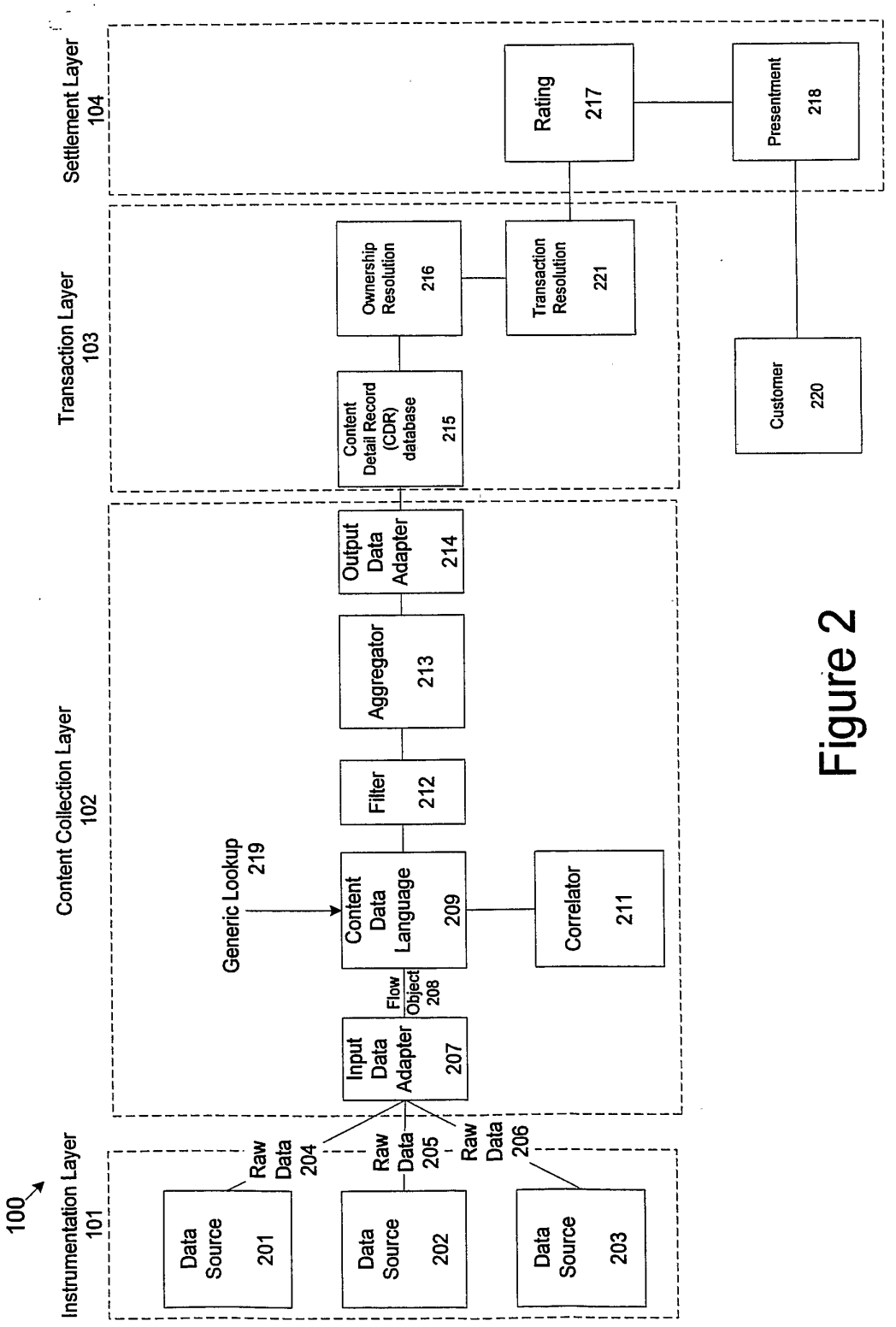

100
Instrumentation Layer
101
Data Source
201
Data Source
202
Data Source
203
Raw Data
204
Raw Data
205
Raw Data
206
Content Collection Layer
102
Input Data Adapter
207
Flow Object
208
Content Data Language
209
Generic Lookup
219
Correlator
211
Filter
212
Aggregator
213
Output Data Adapter
214
Transaction Layer
103
Content Detail Record (CDR) database
215
Ownership Resolution
216
Transaction Resolution
221
Settlement Layer
104
Rating
217
Presentment
218
Customer
220

Figure 2

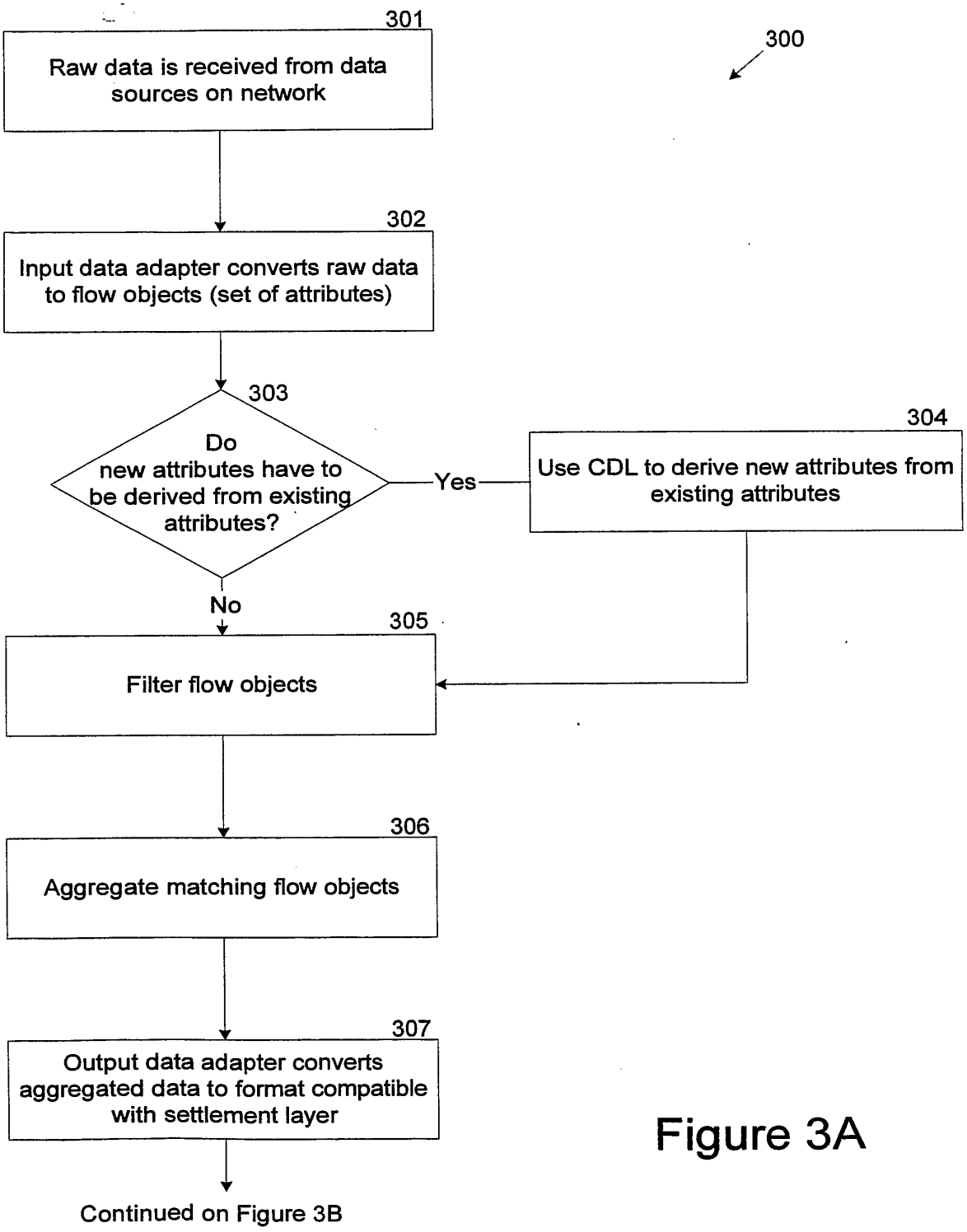

300
301
Raw data is received from data sources on network
302
Input data adapter converts raw data to flow objects (set of attributes)
303
Do new attributes have to be derived from existing attributes?
Yes
304
Use CDL to derive new attributes from existing attributes
No
305
Filter flow objects
306
Aggregate matching flow objects
307
Output data adapter converts aggregated data to format compatible with settlement layer
Continued on Figure 3B

Figure 3A

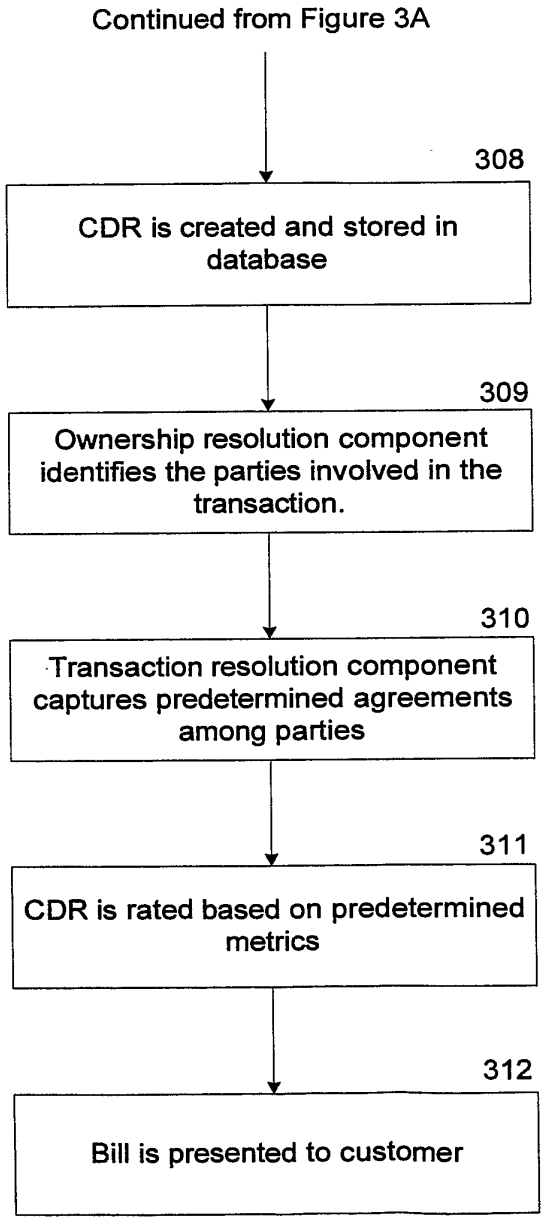

Continued from Figure 3A
308
CDR is created and stored in database
309
Ownership resolution component identifies the parties involved in the transaction.
310
Transaction resolution component captures predetermined agreements among parties
311
CDR is rated based on predetermined metrics
312
Bill is presented to customer

Figure 3B

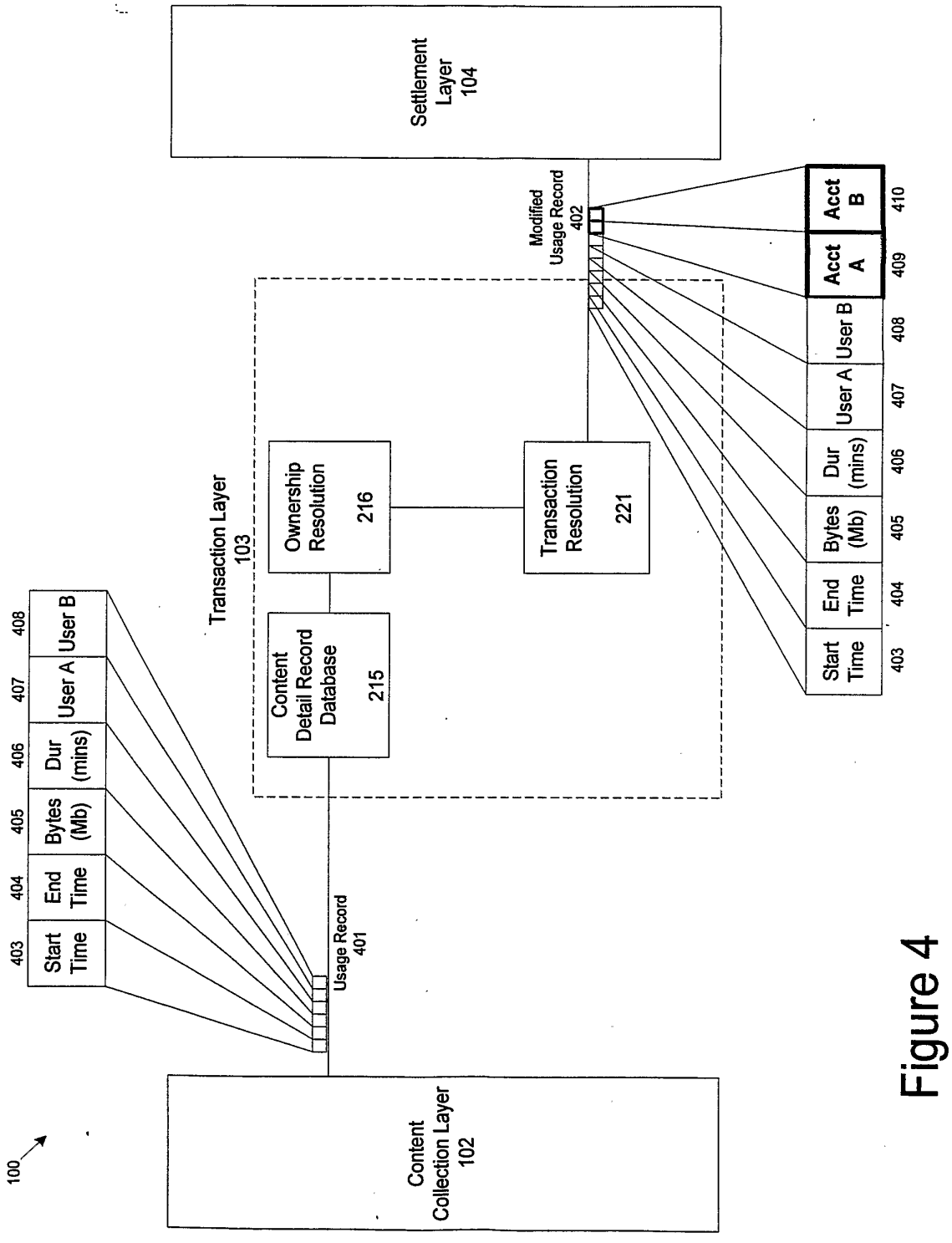

100
Content Collection Layer 102
Settlement Layer 104
Transaction Layer 103
Content Detail Record Database 215
Ownership Resolution 216
Transaction Resolution 221
Usage Record 401
Modified Usage Record 402
403 Start Time
404 End Time
405 Bytes (Mb)
406 Dur (mins)
407 User A
408 User B
409 Acct A
410 Acct B

Figure 4

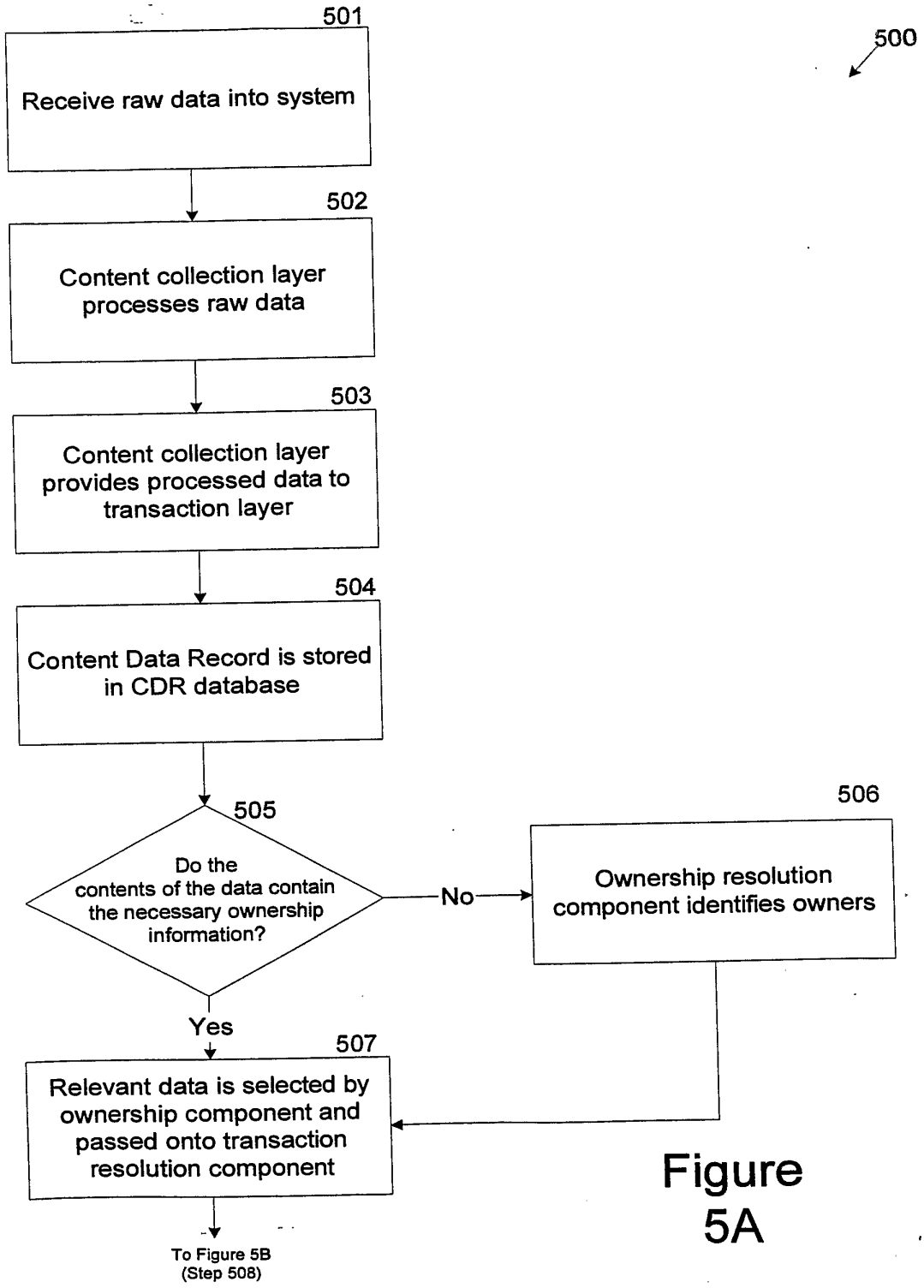

500
501
Receive raw data into system
502
Content collection layer processes raw data
503
Content collection layer provides processed data to transaction layer
504
Content Data Record is stored in CDR database
505
Do the contents of the data contain the necessary ownership information?
No
506
Ownership resolution component identifies owners
Yes
507
Relevant data is selected by ownership component and passed onto transaction resolution component
To Figure 5B (Step 508)

Figure 5A

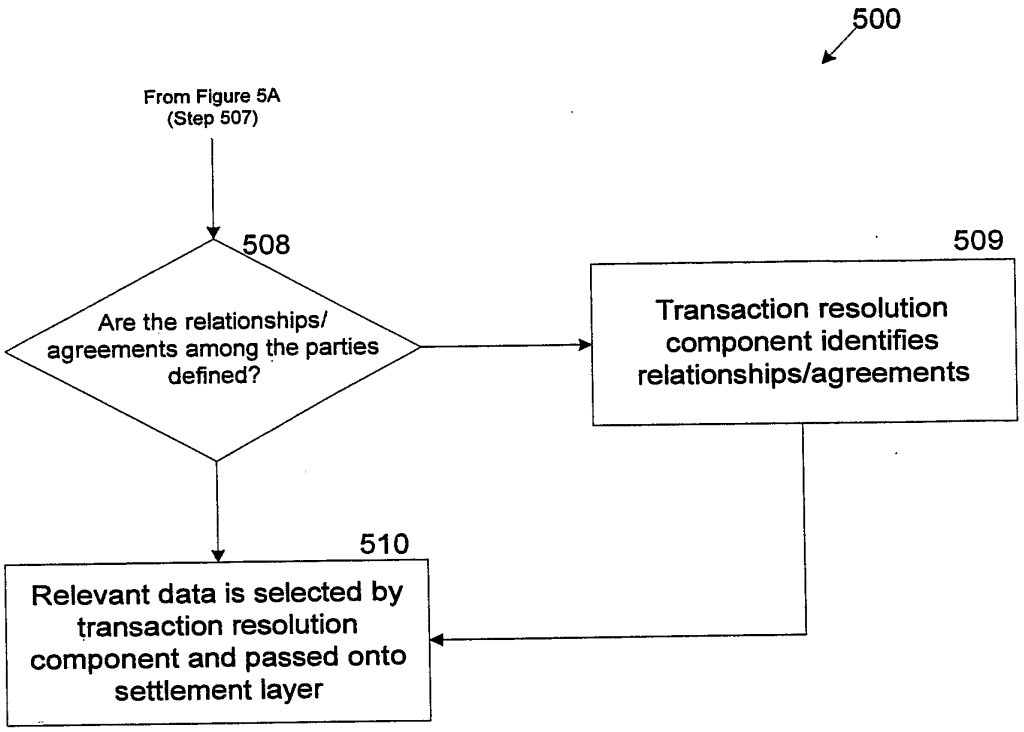

500
From Figure 5A
(Step 507)
508
Are the relationships/ agreements among the parties defined?
509
Transaction resolution component identifies relationships/agreements
510
Relevant data is selected by transaction resolution component and passed onto settlement layer

Figure 5B

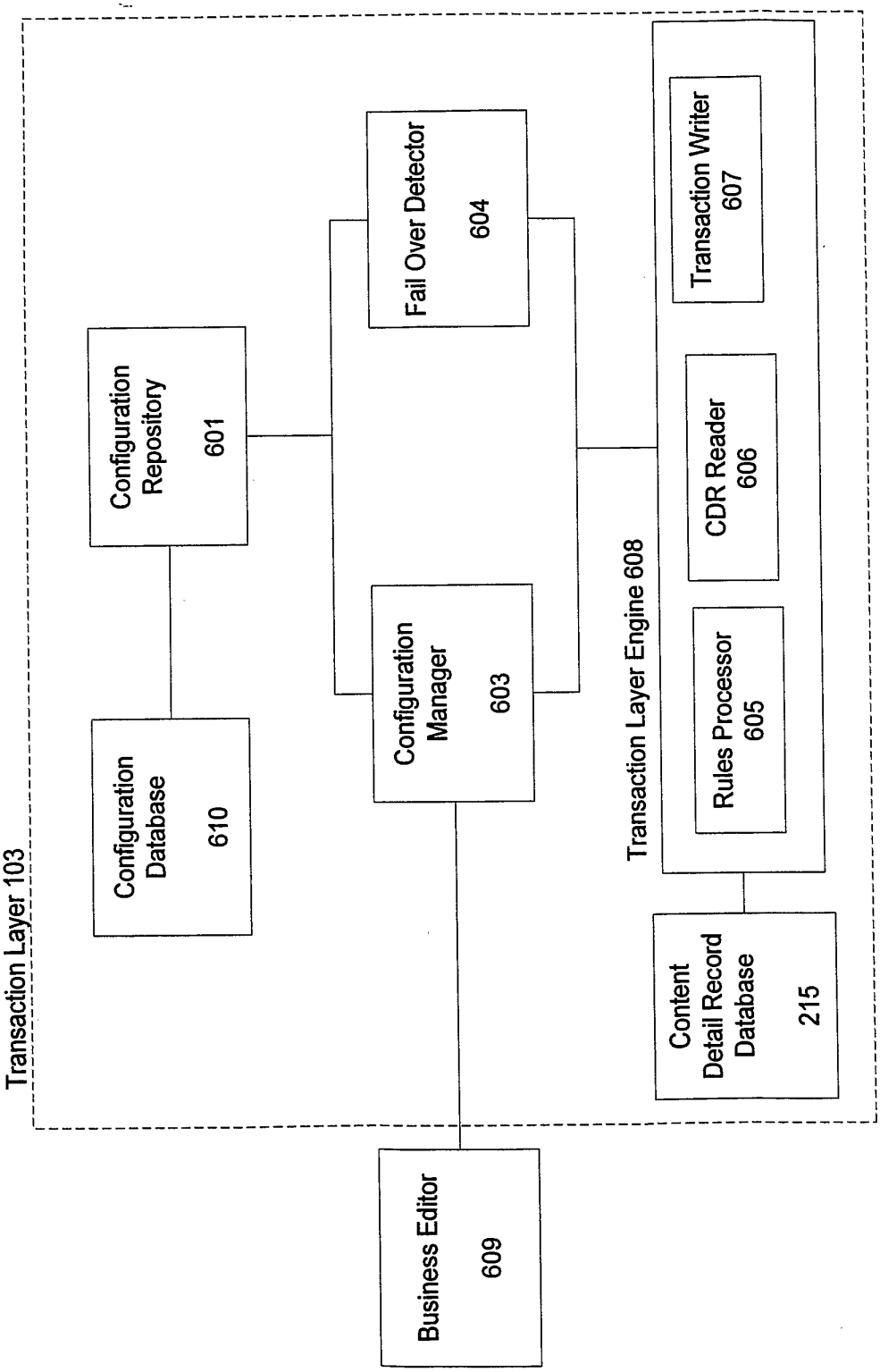

Transaction Layer 103
Configuration Repository 601
Configuration Database 610
Fail Over Detector 604
Configuration Manager 603
Transaction Layer Engine 608
Transaction Writer 607
CDR Reader 606
Rules Processor 605
Content Detail Record Database 215
Business Editor 609

Figure 6

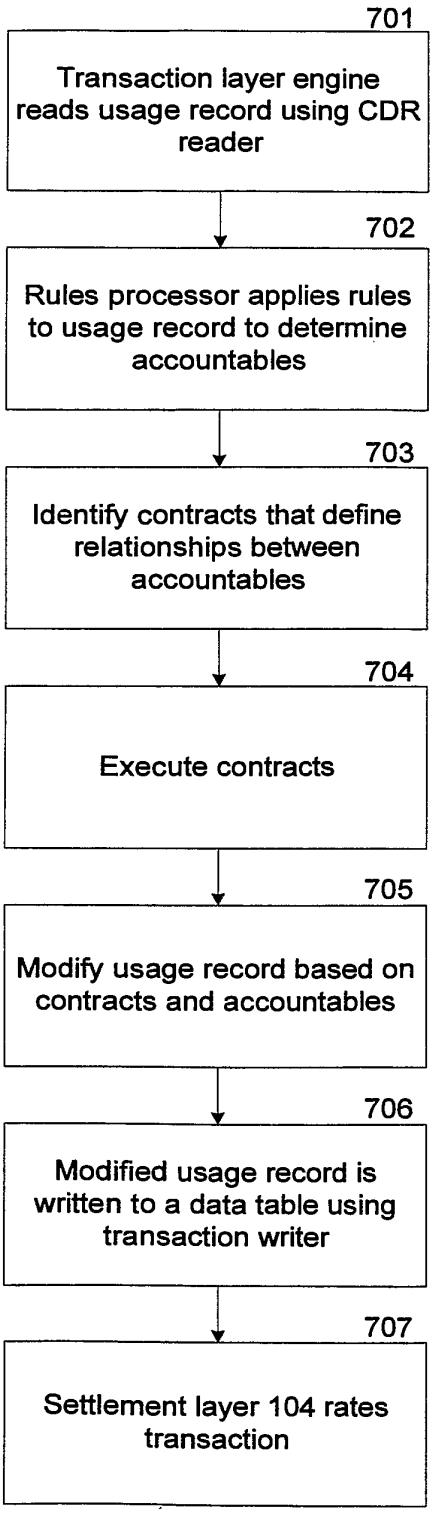

701
Transaction layer engine reads usage record using CDR reader
702
Rules processor applies rules to usage record to determine accountables
703
Identify contracts that define relationships between accountables
704
Execute contracts
705
Modify usage record based on contracts and accountables
706
Modified usage record is written to a data table using transaction writer
707
Settlement layer 104 rates transaction
700

Figure 7

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## (54) A method and apparatus for division of revenue of communication among different proprietors

(57) A method and apparatus for division of revenue of communication among different proprietors is provided in this invention, where the division of revenue among the different proprietors is performed by a gateway office, wherein the gateway office will set a source parameter and a destination parameter respectively from the source and the destination when a call goes through the gateway office; Judge the two parameters to get a revenue zone index; Judge the value of the revenue zone index, and modulate the revenue zone index to get a revenue class index; The gateway office generates contents related to the revenue class index; A central memory receives all these contents, adds an increment of each counter of the revenue class memory related to the revenue class index to a corresponding counter and carries out multiple safety mechanisms; Output the information in the revenue class memory to a storage medium for storing, then output it to a billing center for revenue sorting. The billing mode present in this invention is based on group pairs, so it is more adaptive for the gateway office to divide revenue.

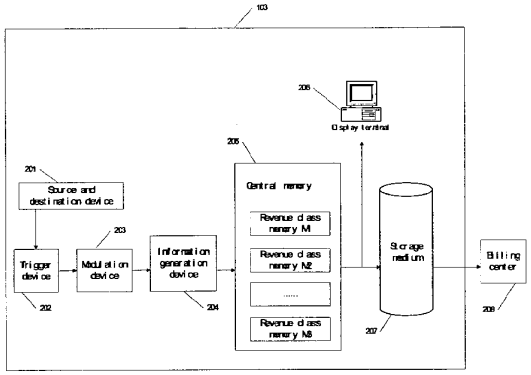



Fig. 2

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EP 1 545 114 A1

## Description

TECHNICAL FIELD

**[0001]** The present invention relates to a method and apparatus for division of revenue of telecommunication among different proprietors.

RELATED ART

**[0002]** As to the relay jumping table billing, in the SPC exchange, it takes relay groups (income and outgoing) as revenue billing units, and accumulates all metering impulses of the relay group as the billing content. Although this technology is simple, it is not able to provide enough flexibility in resource sorting and billing content selecting.

**[0003]** As to the detail billing, in the SPC exchange, it generates a detail record for each call. All these records (telephone billing list) will be sent out from the SPC exchange after a specific period. A specific sorting department sorts all received telephone billing list, which will be treated as the billing content after sorting and summation. It can satisfy all kinds of user's customized demands, but there is a large number of temporary data transferring between the SPC exchange and the sorting department, and the investments on the equipments will be expanded greatly in order to satisfy demands.

SUMMARY OF THE INVENTION

**[0004]** In order to solve said problems of existing technology, this invention provides all kinds of methods for the division of revenue at the SPC exchange level of the gateway office, to satisfy various potential billing demands among the proprietors. Moreover, it is needless for proprietors to add investments immediately to meet with the additional demands for detail billing because of this demand.

**[0005]** The present invention provides a method for division of revenue of communication among different proprietors, wherein the division of revenue among the different proprietors is performed by a gateway office, the method comprising that:

a) When a call goes through the gateway office, the gateway office gets a source of a calling user and a destination of a called user respectively from different proprietors, and extracts a source parameter and a destination parameter from the source and the destination;

b) The gateway office judges values of the source parameter and the destination parameter as said in step a), and if there is one of values of the parameters corresponding to a parameter value for stopping a function on the division of revenue, the division of revenue function is stopped, otherwise, a corresponding revenue zone index is obtained according to said source parameter and destination parameter and step c) is executed;

c) The gateway office judges a value of the revenue zone index as said in step b), if it corresponds to the parameter value for stopping the division of revenue function, the revenue division function is stopped, otherwise, said revenue area index is modulated according to said call, a corresponding revenue class index $R_j$, j=1, 2...n is obtained, and step d) is executed;

d) The gateway office generates contents related to the revenue class index $R_j$ as said in step c), and sends the contents to a central memory of the gateway office after said calling is finished;

e) The central memory of the gateway office receives the contents related to said revenue class index $R_j$ as said in step d), and based on these contents, adds an increment of each counter in revenue class memory $M_j$ (j=1,2... n) related to the revenue class index $R_j$ to the corresponding counter and performs multiple safety mechanisms;

f) The central memory sends information in the revenue class memory $M_j$ obtained in step e) to a storage medium. The storage medium stores the information with a predefined formatted scheme and sends the information to a billing center for sorting the revenue

wherein in said step c), said revenue zone index is modulated by a modulation parameter or several modulation parameters, and the obtained revenue class index varies with different modulation parameters which include type of call, bear capacity, high level carrying(HLC), analog or ISDN user.

wherein in said step d), said contents related to the revenue class index $R_j$ as said in step c) include static and dynamic information on the call as said in step a);

**[0006]** In said step e), the revenue class memory $M_j$ (j=1, 2...n) is set according to user's needs during initialization in the gateway office;

**[0007]** In said step f), the central memory sends the information in the revenue class memory $M_j$ as said in step e) to a display terminal.

wherein in said step e), the multiple safety mechanisms include:

**[0008]** The central memory introducing a windowing mechanism during a receiving procedure;

**[0009]** The accumulation of each counter having a hot backup;

**[0010]** Each counter backups its information to a pair of hard disks with specific intervals.

wherein in said step f), the predefined formatted scheme is either a general scheme or a scheme customized according to user's needs.

**[0011]** The present invention provides an apparatus for division of revenue of communication among different proprietors, wherein the division of revenue among the different proprietors is performed by a gateway office, the apparatus comprising a source and destination device located in the gateway office, and further a trigger device, a modulation device, an information generation device□a central memory and a storage medium which are all located in the gateway office, wherein:

**[0012]** When a call goes through the gateway office, the source and destination device located in the gateway office respectively extracts a source parameter and a destination parameter according to a source of calling user and a destination of called user;

**[0013]** The trigger device judges values of the source parameter and the destination parameter, and if there is one of the values of the parameters corresponding to a parameter value for stopping a function on the division of revenue , the revenue division is stopped, otherwise, a corresponding revenue zone index is obtained according to said source parameter and destination parameter, and then judges a value of said revenue zone index, if it corresponds to the parameter value for stopping the revenue division function, t the revenue division function is stopped, otherwise, said revenue zone index is sent to the modulation device;

**[0014]** The modulation device, according to said call, modulates said revenue area index from the trigger device, and obtains the corresponding revenue class index $R_j$, j=1, 2...n;

**[0015]** The information generation device, according to said revenue class index $R_j$, j=1, 2...n, generates contents related to said revenue class index $R_j$, and sends them to the central memory after said call is finished;

**[0016]** The central memory receives the contents related to said revenue class index $R_j$, and based on these contents, adds an increment of each counter in revenue class memory $M_j$ (j=1,2...n) related to the revenue class index $R_j$ to the corresponding counter, and performs multiple safety mechanisms, and then sends information in said revenue class memory $M_j$ to the storage medium;

**[0017]** The storage medium stores the information in said revenue class memory $M_j$ with a predefined formatted scheme and sends the information to a billing center for sorting the revenue.

wherein said revenue zone index is modulated in the modulation device by a modulation parameter or several modulation parameters, and the obtained revenue class index varies with different modulation parameters which include type of call, bear capacity, high level carrying(HLC), analog or ISDN user.

**[0018]** Wherein said contents related to the revenue class index $R_j$ include static and dynamic information on the said call;

**[0019]** Said revenue class memory $M_j$ (j=1, 2...n) is set according to user's needs during initialization in the gateway office;

**[0020]** Said apparatus also includes a display terminal, which is used to display the information in said revenue class memory $M_j$.

wherein said multiple safety mechanisms include:

**[0021]** The central memory introducing a windowing mechanism during a receiving procedure;

**[0022]** The accumulation of each counter having a hot backup;

**[0023]** Each counter backups its information to a pair of hard disks with specific intervals.

wherein the predefined formatted scheme is either a general scheme or a customized scheme according to user's needs.

**[0024]** The division of revenue of this invention is a kind of billing method based on group pairs, making it more adaptive for gateway offices to divide revenue. Moreover, the division of revenue method present in this invention is not only based on relays, but it can also be realized by other billing units, comparing to the present technology whose billing unit is simply based on relays. The revenue class in this invention is abstract, and can be a mixture of several different entity types. Besides, the present invention also adopts a new normalized input and output format for the division of revenue.

## DESCRIPTION OF THE DRAWINGS

**[0025]**

Fig .1 is a flowchart illustrating different proprietors realizing division of revenue by the gateway office in accordance with a preferred embodiment of the invention;

Fig .2 is a map of the gateway office realizing division of revenue in accordance with a preferred embodiment of the invention;

Fig .3 is a flowchart illustrating the safety mechanisms of the central memory in accordance with a preferred embodiment of the invention.

## DETAILED DESCRIPTION OF THE INVENTION

**[0026]** This invention will be further explained with reference to the drawings and an embodiment.

**[0027]** This invention provides a method and a apparatus for division of revenue of communication among different proprietors, wherein the division of revenue among the different proprietors is performed by a gateway office.

**[0028]** Here, the gateway office is an interface exchanging office carrying out transmission of telephone services among different proprietors. For instance, a user of the Shanghai Mobile makes a call to another fixed phone user of the Shanghai Telecom, which will reach the fixed phone user via a gateway office between the two companies. Since the Shanghai Telecom proprietor has supplied its resource, it will count this kind of resource at the gateway office, and then come to a settlement with the Shanghai Mobile for the revenue. Therefore, the main function of the gateway office is to separately count resources occupied and divide revenue among different proprietors. At the same time, it also provides other gateway services such as the call identification authority and black/white list. The Division of Revenue (DOR) is used to count communication resource among different proprietors.

**[0029]** As shown in Fig.1, the user 101 is a user of the proprietor A 102 and the user 105 is a user of the proprietor B 104. When a call from the calling user 101 to the called user 104 go in and out from the gateway office 103, the gateway office 103 will get a source from the proprietor A, such as Beijing, and get a destination from the proprietor B, such as Shanghai.

**[0030]** Fig.2 is a map of the gateway office implementing division of revenue in accordance with an embodiment of the invention, including a source and destination device 201, a billing center 208, which are existing technology, and a trigger device 202, a modulation device 203, an information generation device 204, a central memory 205, a display terminal 206 and a storage medium 207, which are added in this invention. As shown in Fig.2, the source and destination device 201 of the gateway office 103 gets a source parameter and a destination parameter respectively from the source and the destination, which is a numeric value (0-255). For example, if the source is Beijing, the value of the source parameter is "1", and if the destination is Shanghai, the value of the destination parameter is "2".

**[0031]** At this time the route is already elected to pass, namely when the called user starts ringing, the trigger device 202 of the gateway office 103 judges the value of source and destination parameters. If there is a parameter's value corresponding to the value for stopping the division of revenue function, for example, in this embodiment, if there is a parameter whose value is 0, the division of revenue function is stopped. Those users who do not need this function shield it to consume the least resources. Otherwise, the trigger device 202 obtains a revenue zone parameter according to the source parameter and the destination parameter, as show in table 1.

| Destination / Source | Beijing | Shanghai | ... | ... |
|---|---|---|---|---|
| Beijing | X1 (north china revenue zone index(1)) | X2 (north china-east china revenue zone index (2)) | ... | ... |
| Shanghai | X3 (east china - north china revenue index (3)) | X4 (east - china revenue zone index (4)) | ... | ... |
| ... | ... | ... | ... | ... |
| ... | ... | ... | ... | Xn |

Table.1

**[0032]** $x_1$, $x_2$, $x_3$, $x_4$ ... $x_n$ in the table 1 are revenue zone indices. In this embodiment, the source is Beijing (1) and the destination is Shanghai (2). The trigger device 202 judges the source parameter value and the destination parameter value, if neither of them is zero, the corresponding revenue zone index $x_2$ is obtained, namely North China - East China revenue zone index, whose revenue zone index value is "2". As shown in table 1, in this invention, the revenue zone indices with different values can simply correspond to the different revenue class indices, which means obtaining many different revenue class indices. In existing technology, if the source and the destination are respectively output relay group and input relay group, it realizes the relay jump table function, and the largest number of the relay group soft table is 10 or 14. In this invention, we can dynamically assign many revenue class indices to one input relay group + several destinations, or to one output relay group + several sources, which actually means a relay group can have the nearly infinite number of the soft tables. This already breaks through the number limitation of the relay group soft table,

which is 10 or 14 in the existing technology, therefore, this invention actually functions better than the current relay jump table technology.

**[0033]** The trigger device 202 judges the revenue zone index value, if the value is 0, the function of division of revenue is stopped. This is helpful to users' flexible choice, and save system resource to the greatest extent. Otherwise, the modulation device 203 will modulate the revenue zone index. For instance, in this embodiment, the value of the revenue zone index $x_2$ is "2", not "0", so $x_2$ is modulated. Refer to table 2 for detailed modulation process.

**[0034]** As shown in table 2, for instance, proprietors are interested in the voice service of this call, namely require to count and charge the voice service, then said revenue zone index is modulated with one of the modulation parameters and the corresponding revenue class index $R_j$, j=1, 2...n is obtained. In this embodiment, the revenue zone index $x_2$ is modulated with the type of call (voice) modulation parameter and the corresponding revenue class index R1 is obtained, which corresponds to the voice service of the DDD call, namely the DDD call list. Furthermore, if there are other calls corresponding to the ISDN call, the revenue zone index $x_2$ will be modulated with the type of call (voice) modulation parameter, and the corresponding revenue class index R2 will be obtained, which means R2 corresponds to the voice service of the ISDN, namely the ISDN call list.

| Revenue zone index | Type of call | Revenue class index | Billing list |
|---|---|---|---|
| X2 (north china- east china revenue zone index(2)) | Type of call (voice) | R1 (east china - north china revenue class index (1)) (DDD call) | DDD billing list |
| | | R2 (east china - north china revenue class index (2)) (ISDN call) | ISDN billing list |
| | | R3 (east china - north china revenue class index (3)) (IN call) | IN billing list |
| | | ... | ... |

| | | | |
|---|---|---|---|
| | | R4 (east china - north china revenue class index (n)) (other types of call) | Other types of billing lists |

Table.2

**[0035]** This invention provides an extremely flexible modulation method, wherein said modulating characteristics in this invention means modulating said revenue zone index using one or several modulation parameters, and the different corresponding revenue class indices by different combinations of these modulation parameters are obtained. The purpose of the modulation is to further conclude and arrange all revenue by different modulation parameters, and make revenue sortable according to the proprietor's demand, namely to perform revenue class indexing. At the end, various billing data will be obtained through different revenue class indices. The modulation parameters can be type of call (voice), bear capacity, high level carrying(HLC), analog or ISDN user and so on.

**[0036]** Said modulation in this invention is carried out during the calling process. In the existing technology, the relationship between each revenue zone index and revenue class index is usually one-to-one correspondence, which could satisfy the demand of most users. In this case, the modulation step can be ignored.

**[0037]** After the called user 105 gives reply, and before the call is released, the information generation device 204 of the gateway office 103 generates contents related to said revenue class index, such as R1, which include static and dynamic information on the call. The static information contains the modulating characteristics as shown in table 2, the calling number, the called number, the route and so on, the dynamic information contains the call holding time, the answering time and so on. These static information and dynamic information related to the call will be sent to the central memory 205 of the gateway office 103 after the call is finished.

**[0038]** After the call is released, namely the call is finished, the central memory 205 of the gateway office 103 receives these contents related to said revenue class index $R_j$, and based on these contents, adds the increment values of every counter of the revenue class memory $M_j$ (j=1, 2...n), which is related to said revenue class index $R_j$, to the corresponding counter. For example, in this call there are several counters in the revenue class memory M1 corresponding to the revenue class index R1 of the central memory 205, such as a total-number-of-calls counter□total-length-of-calls counter, etc, which respectively accumulate the total number of calls and the total length of calls, based on this call. This revenue class memory $M_j$ (j=1, 2...n) is set according to users' needs during the gateway office initializing procedure.

**[0039]** Because of the importance of the resource, multiple safety mechanisms are performed in the present invention, which including: The central memory 205 introduces a windowing mechanism during the receiving procedure. The accumulation of each counter has a hot backup, as shown in Fig.3, the central memory 205 is comprised of primary central storage region 301, hot backup central storage region 302, primary hard disk 305 and standby hard disk 307, the primary central storage region 301 and the hot backup central storage region 302 stores at the same time, as arrow 303 shows, one-region working task can be performed under certain circumstances. However, synchronous working starts as soon as the two-region working task takes over.Each counter backups its information to a pair of hard disks with specific intervals, namely to the primary hard disk 305 and the standby hard disk 306, the backuping task is executed by the primary central storage region 301, as arrow 304 shows. Since these safety mechanisms are existing technology, just a simply introduction is provided.

**[0040]** The central memory 205 sends the information of said revenue class memory $M_j$ to the storage medium 207, which stores the information with reference to a predefined formatted scheme and sends the information to the billing center 208 for revenue sorting the same way as other bill documents. The central memory 205 also can send the information of said revenue class memory $M_j$ to the display terminal 206. For example, display contents of each counter of the revenue class memory $M_j$ through display terminal 206, then the network resource occupation situation of each

proprietor can be observed directly and instantly, which realizes flexible online operation. The revenue sorting here means arranging the billing data (such as the detailed billing phone list, the double counting jump table file, all said revenue class indices) generated in the gateway office in a document, sending the entire document to the billing center 208, where the document will be operated according to the predefined procedure and reorganized into a list of each revenue class and the corresponding total number of calls, total length of calls.

**[0041]** The predefined format can be a general style, as shown in table 3, the first part is a file header, such as information indicating the revenue dividing category, information on the file generation time, information labeling the local gateway office, etc. The following is a revenue class index sequence, the last part is a file trailer, such as an end-of-file indicator; The format can also be a customized style according to the user's need, as shown in table 4, the first part is a file header, such as information indicating the revenue dividing category, information on the file generation time, information labeling the local gateway office, etc, the following is a each revenue class index arranged in an order of the relay group and the bear type, the last part is a file trailer, such as an end-of-file indicator.

Table.3

<table>
<tr><td colspan="2">File header (such as: such as information indicating the revenue dividing category, information on the file generation time, information labeling the local gateway office, etc)</td></tr>
<tr><td rowspan="4">Arranging each revenue class index in order</td><td>Revenue class index sequence number 1</td></tr>
<tr><td>Total number of calls</td></tr>
<tr><td>Total length of calls</td></tr>
<tr><td>Total number of pulses</td></tr>
<tr><td>...</td><td>...</td></tr>
<tr><td colspan="2">File trailer (such as end-of-file indicator)</td></tr>
</table>

Table.4

<table>
<tr><td colspan="2">File header (such as: such as information indicating the revenue dividing category, information on the file generation time, information labeling the local gateway office, etc)</td></tr>
<tr><td rowspan="4">Arranging each revenue class index in an order of the relay group and the bear type</td><td>Revenue class index sequence number (1, 2, 3)</td></tr>
<tr><td>Corresponding relay group name</td></tr>
<tr><td>Corresponding bear type</td></tr>
<tr><td>Total number of calls</td></tr>
<tr><td rowspan="2"></td><td>Total length of calls</td></tr>
<tr><td>Total number of pulses</td></tr>
<tr><td>...</td><td>...</td></tr>
<tr><td colspan="2">File trailer (such as end-of-file indicator)</td></tr>
</table>

**[0042]** Therefore, the output format adopted in this invention greatly meets the users' demand, and makes it very convenient for the users to introduce this new function. Moreover, the output format can be customized to meet the needs of various high-end users. The output format provides more options, such as bureau name, file generation time, relay group name and other specific information, making it more supportive to on-line transmission.

**[0043]** More detailed steps corresponding to the embodiment of this invention are as follows:

a) When a call goes through the gateway office, the gateway office gets a source of a calling user and a destination of a called user respectively from different proprietors, and extracts a source parameter and a destination parameter from the source and the destination;

b) The gateway office judges values of the source parameter and the destination parameter as said in step a), and if there is one of values of the parameters corresponding to a parameter value for stopping a function on the division of revenue, the division of revenue function is stopped, otherwise, a corresponding revenue zone index is obtained according to said source parameter and destination parameter and step c) is executed;

c) The gateway office judges a value of the revenue zone index as said in step b), if it corresponds to the parameter value for stopping the division of revenue function, the revenue division function is stopped, otherwise, said revenue

area index is modulated according to said call, a corresponding revenue class index $R_j$, j=1, 2...n is obtained, and step d) is executed;

d) The gateway office generates contents related to the revenue class index $R_j$ as said in step c), and sends the contents to a central memory of the gateway office after said calling is finished;

e) The central memory of the gateway office receives the contents related to said revenue class index $R_j$ as said in step d), and based on these contents, adds an increment of each counter in revenue class memory $M_j$ (j=1,2... n) related to the revenue class index $R_j$ to the corresponding counter and performs multiple safety mechanisms;

f) The central memory sends information in the revenue class memory $M_j$ obtained in step e) to a storage medium. The storage medium stores the information with a predefined formatted scheme and sends the information to a billing center for sorting the revenue

**[0044]** As to a medium-sized gateway office (10 hours when busy, 100CAPS bill list), the data volume ratio of detail billing in existing technology to the division of revenue in the present invention is over 100:1.

**[0045]** The present invention also greatly reduces the massive dump of the exchanger, the mass data processing of the sorting center and the mass data storage and transmission, saving various resources.

**[0046]** The division of revenue of this invention is a kind of billing method based on group pairs, making it more adaptive for gateway offices to divide telecommunication revenue. Moreover, the division of revenue method present in this invention is not only based on relays, but it can also be realized by other billing units, comparing to the exiting technology whose billing unit is simply based on relays.

**[0047]** It should be understood that the said embodiment has been presented by way of example only, and not limitation. Thus, all modifications that fall within the scope of this invention are intended to be included therein.

## Claims

1. A method for division of revenue of communication among different proprietors, wherein the division of revenue among the different proprietors is performed by a gateway office, the method comprising that:

   a) When a call goes through the gateway office, the gateway office gets a source of a calling user and a destination of a called user respectively from different proprietors, and extracts a source parameter and a destination parameter from the source and the destination;

   b) The gateway office judges values of the source parameter and the destination parameter as said in step a), and if there is one of values of the parameters corresponding to a parameter value for stopping a function on the division of revenue, the division of revenue function is stopped, otherwise, a corresponding revenue zone index is obtained according to said source parameter and destination parameter and step c) is executed;

   c) The gateway office judges a value of the revenue zone index as said in step b), if it corresponds to the parameter value for stopping the division of revenue function, the revenue division function is stopped, otherwise, said revenue area index is modulated according to said call, a corresponding revenue class index $R_j$, j=1, 2...n is obtained, and step d) is executed;

   d) The gateway office generates contents related to the revenue class index $R_j$ as said in step c), and sends the contents to a central memory of the gateway office after said calling is finished;

   e) The central memory of the gateway office receives the contents related to said revenue class index $R_j$ as said in step d), and based on these contents, adds an increment of each counter in revenue class memory $M_j$ (j=1,2...n) related to the revenue class index $R_j$ to the corresponding counter and performs multiple safety mechanisms;

   f) The central memory sends information in the revenue class memory $M_j$ obtained in step e) to a storage medium. The storage medium stores the information with a predefined formatted scheme and sends the information to a billing center for sorting the revenue.

2. The method according to claim 1, wherein in said step c), said revenue zone index is modulated by a modulation parameter or several modulation parameters, and the obtained revenue class index varies with different modulation parameters which include type of call, bear capacity, high level carrying(HLC), analog or ISDN user.

3. The method according to claim 1, wherein in said step d), said contents related to the revenue class index $R_j$ as said in step c) include static and dynamic information on the call as said in step a);

   In said step e), the revenue class memory $M_j$ (j=1, 2...n) is set according to user's needs during initialization in the gateway office;

   In said step f), the central memory sends the information in the revenue class memory $M_j$ as said in step e)

to a display terminal.

4. The method according to claim 1, wherein in said step e) the multiple safety mechanisms include:

The central memory introducing a windowing mechanism during a receiving procedure;
The accumulation of each counter having a hot backup;
Each counter backups its information to a pair of hard disks with specific intervals.

5. The method according to claim 1, wherein in said step f), the predefined formatted scheme is either a general scheme or a scheme customized according to user's needs.

6. An apparatus for division of revenue of communication among different proprietors, wherein the division of revenue among the different proprietors is performed by a gateway office, the apparatus comprising a source and destination device located in the gateway office, and further a trigger device, a modulation device, an information generation device, a central memory and a storage medium which are all located in the gateway office, wherein:

When a call goes through the gateway office, the source and destination device located in the gateway office respectively extracts a source parameter and a destination parameter according to a source of calling user and a destination of called user;
The trigger device judges values of the source parameter and the destination parameter, and if there is one of the values of the parameters corresponding to a parameter value for stopping a function on the division of revenue ,the revenue division is stopped, otherwise, a corresponding revenue zone index is obtained according to said source parameter and destination parameter, and then judges a value of said revenue zone index, if it corresponds to the parameter value for stopping the revenue division function, the revenue division function is stopped, otherwise, said revenue zone index is sent to the modulation device;
The modulation device, according to said call, modulates said revenue area index from the trigger device, and obtains the corresponding revenue class index $R_j$, j=1, 2...n;
The information generation device, according to said revenue class index $R_j$, j=1, 2...n, generates contents related to said revenue class index $R_j$, and sends them to the central memory after said call is finished;
The central memory receives the contents related to said revenue class index $R_j$, and based on these contents, adds an increment of each counter in revenue class memory $M_j$ (j=1,2...n) related to the revenue class index $R_j$ to the corresponding counter, and performs multiple safety mechanisms, and then sends information in said revenue class memory $M_j$ to the storage medium;
The storage medium stores the information in said revenue class memory $M_j$ with a predefined formatted scheme and sends the information to a billing center for sorting the revenue.

7. The apparatus according to claim 6, wherein said revenue zone index is modulated in the modulation device by a modulation parameter or several modulation parameters, and the obtained revenue class index varies with different modulation parameters which include type of call, bear capacity, high level carrying(HLC), analog or ISDN user.

8. The apparatus according to claim 6, wherein:

Said contents related to the revenue class index $R_j$ include static and dynamic information on the said call;
Said revenue class memory $M_j$ (j=1, 2...n) is set according to user's needs during initialization in the gateway office;
Said apparatus also includes a display terminal, which is used to display the information in said revenue class memory $M_j$.

9. The apparatus according to claim 6, wherein said multiple safety mechanisms include:

The central memory introducing a windowing mechanism during a receiving procedure;
The accumulation of each counter having a hot backup;
Each counter backups its information to a pair of hard disks with specific intervals.

10. The apparatus according to claim 6, wherein the predefined formatted scheme is either a general scheme or a customized scheme according to user's needs.

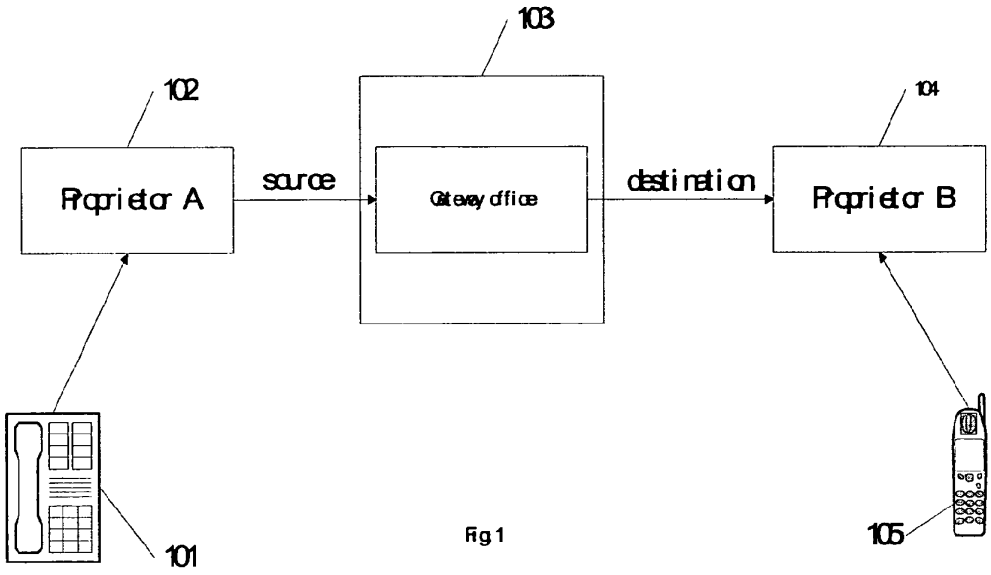

103
102
104
Proprietor A
source
Gateway office
destination
Proprietor B
101
105

Fig 1

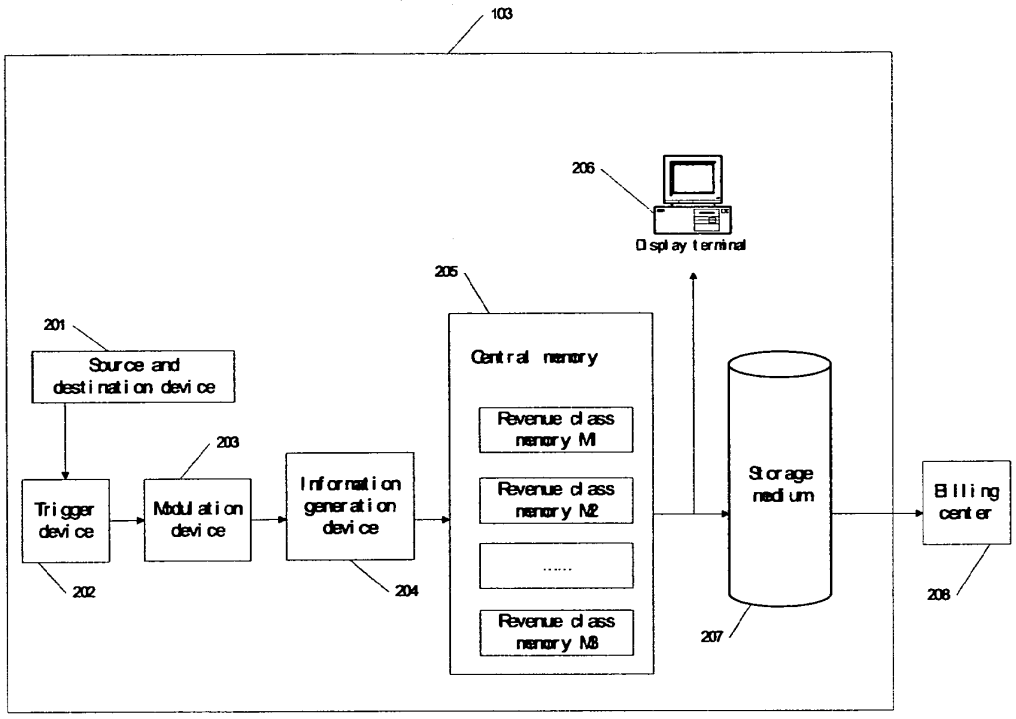

103
206
Display terminal
205
201
Source and destination device
Central memory
Revenue class memory M1
203
Trigger device
Modulation device
Information generation device
Revenue class memory M2
.....
Revenue class memory M3
Storage medium
Billing center
202
204
207
208

Fig. 2

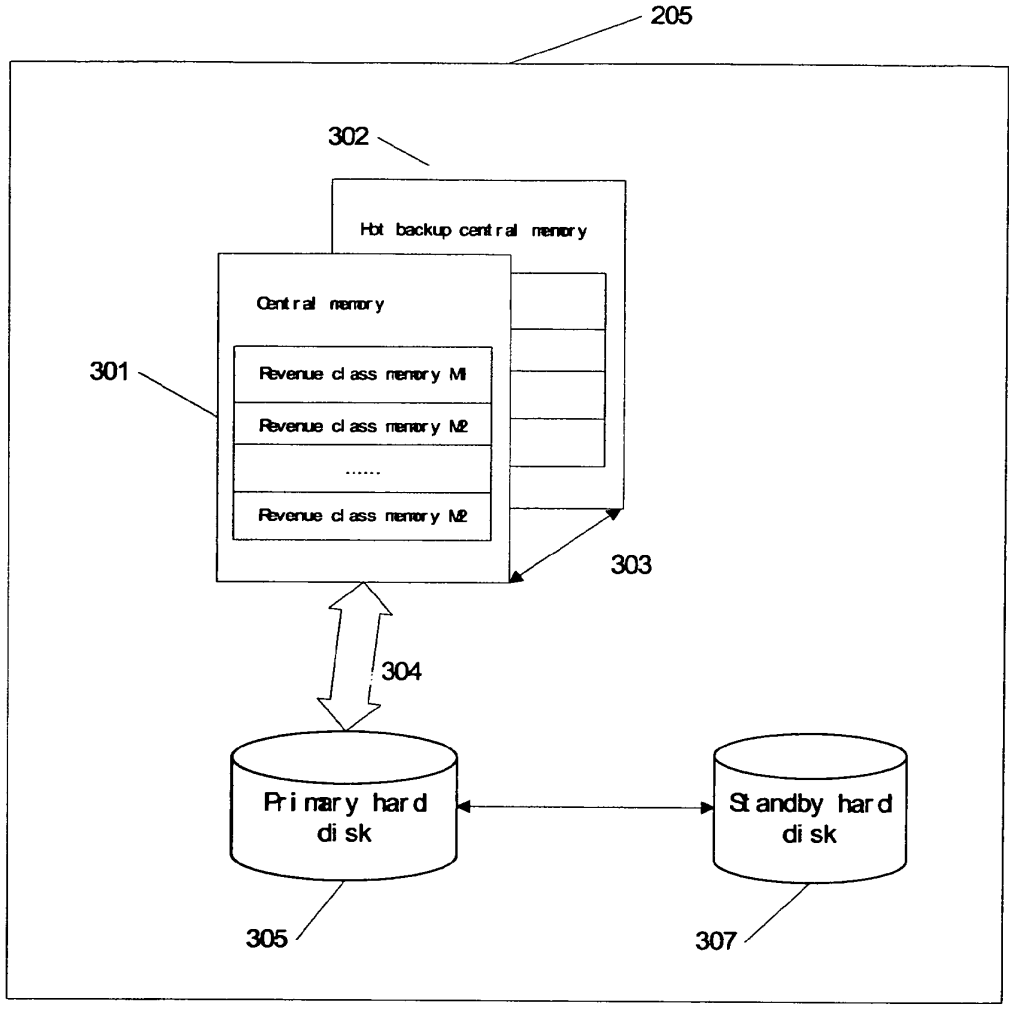

205
302
Hot backup central memory
Central memory
301
Revenue class memory M1
Revenue class memory M2
.....
Revenue class memory M2
303
304
Primary hard disk
Standby hard disk
305
307

Fig. 3

European Patent Office

# EUROPEAN SEARCH REPORT

Application Number
EP 04 02 7514

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The present search report has been drawn up for all claims

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| The Hague | 19 April 2005 | Patlaka, E. |

CATEGORY OF CITED DOCUMENTS

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L : document cited for other reasons

& : member of the same patent family, corresponding document

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European Patent Office

# EUROPEAN SEARCH REPORT

Application Number
EP 04 02 7514

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***H04L 12/14*** *(2006.01)*

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**PCT/CN2006/001156**

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(74) Representative: **Pfenning, Meinig & Partner GbR**
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**80339 München (DE)**

(54) **A METHOD AND SYSTEM FOR CONTENT CHARGING**

(57) A method for content charging includes: the portal server transmits the service activation request to the policy server based on the request for user using the service; the policy server determines the service policy corresponding to the service request after responding to the service activation request and distributes the service policy activation message to the content control gateway; the content control gateway performs the service policy and reports the user service usage message to the policy server; the policy server performs the charging according to the user service usage message. The solution provided by the present invention can realize the exact and low-cost charging for the content service and meet the requirement of QoS dynamic adjustment of the content service.

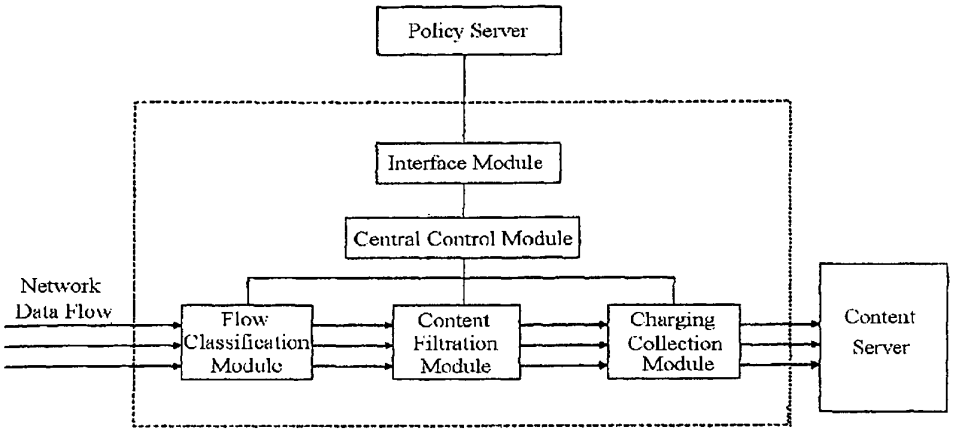



Fig.3

EP 1 887 732 A1

Printed by Jouve, 75001 PARIS (FR)

## Description

### Field of the Invention

**[0001]** The present invention relates to the technical field of network communications, in particular, to a method and a system for content charging.

### Background of the Invention

**[0002]** With the rapid development of the Internet, content services become more and more abundant. Correspondingly, Internet Content Providers (ICPs) for getting profit by providing contents come on the scene. By cooperating with the ICP, service providers may increase the income of the access service by expanding the scale of network userson one hand, and earn the profit sharing of content income of the ICP on the other hand. At the same time, the ICP may obtain a low-cost channel for selling its content service rapidly.

**[0003]** The content platform of the service provider is developed on such background. The general mode of the content platform is as follows: The service provider provides a technical platform, and the ICP issues its content service via this platform. The service provider performs advertising, authentication, charging for the use of the content service via the platform. The user uses the content service provided by each ICP via the platform. The content platform records various fees caused by the user, and all of the fees will be recorded on a content account provided to the user by the service provider. With this content platform, the user does not need to settle accounts with each ICP; instead, the user only needs to settle accounts with the service provider.

**[0004]** The existing content charging solution for this content platform is usually implemented as follows:

**[0005]** A user connects to the network, logs in a portal website Portal Server, and connects to a Content Server of an ICP via a content channel. If the user is interested in a content provided by the ICP, then he/she clicks the button "OK", and the ICP Content Server will send an authentication request to the content platform of the service provider. If the authentication is passed, the right to use the content is assigned to the user and a charging start message is sent to the content platform.

**[0006]** To ensure the accuracy of the charging, the Content Server of the ICP sends an intermediate charging message to the content platform at a certain time interval during the usage of the content. When the user logs out the Content Server, the Content Server of the ICP sends a charging completion message to the content platform.

**[0007]** The content platform processes the charging message in real time, and performs rating and accounting on the content consumption of the user according to the information in the charging message such as service number, time length traffic flow, etc., together with the charging policy of the service.

**[0008]** In the prior art, strict requirements are laid on the interconnection technology between the content platform and the ICP. The ICP has to carry out customized development according to the content platform authentication and charging interface provided by the service provider, and joint debugging and testing should be performed after the development. Services may only be formally issued after the testing is passed. Thus, the cost is very high.

**[0009]** Some small-scale ICPs are weak in technical strength and they are not able to carry out customized development according to the charging interface. Some other ICPs purchase their service contents, such as multiplayer-fighting games, from other software company, so they have no source code for interface development, and are not able to implement content charging for such services.

**[0010]** Quality of Service (QoS) is required for some content services. For example, Video On Demand (VOD) service requires a broad bandwidth. However, in the mode aforementioned, the bandwidth may not be dynamically adjusted according to the service, and it is disadvantageous for operation and management.

**[0011]** In the actual operation of the ICP, it is difficult for the service provider to control the correctness of the service number, traffic flow and time length in the charging message, thus accurate charging may not be performed.

### Summary of the Invention

**[0012]** The present invention provides a method and a system for implementing content charging at low cost, so that the service charging may be more accurate and reasonable, and the bandwidth may be adjusted dynamically according to the service.

**[0013]** The present invention provides a method for content charging, including:

**[0014]** sending, by a Portal Server, a service activation request to a Policy Server, based on a service request from a user;

**[0015]** responding to the service activation request, determining a service policy corresponding to the service request, and delivering a service policy activation message to a content control gateway, by the Policy Server;

**[0016]** executing the service policy and reporting user service consumption information to the Policy Server by the content control gateway; and permitting the user to use the service, and charging according to the user service consumption information reported by the content control gateway, by the Policy Server.

**[0017]** The method further includes:

**[0018]** sending, by the Portal Server, a service deactivation request to the Policy Server, when a request for stopping the service from the user is received; and

**[0019]** responding to the service deactivation request, delivering a service policy cancellation message, performing rating and accounting according to the consump-

tion information, by the Policy Server.

**[0020]** The content control gateway reports the user service consumption information to the Policy Server periodically during the service;

**[0021]** The Policy Server performs rating according to the user service consumption information, and settles accounts on the service consumption of the user according to each rating information after the user stops using the service.

**[0022]** After responding to the service activation request, the Policy Server queries a preset correlation table between the service and the service policy according to the service activation request, determines the service policy corresponding to the service, and extracts the parameters needed for executing the service policy, then fills the parameters in the service policy activation message and delivers the service policy activation message to the content control gateway.

**[0023]** Wherein, the service policy message includes the information of the source IP address, destination IP address, destination port, destination service resource and traffic flow information of the network packet.

**[0024]** The content control gateway grants the right to the source IP address of the user network packet to access the destination IP address, destination port and destination service resource, and controls the network flow according to the traffic flow information in the policy message.

**[0025]** The content control gateway distinguishes between the content data flows according to the Content Server or the service port of the content, controls the content data flow and collects the consumption information.

**[0026]** In another aspect of the invention, there is provided a system for content charging, which includes a Portal Server and a Content Server, wherein

**[0027]** the system further includes a Policy Server and a content control gateway, the Policy Server is connected with the Portal Server and the content control gateway and is adapted to deliver a service policy activation message and a service policy cancellation message, perform rating and charging according to user service consumption information reported by the content control gateway;

**[0028]** the content control gateway is connected with the Content Server and is adapted to control access to the Content Server of the user according to the access right, count the service consumption information and report the user service consumption information to the Policy Server for charging.

**[0029]** The Policy Server includes a central control module, a charging engine module, a portal interface module and a device interface module.

**[0030]** The central control module is connected with the charging engine module, portal interface module and device interface module, and is adapted to respond to a service activation request sent by the portal interface module, convert the service activation request into a service policy message corresponding to the service, deliver a service policy activation message via the device interface module, receive user service consumption information reported by the device interface module, and invoke the charging engine module for rating.

**[0031]** The portal interface module is adapted to receive a service request from the user, send a service activation request or a service deactivation request to the central control module, and return the execution result of the service request.

**[0032]** The device interface module is adapted to forward the policy information delivered by the central control module, and report policy execution information and service consumption information to the central control module.

**[0033]** The charging engine module is adapted to receive an invoking instruction from the central control module and perform rating and charging according to the user service consumption information.

**[0034]** The content control gateway includes a central control module, a flow classification module, a content filtration module, a charging collection module and an interface module.

**[0035]** The central control module is adapted to receive a policy sent by the Policy Server, and interact with the flow classification module, content filtration module and charging collection module for interpreting and executing the policy.

**[0036]** The flow classification module is adapted to check, classify, control a source IP address, a destination IP address and destination port information of a network packet on the IP layer, and permit a network flow that conforms to the policy to pass.

**[0037]** The content filtration module is adapted to check, classify, control resources to be accessed by the network packet on the application layer, and permit the network flow that conforms to the policy to pass.

**[0038]** The charging collection module is adapted to collect the time length and the traffic flow information of the network flow, and report the original charging data to the central control module.

**[0039]** The interface module is adapted to provide an interface between the central control module and the Policy Server.

**[0040]** In still another aspect of the invention, there is provided a Policy Server for implementing content charging, which includes a central control module, a charging engine module, a portal interface module and a device interface module.

**[0041]** The central control module is connected with the charging engine module, portal interface module and device interface module, and is adapted to receive a service activation request sent by the portal interface module, convert the service activation request into a service policy message corresponding to the service, deliver the service policy activation message via the device interface, receive user service consumption information reported by the device interface module, and invoke the charging engine module for rating.

**[0042]** The portal interface module is adapted to receive a service request from the user, send a service activation request or a service deactivation request to the central control module, and return the execution result of the service request.

**[0043]** The device interface module is adapted to forward the policy information delivered by the central control module, and report policy execution information and service consumption information to the central control module.

**[0044]** The charging engine module is adapted to receive an invoking instruction from the central control module and perform rating and charging according to the user service consumption information.

**[0045]** The server further includes a database interface and a memory database, Through the database interface, an external database and the memory database may be accessed. The memory database is adapted to store policy data, charging data, configuration data and user session data, and receive an instruction from the central control module for updating the data.

**[0046]** The invention further provides a content control gateway for implementing the charging method according to claim 1, which includes a central control module, a flow classification module, a content filtration module, a charging collection module and an interface module.

**[0047]** The central control module is adapted to receive a policy sent by the Policy Server, and interact with the flow classification module, content filtration module and charging collection module for interpreting and executing the policy.

**[0048]** The flow classification module is adapted to check, classify and control a source IP address, a destination IP address and destination port information of a network packet on the IP layer, and only permit a network flow that conforms to the policy to pass.

**[0049]** The content filtration module is adapted to check, classify and control resources to be accessed by the network packet on the application layer, and only permit the network flow that conforms to the policy to pass.

**[0050]** The charging collection module is adapted to collect the time length and the traffic flow information of the network flow, and report the original charging data to the central control module.

**[0051]** The interface module is adapted to provide an interface between the central control module and the Policy Server.

**[0052]** In summary, in the method and system for content charging according to the embodiments of the invention, by determining the service policy corresponding to the service information and executing the service policy, the user is controlled to use the service, the content data flows are distinguished according to the Content Server or the service port of the content, and the content data flow is controlled and the consumption information is collected. So that charging may be performed according to the user service consumption information reported. As a result, the interconnection difficulty and interconnection cost between the ICP Content Server and the content platform of the service provider may be lowered greatly, and a non-coding interconnection operation solution may be provided. Thus, the service provider may rapidly dispose a content service, the ICP may be effectively prevented from falsifying data, and accurate charging data may be provided. At the same time, the corresponding network QoS may be ensured according to the requirements of a certain content service, thus an overall QoS may be provided, and the market competitive power may be improved.

## Brief Description of the Drawings

**[0053]** Figure 1 is a schematic diagram showing an exemplary system structure according to an embodiment of the invention;

**[0054]** Figure 2 is a schematic diagram showing the structure of the Policy Server according to an embodiment of the invention;

**[0055]** Figure 3 is a schematic diagram showing the structure of the content control gateway according to an embodiment of the invention; and

**[0056]** Figure 4 is a flow chart of the method according to an embodiment of the invention.

## Detailed Description of the Embodiments

**[0057]** To make the principle, characteristics and advantages of the invention clearer, the invention will now be described in detail hereinafter in conjunction with the embodiments and the drawings of the invention.

**[0058]** As shown in Figure 1, the system for content charging according to an embodiment of the invention includes a Portal Server, a Policy Server, a Content Control Gateway (CCG) and a Content Server. Wherein, the Policy Server is connected with the Portal Server and the content control gateway, for delivering or canceling a service policy message, and performing rating and charging according to the service usage information reported by the CCG, such as traffic flow and time length. The CCG is connected with the Content Server, for controlling the access to the Content Server of the user, counting the service consumption information, and periodically reporting the related data to the Policy Server for charging. The Portal Server provides a portal for user access, and provides the user with functions such as login, service channel, service selection, self-help service. The Content Server is a server through which the ICP provides contents. There may be a plurality of Content Servers connected with a CCG, and various contents may also be issued on a Content Server. The servers on which the contents exist may be different, and the service ports of the contents, i.e. Transmission Control Protocol/User Data Protocol (TCP/UDP) ports may be different. The CCG distinguishes between the content data flows according to the server on which the contents exist or the service port of the content, and controls the content

data flows and collects data respectively for executing the policy.

**[0059]** The service policy message may be regarded as an indication message for the service data flow rules, which comprises parameters such as the source IP address, destination IP address, destination port, service resource information and traffic flow information of a network packet. For example, when a Content Server provides a game service, if a user wants to access the game server, the content of the corresponding service policy message may include the following information: the source IP address (which may be the IP address of the user), the IP address of the game server, the port of the game server (which may refer to the TCP/UDP port), the upstream bandwidth, the downstream bandwidth, the Universal Resource Locator (URL), etc. Thus, if the Policy Server delivers the policy and notifies the CCG, the CCG grants the user the right to access the game server after applying the policy. If the Policy Server instructs the CCG to remove the policy, the current user will lose the right to access the game server.

**[0060]** If the user wants to access a streaming server, the content of the corresponding service policy message may include the following information: the source IP address, the IP address of the streaming server, the port of the streaming server, the upstream bandwidth, the downstream bandwidth and the URL. The Policy Server delivers a policy and notifies the CCG, and the CCG grants the user the right to access the streaming server after applying the policy and reserves a designated bandwidth for the video/audio stream. If the Policy Server instructs the CCG to remove the policy, then the current user will lose the right to access the streaming server.

**[0061]** Similarly, if the user wants to access a download server, the content of the corresponding service policy message may include the following information: the source IP address, the IP address of the download server, the port of the download server, the upstream bandwidth, the downstream bandwidth, and the path of the download file. The Policy Server delivers a policy and notifies the CCG, and the CCG grants the user the right to access the download server after applying the policy and reserves a designated download bandwidth. If the Policy Server instructs the CCG to delete the policy, then the current user will lose the right to access the download server.

**[0062]** Each service and its corresponding service policy are stored in the form of a correlation table between the service and the service policy.

**[0063]** The internal structure of the Policy Server is as shown in Figure 2, which may include a central control module, a charging engine, a portal interface module, a device interface module, a database interface module and a local memory database (Built-in-Memory).

**[0064]** The central control module is the core module of the Policy Server, and is mainly responsible for scheduling and controlling other modules in the system. The central control module receives a service activation request sent from the portal interface module, converts it into a service policy message corresponding to the service, and sends the service policy message to the CCG via the device interface. If the policy is executed successfully, the CCG will periodically report the user service consumption information (mainly including time length and traffic flow information), and the central control module invokes the charging engine module for performing rating after receiving the original charging information from the device interface module.

**[0065]** The portal interface is responsible for interconnecting with the Portal Server, sending the service activation request or the service deactivation request to the central control module, and returning the service request execution result to the Portal Server.

**[0066]** The device interface module is responsible for interconnecting with the CCG, forwarding the policy information delivered by the central control module to the CCG, and reporting the policy execution information and service usage information to the central control module.

**[0067]** The charging engine is the charging component of the Policy Server. The central control module invokes the charging engine for performing rating and accounting according to the user service consumption record.

**[0068]** The database interface enables other subsystems to access the database and the memory database.

**[0069]** The memory database is an optional component, which may be regarded as a buffer for the external database. The memory database is mainly adapted to store policy data, charging data, configuration data and user session data. By using the memory database, the performance of the system may be improved greatly. The central control module periodically sends an instruction to the memory database for reading the policy data, charging data, configuration data from the external database and refreshing the local memory data.

**[0070]** The CCG is adapted to control the access to the Content Server of the user, count the service consumption information, and periodically report related data to the Policy Server for performing charging. As shown in Figure 3, the internal structure of the CCG includes a central control module, a flow classification module, a content filtration module, a charging collection module and an interface module.

**[0071]** The central control module is responsible for receiving the policy sent from the Policy Server and interpreting and executing the policy. During the execution of the policy, the central control module needs to interact with and control the flow classification module, the content filtration module and the charging collection module.

**[0072]** The flow classification module checks, classifies and controls the information such as the source IP, the destination IP, the destination port of the network packet, on the IP layer. The network flow that conforms to the policy may pass.

**[0073]** The content filtration module checks, classifies and controls the resources to be accessed by the network packet, such as the URL address applied by the HTTP,

the file path applied by the FTP (File Transfer Protocol) and the RTICP (Real-Time Streaming Protocol) path applied by the stream media, on the application layer. The network flow that conforms to the policy may pass.

**[0074]** The charging collection module collects the time length and the traffic flow information of the network flow, and reports the original charging data to the central control module. The central control module reports the original charging data to the Policy Server.

**[0075]** In the method according to an embodiment of the invention, Portal Server receives a service request from a user, and sends a service activation request to Policy Server. The Policy Server determines the corresponding service policy message according to the service after receiving the service activation request, and delivers the service policy message to CCG. The CCG executes the policy message, permits the user to use the service, and periodically reports the user service consumption information to the Policy Server. The Policy Server performs rating and charging according to the consumption information.

**[0076]** Specifically, as shown in Figure 4, the method includes following steps.

**[0077]** (1) A user sends a login request to the Portal Server, and the Portal Server authenticates the identity of the user.

**[0078]** (2) If the authentication is passed, the Portal Server receives the service selection data input by the user.

**[0079]** (3) The Portal Server sends a service activation request, which carries information such as the user IP, destination IP, service resources, to the Policy Server.

**[0080]** (4) The Policy Server determines the corresponding service policy message according to the service after receiving the service activation request, and delivers the service policy message to the CCG. Each service and its corresponding service policy are stored in the form of a correlation table between the service and the service policy. This table may be stored on the Policy Server or on a third party device. The Policy Server determines the policy corresponding to the service by querying the correlation table according to the activation request, extracts the parameters needed by the policy according to the activation request and the service policy, fills the parameters in the policy message and delivers the policy message. For example, for a game service, the content of the corresponding service policy message may include the following information: the source IP address (which may be the IP address of the user), the IP address of the game server, the port of the game server (which may refer to the TCP/UDP port), the upstream bandwidth, the downstream bandwidth and the URL.

**[0081]** (5) The CCG receives the service policy message, executes the service policy according to the instruction of the message, releases the access right from the user IP (which may be a source IP) to the destination IP, destination port or destination URL, and controls the network flow according to the bandwidth parameters in the policy. The CCG sends the policy execution result to the Policy Server after executing the policy.

**[0082]** (6) The Policy server informs the Portal Server of the service activation result.

**[0083]** (7) The Portal Server displays the service activation result to the user.

**[0084]** (8) If the service is activated, the user starts an application client end and performs content consumption, after knowing from the Portal Server that the service is available.

**[0085]** (9) The CCG periodically reports the service consumption information to the Policy Server during the content service used by the user.

**[0086]** (10) The Policy Server processes the service consumption information reported by the CCG in real time, and performs rating for the user content consumption.

**[0087]** (11) The Portal Server receives a request for stopping the service from the user when the user wants to logout the Content Server.

**[0088]** (12) The Portal Server sends a service deactivation request to the Policy Server.

**[0089]** (13) The Policy Server delivers a policy cancellation request to the CCG.

**[0090]** (14) The CCG cancels the policy and returns the policy cancellation result to the Policy server.

**[0091]** (15) The Policy server informs the Portal Server of the service cancellation result.

**[0092]** (16) The Portal Server displays the service cancellation result to the user.

**[0093]** (17) The CCG reports the last service consumption information of the user to the Policy Server.

**[0094]** (18) The Policy Server processes the service consumption information, performs rating, and settles accounts on the current content consumption according to each rating information.

**[0095]** In another embodiment of the invention, the content control gateway does not need to periodically report the user service consumption information to the Policy Server. Instead, the content control gateway reports the total service consumption information of the user to the Policy Server at a time after receiving the policy cancellation request delivered by the Policy Server. The Policy Server performs rating and accounting according to the consumption information.

**[0096]** The invention provides a novel content charging solution, by means of which the interconnection difficulty and the interconnection cost between the ICP Content Server and the content platform of the service provider may be lowered greatly, and the ICP may be effectively prevented from falsifying data, and accurate charging data may be provided. In the meanwhile, the corresponding network QoS may be ensured according to the requirements of a certain content service.

## Claims

1. A method for content charging, comprising:

   sending, by a Portal Server, a service activation request to a Policy Server based on a service request from a user;
   responding to the service activation request, determining a service policy corresponding to the service request, and delivering a service policy activation message to a content control gateway, by the Policy Server;
   executing the service policy and reporting user service consumption information to the Policy Server by the content control gateway; and
   permitting the user to use the service, and charging according to the user service consumption information reported by the content control gateway, by the Policy Server.

2. The method according to claim 1, wherein the method further comprises:

   sending, by the Portal Server, a service deactivation request to the Policy Server, when a request for stopping the service from the user is received; and
   responding to the service deactivation request, delivering a service policy cancellation message, performing rating and accounting according to the consumption information, by the Policy Server.

3. The method according to claim 1 or 2, wherein the method further comprises:

   reporting, by the content control gateway, the user service consumption information to the Policy Server periodically during the use of the service;
   rating according to the user service consumption information, and accounting on the service consumption of the user according to each rating information after the user stops using the service, by the Policy Server.

4. The method according to claim 1, wherein the method further comprises:

   after responding to the service activation request, querying a preset correlation table between the service and the service policy according to the service activation request, determining the service policy corresponding to the service, extracting the parameters needed for executing the service policy, filling the parameters in the service policy activation message and delivering the service policy activation message to the content control gateway by the Policy Server.

5. The method according to claim 1, 2 or 4, wherein: the service policy activation message comprises the information of the source IP address, destination IP address, destination port, destination service resource and traffic flow information of the network packet.

6. The method according to claim 5, wherein the method further comprises:

   granting the source IP address of the user network packet a right to access the destination IP address, destination port and destination service resource, and controlling the network flow according to the traffic flow information in the service policy message, by the content control gateway.

7. The method according to claim 1, wherein the method further comprises:

   obtaining the content data flows according to the Content Server or the service port of the content, controlling the content data flow and collecting the consumption information, by the content control gateway.

8. A system for content charging, comprising a Portal Server and a Content Server, wherein the system further comprises a Policy Server and a content control gateway, the Policy Server is connected with the Portal Server and the content control gateway and is adapted to deliver a service policy activation message and a service policy cancellation message, perform rating and charging according to user service consumption information reported by the content control gateway;
   the content control gateway is connected with the Content Server and is adapted to control access to the Content Server of the user according to the access right, count the service consumption information and report the user service consumption information to the Policy Server for charging.

9. The system according to claim 8, wherein the Policy Server comprises a central control module, a charging engine module, a portal interface module and a device interface module, wherein:

   the central control module is connected with the charging engine module, portal interface module and device interface module, and is adapted to respond to a service activation request sent by the portal interface module, convert the service activation request into a service policy message corresponding to the service, deliver a

service policy activation message via the device interface module, receive user service consumption information reported by the device interface module, and invoke the charging engine module for rating;
the portal interface module is adapted to receive a service request from the user, send a service activation request or a service deactivation request to the central control module, and return the execution result of the service request;
the device interface module is adapted to forward the policy information delivered by the central control module, and report policy execution information and service consumption information to the central control module;
the charging engine module is adapted to receive an invoking instruction from the central control module and perform rating and charging according to the user service consumption information.

**10.** The system according to claim 8, wherein the content control gateway comprises a central control module, a flow classification module, a content filtration module, a charging collection module and an interface module, wherein:

the central control module is adapted to receive a policy sent by the Policy Server, and interact with the flow classification module, content filtration module and charging collection module for interpreting and executing the policy;
the flow classification module is adapted to check, classify, control a source IP address, a destination IP address and destination port information of a network packet on the IP layer, and permit a network flow that conforms to the policy to pass;
the content filtration module is adapted to check, classify, control resources to be accessed by the network packet on the application layer, and permit the network flow that conforms to the policy to pass;
the charging collection module is adapted to collect the time length and the traffic flow information of the network flow, and report the original charging data to the central control module;
the interface module is adapted to provide an interface between the central control module and the Policy Server.

**11.** A Policy Server, for realizing the charging method according to claim 1, wherein the Policy Server comprises a central control module, a charging engine module, a portal interface module and a device interface module, wherein:

the central control module is connected with the charging engine module, portal interface module and device interface module, and is adapted to receive a service activation request sent by the portal interface module, convert the service activation request into a service policy message corresponding to the service, deliver the service policy activation message via the device interface, receive user service consumption information reported by the device interface module, and invoke the charging engine module for rating;
the portal interface module is adapted to receive a service request from the user, send a service activation request or a service deactivation request to the central control module, and return the execution result of the service request;
the device interface module is adapted to forward the policy information delivered by the central control module, and report policy execution information and service consumption information to the central control module;
the charging engine module is adapted to receive an invoking instruction from the central control module and perform rating and charging according to the user service consumption information.

**12.** The server according to claim 11, wherein the server further comprises a database interface and a memory database, through the database interface, an external database and the memory database is accessed; the memory database is adapted to store policy data, charging data, configuration data and user session data, and receive an instruction from the central control module for updating the data.

**13.** A content control gateway, for implementing the charging method according to claim 1, comprising a central control module, a flow classification module, a content filtration module, a charging collection module and an interface module, wherein:

the central control module is adapted to receive a policy sent by the Policy Server, and interact with the flow classification module, content filtration module and charging collection module for interpreting and executing the policy;
the flow classification module is adapted to check, classify and control a source IP address, a destination IP address and destination port information of a network packet on the IP layer, and only permit a network flow that conforms to the policy to pass;
the content filtration module is adapted to check, classify and control resources to be accessed by the network packet on the application layer, and only permit the network flow that conforms to the policy to pass;

the charging collection module is adapted to collect the time length and the traffic flow information of the network flow, and report the original charging data to the central control module;
the interface module is adapted to provide an interface between the central control module and the Policy Server.

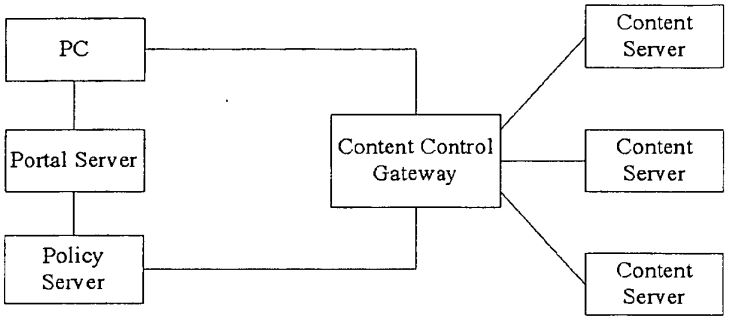

PC
Portal Server
Policy Server
Content Control Gateway
Content Server
Content Server
Content Server

Fig.1

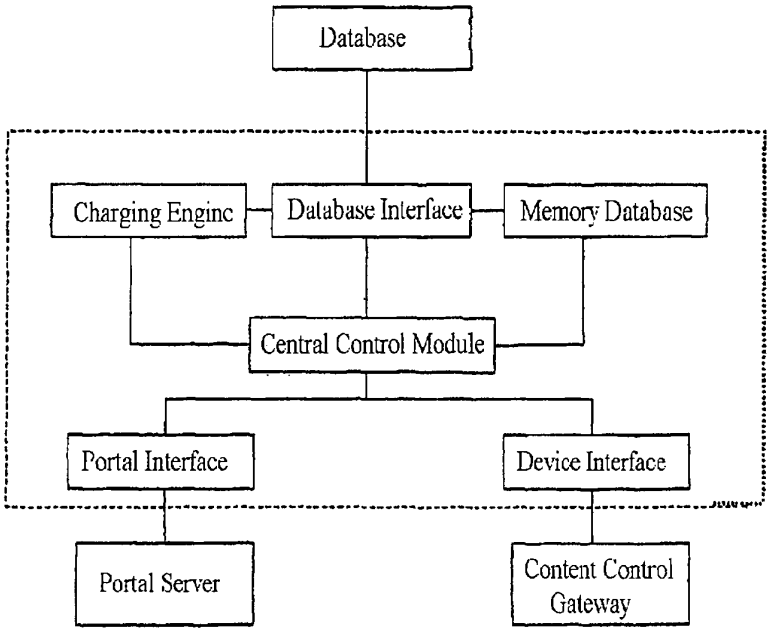

Database
Charging Engine
Database Interface
Memory Database
Central Control Module
Portal Interface
Device Interface
Portal Server
Content Control Gateway

Fig.2

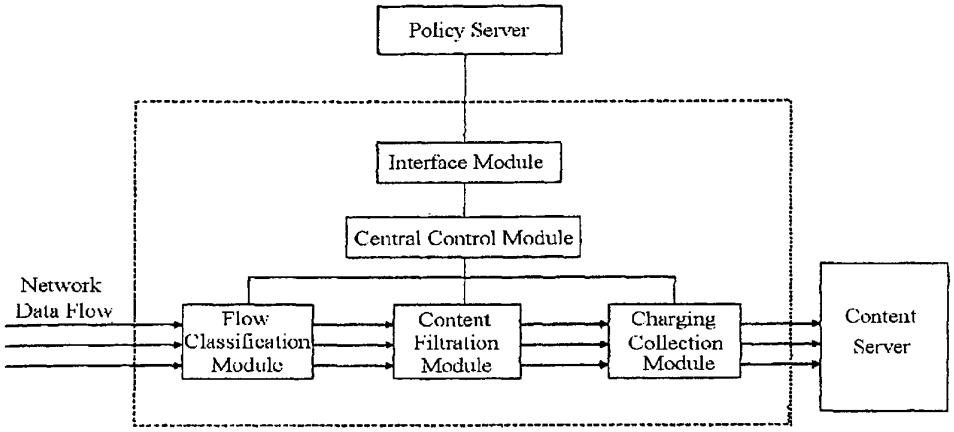

Policy Server
Interface Module
Central Control Module
Network
Data Flow
Flow
Classification
Module
Content
Filtration
Module
Charging
Collection
Module
Content
Server

Fig.3

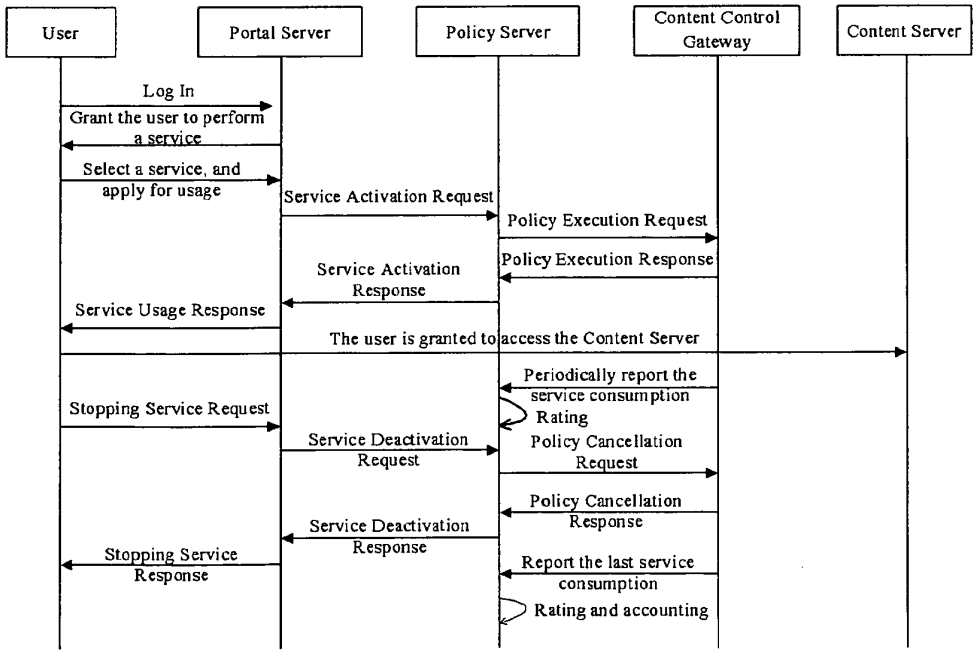

User
Portal Server
Policy Server
Content Control
Gateway
Content Server
Log In
Grant the user to perform
a service
Select a service, and
apply for usage
Service Activation Request
Policy Execution Request
Policy Execution Response
Service Activation
Response
Service Usage Response
The user is granted to access the Content Server
Periodically report the
service consumption
Rating
Stopping Service Request
Service Deactivation
Request
Policy Cancellation
Request
Policy Cancellation
Response
Service Deactivation
Response
Stopping Service
Response
Report the last service
consumption
Rating and accounting

Fig.4

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2006/001156

A. CLASSIFICATION OF SUBJECT MATTER

H04L 12/14 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04L (2006.01), G07F (2006.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNPAT, CNKI, WPI, EPODOC, PAJ: bill+, charg+, account, content, policy, strategy, request, gateway, server

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | WO, A1, 0159990 (FUTURE TECH INC) 16.AUG. 2001 (16.08.2001), the whole document. | 1-13 |
| A | EP, A1, 1400934 (OPENWAVE SYSTEMS INC) 24.MAR. 2004 (24.03.2004), the whole document. | 1-13 |
| A | CN, A, 1556634 (ZHONGXING COMMUNICATION CO LTD SHENZHEN) 22.DEC. 2004 (22.12.2004), the whole document. | 1-13 |

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"L" document which may throw doubts on priority claim (S) or which is cited to establish the publication date of another citation or other special reason (as specified)

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 29. AUG. 2006 (29. 08. 2006) | 21 · SEP 2006 (21 · 09 · 2006) |
| Name and mailing address of the ISA/CN<br>The State Intellectual Property Office, the P.R.China<br>6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China<br>100088<br>Facsimile No. 86-10-62019451 | Authorized officer<br>WANG,Hongli<br>Telephone No. (86-10) 62084525 |

Form PCT/ISA/210 (second sheet) (April 2005)

**INTERNATIONAL SEARCH REPORT**
Information on patent family members

International application No.
**PCT/CN2006/001156**

| Patent Documents referred in the Report | Publication Date | Patent Family | Publication Date |
|---|---|---|---|
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| | | KR2000024368 A | 06.05.2000 |
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| EP1400934A1 | 24.03.2004 | NONE | |
| CN1556634A | 22.12.2004 | NONE | |

Form PCT/ISA /210 (patent family annex) (April 2005)

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## (54) CHARGING ASSOCIATING METHOD, SYSTEM, CHARGING CENTER, AND DEVICE FOR APPLICATION SERVICE

(57) A method for charging correlation for an application or service is provided. The method may include: receiving a service identifier assigned for an application or service; and correlating Charging Data Records CDRs generated for the application or service based on the service identifier. A system for charging correlation, a billing center and an apparatus for charging correlation are also provided. These method and apparatus may provide a simple charging correlation process for an application or service.

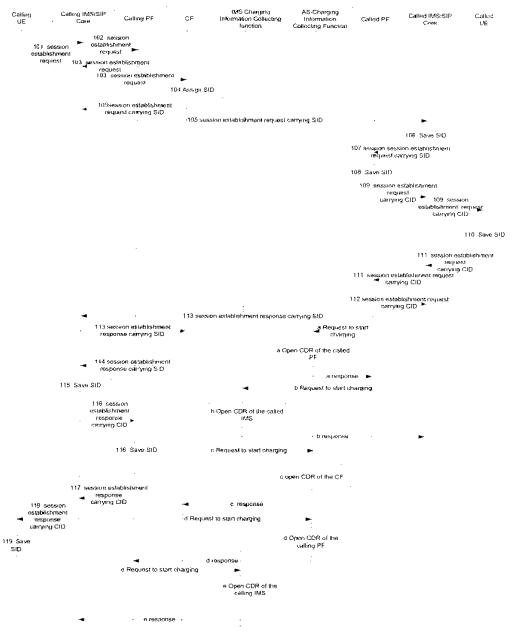


Fig. 1

EP 2 007 065 A1

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## Description

### Field of the Invention

**[0001]** The present invention relates to applications and services, and particularly, to a method and system for charging correlation of applications and services, a billing center and an apparatus for generating charging data record.

### Background of the Invention

**[0002]** At present, communication systems have provided applications and services for individual user and/or group users, and communication media employed in these applications and services may include text, audio, video, and varieties combinations of multimedia. A general application or service is mainly oriented to individuals, and there usually is only one or two User Equipments (UEs) communicating with an Application Server or with each other. However, in an application or service in which group users take part, users of one or more groups usually communicate with other users at the same time. In other words, this kind of communication is not a two-party communication including one calling user and one called user, but a communication including a plurality of calling users and a plurality of called users. Such an application or service in which group users take part is also called a multi-party service.

**[0003]** In a session-based service, a Charging Identifier (CID) is allocated each time when an Application Server (AS) establishes a session with a UE, and all CIDs allocated are saved in the AS and a service bearer network. A billing center retrieves Charging Data Records (CDRs) corresponding to the CIDs from the service bearer network and the AS via a charging function collecting entity, and combines CDRs that correspond to the same CID in order to perform a charging. For applications and services employing an IP Multi-media Subsystem (IMS) as a service bearer network, the CIDs allocated are also called IMS Charging Identifiers (ICIDs). However, the applicant finds out that the CID-based charging method described above has some disadvantages in practical applications and services.

**[0004]** For example, in a service communication, when a UE establishes a session with an AS for a first time, the UE is given a CID. For some reasons, the UE may exit the service communication temporarily before the service communication is end. Later, the UE re-enters the service communication. In such a case the UE is given a new CID for a session established after re-entering the service communication. From a perspective of a user using the UE, the two sessions, established for the first entering and established for the re-entering, respectively, are two related sessions, and need to be combined for a charging. However, from a perspective of the billing center, the two sessions correspond to different CIDs, thus the two sessions are considered as unrelated sessions. If the two sessions need to be correlated, the billing center needs to analyze CDRs of the two sessions and perform complicated calculation based on user information recorded in the CDRs, yet it is still difficult to guarantee an accurate correlation of the two sessions. Such problem becomes more apparent in multi-party services.

**[0005]** In a multi-party service, UEs used by users of various parties of this service access a center control server via respective access servers. The center control server provides centralized session handling, which includes session signaling controls, media transmission authorization to communication parties, media data duplication and distribution, etc. One multi-party service has one center control server and at least one access server. The center control server performs controlling function (CF) and the access server performs participating function (PF). Logically, a CF corresponds to a multi-party service. In a multi-party service, the CF establishes one session for each UE, and the sessions of each UE correspond to a PF. Therefore, the center control server is looked as a CF while the access server is looked as at least one PF corresponding to at least one UE connected to the access server.

**[0006]** Therefore, multi-party services have a common feature that, a multi-party service has at least one session and each session corresponds to a UE of one user and corresponds to its CID. Due to such feature of multi-party services, the billing center needs to correlate a great number of CIDs when performing charging, which leads to poor charging accuracy and difficult implementation. Moreover, for a multi-party service, there is also a need to charge a user by correlating a plurality of sessions of the user in one multi-party service. However, according to the charging technique in the prior art, the billing center needs to generate CDRs based on ICIDs first and make further calculations based on group information in the CDRs, which is still complicated and tends to be inaccurate.

**[0007]** As discussed above, CID-based charging method in the prior art cannot correlate different sessions of a user in one service communication, but only can correlate actions of the user in one session. Such charging method may easily result in a repeated charging for one action and may omit an action which needs to be charged, thereby threatening security and reliability of charging operations and reducing user satisfaction.

**[0008]** Furthermore, as new demands emerge, it is becoming more and more difficult to use a single AS to handle a plurality of applications or services. In order to provide more flexible and richer services, operators or service providers are developing multi-services which includes a plurality of sub-services. For a perspective of a multi-service, the above application or service provided by the AS can be called single-service. In a multi-service, each sub-service has a sub-service server e.g. an AS, and an entire multi-service also has a service control function adapted to perform a centralized control of all the sub-service servers. For example, the service control

function controls initiation procedures of the respective sub-services and controls assignment of session identifiers of the respective sub-services, etc. A current typical multi-service has a structure that one of the sub-services is considered as the primary service, and all other sub-services of the multi-service are considered as supplementary services. The sub-service server serves the primary service can be called a primary service server and the sub-service servers serve the supplementary services can be called supplementary service servers. The implementation of the supplementary services depends on the implementation of the primary service in certain degree and provides supplementary functions for the implementation of the primary service. For example, a Presence Server may be configured in a PoC service network and be used to display group status to users during a PoC service session. For another example, a Location Service Server (LCS Server) may also be used in a PoC service network to provide location information of participating users.

**[0009]** As the development of multi-services, operators or service providers may develop correlating charging policies for multi-services. However, as discussed above, the conventional charging method is based on CIDs corresponding to separate sessions. Therefore the billing center needs to correlate CDRs of a plurality of services in a multi-service charging to perform a charging. Because a CID corresponds to only one session of a sub-service of a user, the billing center needs to analyze each CDR and performs comprehensive calculation by using complicated processes, thereby resulting in low charging accuracy and low feasibility.

**[0010]** Therefore, the conventional CID-based charging method is only applicable to correlate a plurality of actions of a user in one session, but is not applicable to correlate a plurality of sessions of a user in a single-service and says nothing of correlating a plurality of sessions of a user in a plurality of sub-services of a multi-service.

## Summary of the Invention

**[0011]** Embodiments of a method and a system for charging correlation, a billing center and an apparatus for generating charging data record for implementing a charging correlation for an application or service are provided, which enables a charging correlation process to be easily performed and to greatly improve charging accuracy.

**[0012]** A method for charging correlation for an application or service may include:

assigning a service identifier by a service control function to an application or service;
sending the service identifier to a charging system; and
correlating, by the charging system, at least one Charging Data Record CDR generated for the application or service based on the service identifier.

**[0013]** A system for charging correlation for an application or service may include:

a service control function, adapted to assign a service identifier for an application or service; and
a charging system, adapted to correlate Data Records CDRs generated for the application or service based on the service identifier.

**[0014]** A billing center may include:

a first module, adapted to receive a service identifier assigned to an application or service and CDRs generated for the application or service; and
a second module, adapted to correlate the CDRs based on the service identifier from the first module.

**[0015]** An apparatus for generating charging data record may include:

a first module, adapted to receive a service identifier assigned to an application or service; and
a second module, adapted to generate Charging Data Records CDRs carrying the service identifier from the first module for the application or service.

**[0016]** The method for charging correlation, the system for charging correlation, the billing center and the apparatus for generating charging data record for implementing a charging correlation for an application or service provided in accordance with embodiments of the present invention are able to correlate a plurality of CDRs generated during an application or service, thereby implementing a correlated charging of a plurality of users participating in the application or service in a simple way. A plurality of CDRs generated for one user in the application or service may be correlated and the user can be accurately charged. Furthermore, correlated charging for multi-services can also be implemented. The technical solution provided in embodiments of the present invention is easy to be implemented and does not need to make many modifications to the existing networks, and therefore is highly feasible.

## Brief description of the drawings

**[0017]**

Figure 1 is a flowchart of a charging correlation process in a session establishment in accordance with an embodiment of the present invention.
Figure 2 is a flowchart of a charging correlation process in a session establishment in accordance with an embodiment of the present invention.
Figure 3 is a flowchart of a charging correlation process in a session modification in accordance with an embodiment of the present invention.
Figure 4 is a flowchart of a charging correlation proc-

ess when a new user is added in accordance with an embodiment of the present invention.

Figure 5 is a flowchart of a charging correlation process of an on-demand session in accordance with an embodiment of the present invention.

Figure 6 is a flowchart of a charging correlation process of a pre-established session in accordance with an embodiment of the present invention.

Figure 7 is a flowchart of a charging correlation process when a user who established an on-demand session re-enters the session in accordance with an embodiment of the present invention.

Figure 8 is a flowchart of a charging correlation process when a user who established a pre-established session re-enters the session in accordance with an embodiment of the present invention.

Figure 9 is a flowchart of a charging correlation process for a multi-service in accordance with an embodiment of the present invention.

Figure 10 is a flowchart of a charging correlation process for a multi-service in accordance with an embodiment of the present invention.

Figure 11 is a structure diagram of a system for implementing a charging correlation of an application or service in accordance with an embodiment of the present invention.

## Detailed Description of the Embodiments

**[0018]** This invention will hereinafter be described in detail with reference to accompanying drawings and embodiments.

**[0019]** A charging method for an application or service according to an embodiment of the present invention may include: assigning a service identifier to an application or service session, sending the service identifier to a charging system, and correlating, by the charging system, the CDRs generated in this service based on the service identifier. The charging method is described in detail in the following embodiments.

**[0020]** The charging system may include a charging information collecting function used to receive CDRs from ASs and bearer control layer entities, a charging gateway, and a billing center used to correlate the CDRs and perform other operations for charging. The charging information collecting function functions as an interface of the charging system, receives CDRs from network nodes e.g., ASs or bearer control layer entities connected to the charging information collecting function, and sends the CDRs to the billing center via the charging gateway. ASs and the bearer control layer entities have respective charging information collecting functions. A charging information collecting function corresponding to ASs is usually called an AS-charging information collecting function and a charging information collecting function corresponding to bearer control layer entities is usually called a bearer control layer-charging information collecting function. For bearer control layer in an IMS network, the bearer control layer-charging information collecting function is also called an IMS charging information collecting function. Embodiments of the present invention mainly concerns about transmission of service identifiers among ASs, bearer control layer entities and charging information collecting functions, therefore the figures and illustrations of the embodiments of the present invention omit the processes that the charging information collecting functions send CDRs and service identifiers to the billing center. In the figures and illustrations of the embodiments of the present invention, the AS-charging information collecting function entities and IMS charging information collecting function entities are referred to as AS-charging information collecting functions and IMS charging information collecting functions.

**[0021]** A first charging correlation scheme given in an embodiment of the present invention implements charging with a plurality of CDRs generated for one user in a single-service. In this embodiment, a service control function, e.g. an AS of a single-service session, assigns a uniform service identifier for the single-service, generates CDRs of participating users and sends the service identifier and the CDRs to a charging system. The charging system correlates the CDRs of a user in this single-service session.

**[0022]** In practical applications, a user may establish one or a plurality of sessions in one service and a CDR corresponds to one session of the user. Different ways may be adapted to correlate CDRs based on the service identifier. The CDRs to be correlated may be CDRs corresponding to a plurality of sessions established for one user in one service, or may be CDRs corresponding to a plurality of sessions established for a part of users or all users in one service. The specific way of correlating CDRs is chosen in accordance with an applied correlation policy and will not be described further herein.

**[0023]** The AS sends the service identifier and the CDRs to a charging information collecting function of a charging system. The charging information collecting function sends the CDRs collected and the service identifier to a billing center which performs charging correlation operations. When this charging correlation scheme is applied to application service layer, the charging information collecting function includes an AS-charging information collecting function corresponding to the service control function entity. The charging correlation scheme may also be applied to bearer control layer, and in such a case the charging information collecting function includes a bearer control layer-charging information collecting function corresponding to a bearer control layer entity that the service control function entity corresponds to, wherein the bearer control layer entity that the service control function corresponds to is used to bear the service control function. At this time, the bearer control layer entity corresponding to the service control function records the service identifier and generates CDRs for the current application or service, and sends the service identifier and the CDRs to the bearer control layer-charging infor-

mation collecting function of the bearer control layer entity. The AS-charging information collecting function and the bearer control layer-charging information collecting function respectively send the CDRs and service identifiers to the billing center. The billing center correlates the CDRs received from the AS-charging information collecting function and correlates the CDRs received from the bearer control layer-charging information collecting function, respectively. Or the billing center may correlates the CDRs received from the AS-charging information collecting function with the CDRs received from the bearer control layer-charging information collecting function. This charging correlation scheme in an embodiment of the present invention may be applied to both the application service layer and the bearer control layer in the embodiments shown in Figures 1 to 8. When the charging correlation scheme is applied only to the application service layer, the charging correlation process involves UE, AS, AS-charging information collecting function and billing center, without involving the bearer control layer entity and the bearer control layer-charging information collecting function. The charging correlation process in which the charging correlation scheme is applied only to the application service layer will not be described in detail herein, yet such process is still covered by the protection scope of the present invention.

**[0024]** The embodiments of the present invention are mainly oriented to session-based applications or services such as multi-party services. In conventional session-based services, session IDs (SIDs) corresponding to different service sessions are already employed. The existing SIDs may be used as service identifiers to correlate a plurality of CDRs. Also new identifiers may be defined as the service identifiers. Usually information exchanged among entities on the application service layer is sent via corresponding bearer control layer entities. For example, servers that perform PF of the multi-party service, a server performing CF, and UEs are used to exchange information via corresponding bearer control layer entities such as an IMS/SIP Core network (IMS/SIP Core). At the same time, network functions in the IMS/SIP Core may also generate CDRs for the current application or service in order to implement a charging process on the bearer control layer. In such process the AS of each application or service corresponds to a bearer control layer entity that is adapted to bear the AS.

**[0025]** At present, the mainstream multi-party services include Push-to-Talk over Cellular network (PoC) service, Conference service, etc. In a PoC service session, a server performing CF is a PoC server that performs CF, also called Controlling PoC Server; and the server performing PF is the PoC server that performs PF, also called Participating PoC Server. In a Conference service session, the server that performs CF is the Conference server that performs CF, also called a Controlling Conference Server; and the server performing PF is the Conference server that performs PF, also called a Participating Conference Server. The server performing PF and the server performing CF are logical functions of multi-party service servers, and the server performing PF and the server performing CF may be physically located in different ASs or in one AS. The server performing CF is referred to as the CF and the server performing PF is referred to as PF herein for the sake of simplicity. The embodiments of the present invention are described in detail herein taken a SIP based multi-party service as an example.

**[0026]** Figure 1 shows a flowchart of a charging correlation process in a session establishment in accordance with an embodiment of the present invention. The entities involved in this embodiment include a calling UE and a calling PF of the calling UE, a calling IMS/SIP Core corresponding to the calling PF and the calling UE, a CF of a present multi-party service, a called UE and a called PF of the called UE, a called IMS/SIP Core corresponding to the called PF and the called UE. The entities involved in this embodiment also include an AS-charging information collecting function corresponding to the calling PF, CF, and the called PF, and an IMS charging information collecting function corresponding to the calling IMS/SIP Core and the called IMS/SIP Core. The calling UE, the calling PF and the CF correspond to a same bearer control layer entity i.e., the calling IMS/SIP Core, the called UE and the called PF correspond to a same bearer control layer entity i.e., the called IMS/SIP Core. The service control function of the current application or service performs CF of the multi-party service.

**[0027]** When the calling/called PF and CF are provided by servers in a network of one service provider, the calling/called PF and the CF may correspond to a same AS-charging information collecting function. In this embodiment, suppose that the calling/called PF and the CF correspond to a same AS-charging information collecting function. However, when the calling/called PF and the CF are provided by servers in different networks of different service providers, the calling/called PF and the CF may correspond to different AS-charging information collecting functions respectively, and accordingly, the calling/called PF and the CF send service identifiers and the CDRs to different AS-charging information collecting functions respectively. Similarly, when IMS/SIP Cores of the calling UE and the called UE are provided in a same network of a same operator, the calling/called IMS/SIP Cores may correspond to one IMS charging information collecting function. When the IMS/SIP Cores of the calling UE and the called UE are in different networks provided by different operators, the calling/called IMS/SIP Cores may correspond to different IMS charging information collecting functions and send service identifiers and the CDRs to different IMS charging information collecting functions respectively. In this embodiment, suppose that the calling/called IMS/SIP Cores correspond to one IMS charging information collecting function.

**[0028]** As shown in Figure 1, the process includes as follows.

**[0029]** 101-102: The calling UE sends a session es-

tablishment request to the calling PF via a corresponding calling IMS/SIP Core. The session establishment request may be carried in an SIP INVITE message in this embodiment; however, the present invention is not limited to this.

**[0030]** The application service layer entities such as the UE, PF, CF, etc., and the corresponding bearer control layer entities such as the IMS/SIP Core, etc., may be in a same network or in different networks. The present invention is not limited to this.

**[0031]** 103: The calling PF sends the session establishment request to the CF via the calling IMS/SIP Core.

**[0032]** 104: The CF assigns a service identifier (SID) for the current multi-party service session and the followings shall be performed once for each of the called UEs.

**[0033]** 105: The CF sends the session establishment request to the called IMS/SIP Core corresponding to the called PF via the calling IMS/SIP Core of the CF. The session establishment request carries the SID assigned in 104.

**[0034]** 106-107: The called IMS/SIP Core saves the received SID and sends the session establishment request carrying the SID to the called PF.

**[0035]** 108-109: The called PF saves the received SID and sends the session establishment request carrying the SID to the called UE via the called IMS/SIP Core.

**[0036]** 110-111: The called UE saves the received SID and returns a session establishment response carrying the SID to the called PF via the called IMS/SIP Core. The session establishment response is carried in an SIP 2000K message in this embodiment, however, the present invention does not limit to this.

**[0037]** 112-113: The called PF sends the session establishment response carrying the SID to the CF via the called IMS/SIP Core and the calling IMS/SIP Core.

**[0038]** 114: The CF returns the session establishment response carrying the SID to the calling IMS/SIP Core.

**[0039]** 115-116: The calling IMS/SIP Core saves the received SID and returns the session establishment response carrying the SID to the calling PF, the calling PF also saves the received SID.

**[0040]** 117-119: The calling PF returns the session establishment response carrying the SID to the calling UE via the calling IMS/SIP Core, and the calling UE saves the received SID. By now, a session establishment process is completed.

**[0041]** In this embodiment, after receiving the SID, the service layer entities and bearer control layer entities related to the charging correlation process may insert the SID into or with the CDRs generated for the current application or service and send the CDRs to the corresponding charging information collecting functions. Specifically, the application service layer entities and bearer control layer entities generate CDRs after receiving a session establishment response indicating a successful session set-up or after sending the session establishment request, and the SID is included in the CDRs and the CDRs are sent to the charging information collecting functions. This embodiment describes a process in which the session is successfully established; hence it is supposed that the session establishment response always indicates a successful session set-up. In Figure 1, the application service layer entities related to the charging correlation process include a calling PF, a called PF and a CF; the bearer control layer entities related to the charging correlation process include a calling IMS/SIP Core and a called IMS/SIP Core. The procedure of sending the SID and the CDRs by the application service layer entities and bearer control layer entities related to the charging correlation process includes the followings.

**[0042]** The called PF may perform step ***a*** after sending the session establishment request in 109 or after receiving the session establishment response in 111. Step ***a*** is independent of other following steps and this embodiment of the present invention does not limit the sequence order of performing ***a*** and the steps following 111. Step ***a*** may include followings. The called PF requests the AS-charging information collecting function to start charging and sends the CDR of the called UE carrying the SID to the AS-charging information collecting function. The AS-charging information collecting function opens the CDR and starts to record actions performed by the called UE with the called PF during a current multi-party service.

**[0043]** The called IMS/SIP Core may save the SID when sending the session establishment request or when sending session establishment response that carries the SID. The called IMS/SIP Core may further perform step ***b*** after receiving the session establishment response in 112. Step ***b*** is independent of other following steps and this embodiment of the present invention does not limit the sequence order of performing step ***b*** and the steps following 112. Step ***b*** may include followings. The called IMS/SIP Core requests the IMS charging information collecting function to start charging, and sends the CDR of the called UE carrying the SID to the IMS charging information collecting function. The IMS charging information collecting function opens the CDR and starts to record actions performed by the called UE with the called IMS/SIP Core during the current multi-party service.

**[0044]** The CF may perform step c after receiving the session establishment response in 113. Step c is independent of other following steps and this embodiment of the present invention does not limit the sequence order of performing step ***c*** and the steps following 113. Step c may include followings. The CF requests the AS-charging information collecting function to start charging and sends CDRs of the calling and called UEs carrying the SID to the AS-charging information collecting function. The AS-charging information collecting function opens the CDRs and starts to record actions performed by the calling and called UE with the CF during the current multi-party service.

**[0045]** The calling PF may perform step ***d*** after receiving the session establishment response in 116. Step ***d*** is independent of other following steps and this embodiment of the present invention does not limit the sequence

order of performing step ***d*** and the steps following 116. Step ***d*** may include followings. The calling PF requests the AS-charging information collecting function to start charging and sends the CDR of the calling UE carrying the SID to the AS-charging information collecting function. The AS-charging information collecting function opens the CDR and starts to record actions performed by the calling UE with the calling PF during the current multi-party service.

**[0046]** The calling IMS/SIP Core may save the SID after sending the session establishment response that carries the SID. The calling IMS/SIP Core may further perform step ***e*** after receiving the session establishment response in 117. Step ***e*** is independent of other following steps and this embodiment of the present invention does not limit the sequence order of performing step ***e*** and the steps following 117. Step ***e*** may include followings. The calling IMS/SIP Core requests the IMS charging information collecting function to start charging and sends the CDR of the calling UE that carries the SID to the IMS charging information collecting function. the IMS charging information collecting function opens the CDR and starts to record actions performed by the calling UE with the calling IMS/SIP Core during the current multi-party service.

**[0047]** When the calling UE and the called UE establish a session and start a multi-party service communication, the AS-charging information collecting function or the IMS charging information collecting function starts to record the actions of the calling and called UEs that are performed on the entities during the multi-party service in real-time.

**[0048]** In the embodiment shown in Figure 1, the calling and the called PFs send the received SID to the calling and the called UEs, respectively. As such, when it needs to modify the session, or to add a new user into a session, or to make a user re-enter into a session, or to make a user exit the session, it is possible for the UEs to send the SID to a server performing PF or a server performing CF, in order to generate partial CDRs corresponding to the SID, or to generate a new CDR corresponding to the SID, or to update the CDR corresponding to the SID, or to close the CDR corresponding to the SID, respectively. However, sending the SID to the calling and the called UEs is not essential. Only when the above factors are taking into consideration, it is necessary to send the SID to the calling and the called UEs. In Figure 1, the calling and called UEs do not negotiate media parameters before establishing a session i.e., the calling and the called UEs establish an on-demand session. When the calling and called UEs negotiate media parameters before establishing a session i.e., the calling and the called UEs establish a pre-established session, the charging correlation process will be different from the process shown in Figure 1, as shown in Figure 2.

**[0049]** Figure 2 shows a flowchart of a charging correlation process in a session establishment in accordance with an embodiment of the present invention. In this embodiment, media parameters have been negotiated between the calling UEs and the calling PF that servers the calling UEs before establishing a session, and media parameters have been negotiated also between the called UEs and the called PF that servers the called UEs. The entities involved in the process are the same as the entities in Figure 1. A brief description of the pre-established session is given as follows. Before establishing a session, the UE negotiates session parameters with the server performing PF for the UE. The UE initiates a session establishment process by a session modify request such as a parameter message (REFER message). Therefore in the session establishment process, session parameters negotiation may be omitted and the UE does not need to upload session parameters. The UE just needs to indicate the server performing PF which service is to be joined by the UE. As such, SIP signaling that is exchanged with the UE has fewer bits, and air interface resources may be saved. The server performing PF then initiates a normal session establishment process with the server performing CF according to the indication from the UE, and informs the UE of a successful set-up by sending a media data control protocol message to the UE after the session between the PF and the CF is established. The media data control protocol may be the Talk Burst Control Protocol (TBCP) or the Media Burst Control Protocol (MBCP).

**[0050]** Figure 2 mainly includes followings.

**[0051]** 201-202: The calling UE sends a session modify request to the calling PF via the calling IMS/SIP Core corresponding to the calling UE. The calling PF returns a session modify response to the calling UE. The session modify request may be carried in an SIP parameter message (SIP REFER message) and the session modify response may be carried in an SIP accepted message (SIP ACCEPTED message), however, the present invention is not limited to this.

**[0052]** 203: The calling PF sends a session establishment request to the CF via the calling IMS/SIP Core corresponding to the calling PF.

**[0053]** 204: The CF assigns a service identifier SID for a current multi-party service and the followings is performed once for each of the called UEs.

**[0054]** 205: The CF sends the session establishment request to the called IMS/SIP Core via the calling IMS/SIP Core. The session establishment request carries the SID assigned in 204.

**[0055]** 206-207: The called IMS/SIP Core saves the received SID and sends the session establishment request that carries the SID to the called PF.

**[0056]** 208-210: The called PF saves the received SID and returns a session establishment response carrying the SID to the CF via the called IMS/SIP Core and the calling IMS/SIP Core.

**[0057]** While returning the session establishment response to the CF, the called PF also performs 210'. 210' may include followings. The called PF sends to the called IMS/SIP Core a media data control protocol message

carrying the SID, such as a TBCP Connect message used to notify the called UE to join the current service. The called UE saves the SID and returns an acknowledgment e.g. a TBCP Talk Burst Acknowledge message to the called PF via the called IMS/SIP Core. The called PF sends a confirmation e.g. a TBCP Talk Burst Confirm message to the called UE and then media data streams may be transmitted to the called UE.

**[0058]** In this embodiment, suppose that the called UE has negotiated parameters with the called PF and an auto-answer mode Has been set. That is, the called PF may send the media data control protocol message to the called UE, and return a session establishment response to the CF, without requesting the called UE in advance. The media data control protocol message, such as a TBCP Connect message or a Talk Burst Confirm message that is sent to the called UE, carries the SID. In another example, the called UE may also be configured to a manual response mode. That is, the called PF first sends a session establishment request e.g. an INVITE message to the called UE and then sends the media data control protocol message to the called UE. The called PF sends a session establishment response to the CF after the called user agrees to join the current service. In such a case, the media data control protocol message such as a TBCP Connect message or Talk Burst Confirm message, or the session establishment request such as an INVITE message that is sent to the called UE, may carry the SID.

**[0059]** 211-214: The CF returns a session establishment response carrying the SID to the calling IMS/SIP Core. The calling IMS/SIP Core saves the received SID and returns a session establishment response carrying the SID to the calling PF. The calling PF also saves the received SID.

**[0060]** 215-217: The calling PF sends a media data control protocol message, such as a TBCP Connect message, to the calling UE via the calling IMS/SIP Core to inform the calling UE that it is ready for a service session setup. The calling UE returns an acknowledgment, such as a TBCP Talk Burst Acknowledge message, to the calling PF via the calling IMS/SIP Core. The calling PF sends a confirmation such as a TBCP Talk Burst Confirm message to the called UE and is ready to receive media data streams from the calling UE. After that, the calling PF sends a session setup notification such as a NOTIFY message carrying the SID to the calling UE via the calling IMS/SIP Core. The calling UE saves the received SID and a whole session establishment process is completed.

**[0061]** In this process, the calling PF sends the SID to the calling UE by carrying the SID in a session setup notification or in a media data control protocol message such as a TBCP Connect message or a Talk Burst Confirm message.

**[0062]** The procedure of sending the SID and the CDRs received from the application service layer entities and bearer control layer entities that are related to the charging correlation process may include the followings.

**[0063]** The called IMS/SIP Core may save the SID after sending the session establishment request that carries the SID, the media data control protocol message that carries the SID, or the session establishment response that carries the SID. The called IMS/SIP Core may perform Step ***a*** after receiving the session establishment response, e.g., the response to the session establishment request or the response to the media data control protocol message, from the called UE. Step ***a*** is independent of other following steps and this embodiment of the present invention does not limit the sequence order of performing step ***a*** and other steps. Step ***a*** may include followings. The called IMS/SIP Core requests the IMS charging information collecting function to start charging, and sends the CDR of the called UE to the IMS charging information collecting function, wherein the CDR of the called UE carries the SID. The IMS charging information collecting function opens the CDR and starts to record actions performed by the called UE with the called IMS/SIP Core during the current multi-party service.

**[0064]** The called PF may perform step ***b*** after sending the session establishment request or media data control protocol message to the called UE, or after receiving the session establishment response e.g., a response to the session establishment request or a response to the media data control protocol message from the called UE. Step ***b*** is independent of other following steps and this embodiment of the present invention does not limit the sequence order of performing step ***b*** and other steps. Step ***b*** may include followings. The called PF requests the AS-charging information collecting function to start charging and sends the CDR of the called UE that carries the SID to the AS-charging information collecting function. The AS-charging information collecting function opens the CDR and starts to record actions performed by the called UE with the called PF during the current multi-party service.

**[0065]** The CF may perform step c after receiving the session establishment response in 210. Step c is independent of other following steps and this embodiment of the present invention does not limit the sequence order of performing step c and the steps following 210. Step c may include followings. The CF requests the AS-charging information collecting function to start charging and sends CDRs of the calling and called UEs that carry the SID to the AS-charging information collecting function. The AS-charging information collecting function opens the CDRs and starts to record actions performed by the calling and called UE with the CF during the current multi-party service.

**[0066]** The calling PF may perform step ***d*** after receiving the session establishment response in 213. Step ***d*** is independent of other following steps and this embodiment of the present invention does not limit the sequence order of performing step ***d*** and the steps following 213. Step ***d*** may include followings. The calling PF requests the AS-charging information collecting function to start

charging and sends the CDR of the calling UE that carries the SID to the AS-charging information collecting function. The AS-charging information collecting function opens the CDR and starts to record actions performed by the calling UE with the calling PF during the current multi-party service.

**[0067]** The calling IMS/SIP Core may save the SID after sending the session establishment response carrying the SID. The calling IMS/SIP Core may further perform step e after receiving the session establishment response in 211. Step e is independent of other following steps and this embodiment of the present invention does not limit the sequence order of performing step e and the steps following 211. Step e may include followings. The calling IMS/SIP Core requests the IMS charging information collecting function to start charging and sends the CDR of the calling UE that carries the SID to the IMS charging information collecting function. the IMS charging information collecting function opens the CDR and starts to record actions performed by the calling UE with the calling IMS/SIP Core during the current multi-party service.

**[0068]** During a multi-party service, a UE may modify the session, for example, the UE may modify the session media parameters, which may result that the AS-charging information collecting function or IMS charging information collecting function may generate a partial CDR. The partial CDR and original CDRs belong to the same multi-party service and need to be correlated in the charging correlation process. Therefore, in a session modification process, the UE needs to send the SID saved during the session establishment process to entities such as the server performing PF and the server performing CF which are related to the charging correlation process, so that the entities can generate partial CDRs corresponding to the SID. In this way the partial CDR may be correlated with other CDRs generated for the multi-party service.

**[0069]** Figure 3 shows a flowchart of a charging correlation process in a session modification process in accordance with an embodiment of the present invention. The entities involved in this embodiment may include: a calling UE and a calling PF of the calling UE, a calling IMS/SIP Core corresponding to the calling PF and the calling UE, a CF of a current multi-party service, a called UE and a called PF of the called UE, and a called IMS/SIP Core corresponding to the called PF and the called UE. This embodiment also involves: a AS-charging information collecting function corresponding to the calling PF, the called PF and the CF, and an IMS charging information collecting function corresponding to the calling IMS/SIP Core and the called IMS/SIP Core. Figure 3 includes the following processes.

**[0070]** 301: The calling UE sends a session modify request that carries the SID to the calling PF via the calling IMS/SIP Core. The session modify request is carried in an SIP UPDATE message or in an SIP Re-INVITE message in this embodiment, however, the present invention is not limited to this.

**[0071]** 302: The calling PF sends the session modify request that carries the SID to the calling IMS/SIP Core.

**[0072]** 303: The calling IMS/SIP Core sends the session modify request that carries the SID to the CF, and the followings is performed once for each of the called UEs.

**[0073]** 304-305: The CF sends the session modify request that carries the SID to the called IMS/SIP Core via the calling IMS/SIP Core.

**[0074]** 306: The called IMS/SIP Core sends the session modify request that carries the SID to the called PF.

**[0075]** 307-308: The called PF sends the session modify request that carries the SID to the called UE via the called IMS/SIP Core.

**[0076]** 309-310: The called UE returns a session modify response that carries the SID to the called PF via the called IMS/SIP Core. The session modify response may be carried in an SIP 2000K message in this embodiment, however, the present invention is not limited to this.

**[0077]** 311-313: The called PF sends the session modify response that carries the SID to the CF via the called IMS/SIP Core and the calling IMS/SIP Core.

**[0078]** 314-315: The CF returns the session modify response that carries the SID to the calling IMS/SIP Core, the calling IMS/SIP Core returns the session modify response that carries the SID to the calling PF.

**[0079]** 316-317: The calling PF returns the session modify response that carries the SID to the calling UE via the calling IMS/SIP Core and the session modify process is completed.

**[0080]** In the above process, the procedure of sending the SID and the CDRs by the application service layer entities and bearer control layer entities that are related to the charging correlation process includes the followings.

**[0081]** The called PF may perform step ***a*** after sending the session modify request to the called UE or after receiving the session modify response from the called UE. Step ***a*** is independent from steps following 307 and the present invention does not limit the sequence order of performing step ***a*** and the steps following 307. Step ***a*** may include followings. The called PF requests the AS-charging information collecting function to start an intermediate charging and sends a partial CDR of the called UE, that is generated by the called PF and carries the SID, to the AS-charging information collecting function. The AS-charging information collecting function updates CDR of the called PF, saves the partial CDR, and starts to record actions that may affect an accounting and are performed by the called UE on the called PF after the session is modified in the current multi-party service.

**[0082]** The called IMS/SIP Core may save the SID after sending the session modify request or the session modify request response carrying the SID. The called IMS/SIP Core may further perform step ***b*** after receiving the session modify response from the called UE. Step ***b*** is independent from steps following 309 and the present inven-

tion does not limit the sequence order of performing step ***b*** and the steps following 309. Step ***b*** may include followings. The called IMS/SIP Core requests the IMS charging information collecting function to start an intermediate charging and sends a partial CDR of the called UE, that is generated by the called IMS/SIP Core and carries the SID, to the IMS charging information collecting function. The IMS charging information collecting function updates CDR of the called IMS/SIP Core, saves the partial CDR and starts to record actions that may affect an accounting and are performed by the called UE on the called IMS/SIP Core after the session is modified in the current multi-party service.

**[0083]** The CF may perform step c after receiving the session modify response in 313. Step c is independent from steps following 313 and the present invention does not limit the sequence order of performing step ***c*** and the steps following 313. Step ***c*** may include followings. The CF requests the AS-charging information collecting function to start an intermediate charging and sends the partial CDRs of the calling UEs and the called UEs, that is generated by the CF and carries the SID, to the AS-charging information collecting function. The AS-charging information collecting function updates CDR of the CF, saves the partial CDRs of the calling and the called UEs and starts to record actions that may affect an accounting and are performed by the calling and called UE on the CF after the session is modified in the current multi-party service.

**[0084]** The calling PF may perform step ***d*** after receiving the session modify response in 315. Step ***d*** is independent from steps following 315 and the present invention does not limit the sequence order of performing step ***d*** and the steps following 315. Step ***d*** may include followings. The calling PF requests the AS-charging information collecting function to start an intermediate charging and sends the partial CDR of the calling UE, which is generated by the calling PF and carries the SID, to the AS-charging information collecting function. The AS-charging information collecting function updates CDR of the calling PF, saves the partial CDR of the calling UE and starts to record actions that may affect an accounting and are performed by the calling UE on the calling PF after the session is modified in the current multi-party service.

**[0085]** The calling IMS/SIP Core may save the SID while sending the session modify response carrying the SID. The calling IMS/SIP Core may further perform step ***e*** after receiving the session modify response in 314. Step e is independent from steps following 314 and the present invention does not limit the sequence order of performing step e and the steps following 314. Step e may include followings, the calling IMS/SIP Core requests the IMS charging information collecting function to start an intermediate charging and sends the partial CDR of the calling user, which is generated by the calling IMS/SIP Core and carries the SID, to the IMS charging information collecting function. The IMS charging information collecting function updates CDR of the calling IMS/SIP Core, saves the partial CDR of the calling user and starts to record actions that may affect an accounting and are performed by the calling UE on the calling IMS/SIP Core after the session is modified in the current multi-party service.

**[0086]** In the embodiments shown in Figures 1 to 3, the calling PF, the CF and the called PF are separated entities. In practical applications, any one or any combination of the calling PF, the CF and the called PF may be provided by one entity, in which case the basic processes are the same as the embodiments shown in Figures 1 to 3, and will not be described in detail herein but are still covered by the protection scope of the present invention.

**[0087]** In Figures 1 and 2, the calling PF and the CF correspond to a same IMS/SIP Core and the called PF corresponds to another IMS/SIP Core. In practical applications, the calling PF, the CF and the called PF may correspond to different IMS/SIP Cores. When the calling UE and a called UE are in one network provided by an operator, the calling PF and the called PF of the called UE may correspond to the same IMS/SIP Core. When the calling UE and a called UE are in different networks provided by different operators, the calling PF and the called PF correspond to different IMS/SIP Cores. When the calling PF and the CF are in one network provided by the same operator, the calling PF and the CF correspond to the same IMS/SIP Core. When the called PF and the CF are in different networks provided by different operators, the called PF and the CF correspond to different IMS/SIP Cores. However, no matter the calling PF, the CF and the called PF correspond to the same IMS/SIP Core or to different IMS/SIP Cores, the processes in embodiments of the present invention are essentially the same. In one word, the application service layer entities such as the calling PF, the CF and the called PF send/receive session establishment/modify requests or session establishment/modify responses via corresponding IMS/SIP Cores, and the detailed processes thereof will not be described herein, but are still covered by the protection scope of the present invention.

**[0088]** During an existing multi-party service, when adding a new user, the control function entity (e.g., the CF) of the multi-party service generates a new CDR for a session of the new user. A service identifier will be adapted to correlate the CDRs of the new user when adding the new user.

**[0089]** Figure 4 shows a flowchart of a charging correlation process when adding a new user to an existing multi-party service in accordance with an embodiment of the present invention. A process of adding a new user includes: requesting by a UE to add another user (a third party user) into a current multi-party service. The third party user is shown as an added UE in Figure 4. The entities involved in this embodiment include: a UE and a PF of the UE, an IMS/SIP Core corresponding to the UE, an added UE, a CF of the current multi-party service, an

AS-charging information collecting function and an IMS charging information collecting function. In this embodiment, suppose that the UE and the new user added to the current service (the added UE) are served by the same PF, and the UE, the added UE, the PF and the CF correspond to the same IMS/SIP Core.

**[0090]** As shown in Figure 4, the process includes followings.

**[0091]** 401-402: The UE sends an adding request that carries an SID to the PF via the IMS/SIP Core. The adding request may be carried in an SIP REFER message in this embodiment, however, the present invention is not limited to this.

**[0092]** 403-404: The PF sends the adding request that carries the SID to the CF via the IMS/SIP Core.

**[0093]** 405-406: The CF sends the adding request that carries the SID to the PF of the added UE via the IMS/SIP Core, and the PF sends the adding request that carries the SID to the added UE. The added UE returns an adding response that carries the SID to the PF via the IMS/SIP Core after receiving the adding request. The PF returns the adding response that carries the SID to the CF via the IMS/SIP Core. As such, the new UE is added to the current service.

**[0094]** The adding request may be carried in an SIP INVITE message and the adding response may be carried in an SIP 2000K message, however, the present invention is not limited to this.

**[0095]** 407: The CF returns the adding response that carries the SID to the PF of the UE via the IMS/SIP Core. The PF informs the UE that the new user has been added to the current service by returning the adding response that carries the SID to the UE via the IMS/SIP Core. The adding response may be carried in an SIP ACCEPTED message in this embodiment; however, the present invention is not limited to this.

**[0096]** In Figure 4, the application service layer entities related to the charging correlation process include the PF and the CF. The CF may perform step ***a*** after receiving the adding response in 406. Step ***a*** is independent of other following steps and the present invention does not limit the sequence order of performing step ***a*** and the follow-up steps. The PF may perform step ***b*** after receiving the adding response in 406 and step ***b*** is independent of other following steps and the present invention does not limit the sequence order of performing step ***b*** and the follow-up steps.

**[0097]** Step ***a*** may include followings. The CF requests the AS-charging information collecting function to start charging and sends the CDR of the new user (the added UE) that is generated by the CF and carries the SID to the AS-charging information collecting function. The AS-charging information collecting function opens the CDR of the new user from the CF and starts to record actions performed by the new user on the CF during the current multi-party service.

**[0098]** Step ***b*** may include followings. The PF requests the AS-charging information collecting function to start charging and sends the CDR of the new user that is generated by the PF and carries the SID to the AS-charging information collecting function. The AS-charging information collecting function opens the CDR of the new user from the PF and starts to record actions performed by the new user on the PF during the current multi-party service.

**[0099]** The bearer control layer entity related to the charging correlation process in Figure 4 is the IMS/SIP Core. The IMS/SIP Core may perform step c after receiving the adding response in 406, and step c is independent of other following steps and the present invention does not limit the sequence order of performing step c and the follow-up steps. Step ***c*** may include followings. The IMS/SIP Core requests the IMS charging information collecting function to start charging and sends the CDR of the new user that is generated by the IMS/SIP Core and carries the SID to the IMS charging information collecting function. The IMS charging information collecting function opens the CDR of the new user from the IMS/SIP Core and starts to record actions performed by the new user on the IMS/SIP Core during the current multi-party service.

**[0100]** In embodiments shown in Figures 3 and 4, the UE may establish an on-demand session or have a pre-established session, the processes in Figures 3 and 4 may be applied to both cases.

**[0101]** If a UE exits a session, the AS-charging information collecting function and the IMS charging information collecting function need to close the CDRs of the multi-party service of the UE. In such a case, the SID of the current multi-party service needs to be sent to the AS-charging information collecting function and the IMS charging information collecting function so that the CDRs corresponding to the same SID among all CDRs of the UE may be closed based on the same SID.

**[0102]** Figure 5 shows a flowchart of a charging correlation process when a UE that has established a pre-established session exits a session in accordance with an embodiment of the present invention. The entities involved in this embodiment include: a UE and a PF of the UE, an IMS/SIP Core corresponding to the UE, a CF of a current multi-party service, an AS-charging information collecting function and an IMS charging information collecting function. In this embodiment, the UE, the PF and the CF correspond to the same IMS/SIP Core.

**[0103]** As shown in Figure 5, the process includes followings.

**[0104]** 501-502: The UE sends a release session request that carries an SID to the PF via the IMS/SIP Core. The release session request is carried in an SIP BYE message in this embodiment, however, the present invention is not limited to this.

**[0105]** 503: The PF sends the release session request that carries the SID to the CF via the IMS/SIP Core.

**[0106]** 504: The CF returns a release session response that carries the SID to the PF via the IMS/SIP Core. The release session response may be carried in

an SIP 200OK message in this embodiment, however, the present invention is not limited to this.

**[0107]** 505-506: The PF sends the release session response that carries the SID to the UE via the IMS/SIP Core.

**[0108]** In Figure 5, the application service layer entities related to the charging correlation process include the PF and the CF. The CF may perform step ***a*** after receiving the release session response in 503. Step ***a*** is independent of following steps and the present invention does not limit the sequence order of performing step ***a*** and the steps following 503. The PF may perform step ***b*** after receiving the release session response in 504 and step ***b*** is independent of following steps and the present invention does not limit the sequence order of performing step ***b*** and the steps following 504.

**[0109]** Step ***a*** may include followings. The CF requests the AS-charging information collecting function to stop charging and sends the SID to the AS-charging information collecting function. The AS-charging information collecting function closes CDR of the UE from the CF and stops recording charging data of the UE.

**[0110]** Step ***b*** may include followings. The PF requests the AS-charging information collecting function to stop charging and sends the SID to the AS-charging information collecting function. The AS-charging information collecting function closes CDR of the UE from the PF and stops recording the charging data of the UE.

**[0111]** The bearer control layer entity related to the charging correlation process in Figure 5 is the IMS/SIP Core. The IMS/SIP Core may perform step ***c*** after receiving the release session response in 505, and step ***c*** is independent of following steps and the present invention does not limit the sequence order of performing step c and the steps following 505.

**[0112]** Step ***c*** may include followings. The IMS/SIP Core requests the IMS charging information collecting function to stop charging and sends the SID to the IMS charging information collecting function. The IMS charging information collecting function closes CDR of the UE from the PF.

**[0113]** The release session process shown in Figure 5 is suitable to be used for a user who establishes an on-demand session. For a user who establishes a pre-established session, a different release session process shall be used. Figure 6 shows a flowchart of a charging correlation process for a user who establishes a pre-established session in accordance with an embodiment of the present invention. The entities involved in this embodiment include: a UE and a PF of the UE, an IMS/SIP Core corresponding to the UE, a CF of a current multi-party service, an AS-charging information collecting function and an IMS charging information collecting function. In this embodiment, the UE, the PF and the CF correspond to the same IMS/SIP Core.

**[0114]** A whole session establishment process for a user who establishes a pre-established session includes two parts: firstly, the UE and the PF negotiate session parameters before establishing a session; then, the PF establishes a session with the CF for the UE when the UE is ready for establishing the session. Therefore this kind of session establishment process shall be ended in two steps: firstly, the session that is pre-established between the UE and the PF is modified; then, the session between the PF and the CF is released. As shown in Figure 6, the process includes followings.

**[0115]** 601-602: The UE sends a session modify and release request that carries an SID to the PF via the IMS/SIP Core in order to release the session. The session modify and release request may be carried in an SIP REFER BYE message in this embodiment, however, the present invention is not limited to this.

**[0116]** 603: The PF returns a session modify response to the UE via the IMS/SIP Core. The session modify response may be carried in an SIP ACCEPTED message in this embodiment, however, the present invention is not limited to this.

**[0117]** 604: The PF sends a release session request carrying the SID to the CF via the IMS/SIP Core. The release session request may be carried in a BYE message, however, the present invention is not limited to this.

**[0118]** 605: The CF returns a release session response to the PF via the IMS/SIP Core. The release session response may be carried in an SIP 2000K message in this embodiment, however, the present invention is not limited to this.

**[0119]** 606-607: The PF sends a release session notification to the UE via the IMS/SIP Core to notify the UE of a successful release of the session between the UE and the CF. The UE returns a release session response to the PF. The release session response may be carried in a NOTIFY message, and the release session response may be carried in an OK message, however, the present invention is not limited to this.

**[0120]** In Figure 6, the application service layer entities related to the charging correlation process include the PF and the CF. The CF may perform step ***a*** after receiving the release session request in 604 and after successful releasing the session. Step ***a*** is independent of following steps and the present invention does not limit the sequence order of performing step ***a*** and the steps following 604. The PF may perform step ***a*** after receiving the release session response in 607.

**[0121]** Step ***a*** may include followings. The CF requests the AS-charging information collecting function to stop charging and sends the SID to the AS-charging information collecting function. The AS-charging information collecting function closes CDR of the UE from the CF and stops recording the charging data of the UE.

**[0122]** Step ***b*** may include followings. The PF requests the AS-charging information collecting function to stop charging and sends the SID to the AS-charging information collecting function. The AS-charging information collecting function closes CDR of the UE from the PF and stops recording the charging data of the UE.

**[0123]** The bearer control layer entity related to the

charging correlation process in Figure 6 is the IMS/SIP Core. The IMS/SIP Core may perform step ***c*** after receiving the release session response in 605, and step ***c*** is independent of following steps and the present invention does not limit the sequence order of performing step c and the steps following 605.

**[0124]** Step ***c*** may include followings. The IMS/SIP Core requests the IMS charging information collecting function to stop charging and sends the SID to the IMS charging information collecting function. The IMS charging information collecting function closes CDR of the UE from the PF.

**[0125]** Besides the situations described above, new CDRs may be generated by the entities related to the charging correlation process in two other situation. The charging correlation processes in accordance with the embodiments of the present invention are suitable in such two situations. In the first situation, a user who establishes an on-demand session exits a current multi-party service session temporarily while the current multi-party service proceeds, then the user re-enters the multi-party service. In the other of the two situations, a user who establishes a pre-established session exits a current multi-party service session temporarily while the current multi-party service proceeds, then the user re-enters the multi-party service. The charging correlation processes in the two situations are described with reference to Figures 7 and 8.

**[0126]** Figure 7 shows a flowchart of a charging correlation process in a case that a user who establishes an on-demand session re-enters a session after the user exits the session in accordance with an embodiment of the present invention. The entities involved in this embodiment include: a UE and a PF of the UE, an IMS/SIP Core corresponding to the UE, a CF of a current multi-party service, an AS-charging information collecting function and an IMS charging information collecting function. In this embodiment, the UE, the PF and the CF correspond to a same IMS/SIP Core. As shown in Figure 7, the process includes followings.

**[0127]** 701-702: The UE sends a session joining request carrying an SID to the PF via the IMS/SIP Core. The session joining request may be carried in an SIP REFER message or an SIP INVITE message in this embodiment, however, the present invention is not limited to this.

**[0128]** 703: The PF sends the session joining request carrying the SID to the CF via the IMS/SIP Core.

**[0129]** 704: The CF returns a session joining response carrying the SID to the PF via the IMS/SIP Core. The session joining response may be carried in an SIP 2000K message or an SIP ACCEPTED message in this embodiment, however, the present invention is not limited to this.

**[0130]** 705-706: The PF sends the session joining response carrying the SID to the UE via the IMS/SIP Core.

**[0131]** In Figure 7, the application service layer entities related to the charging correlation process include the PF and the CF. The CF may perform step ***a*** after receiving the session joining response in 703. Step ***a*** is independent of following steps and the present invention does not limit the sequence order of performing step ***a*** and the steps following 703. The PF may perform step ***b*** after receiving the session joining response in 704 and step ***b*** is independent of following steps and the present invention does not limit the sequence order of performing step ***b*** and the steps following 704.

**[0132]** Step ***a*** may include followings, the CF requests the AS-charging information collecting function to start charging and sends the CDR of the user who requests to re-enter the session (the UE), which is generated by the CF and carries the SID, to the AS-charging information collecting function. The AS-charging information collecting function opens the CDR of the UE received from the CF and starts to record actions that affect an accounting and are performed by the UE on the CF during the current multi-party service. It need to be noted that when the user re-enters the session, the opened CDR of the UE is a new CDR instead of the CDR of the UE generated before the UE dropped out of the session. However, the two CDRs have the same SID and can be correlated based on the SID.

**[0133]** Step ***b*** may include followings. The PF requests the AS-charging information collecting function to start charging and sends the CDR of the UE, which is generated by the PF and carries the SID, to the AS-charging information collecting function. The AS-charging information collecting function opens the CDR of the UE received from the PF and starts to record actions that affect the accounting and are performed by the UE on the PF during the current multi-party service.

**[0134]** The bearer control layer entity related to the charging correlation process in Figure 7 is the IMS/SIP Core. The IMS/SIP Core may perform step c after receiving the session joining response in 705, and step c is independent of following steps and the present invention does not limit the sequence order of performing step ***c*** and the steps following 705.

**[0135]** Step ***c*** may include followings. The IMS/SIP Core requests the IMS charging information collecting function to start charging and sends the CDR of the UE, which is generated by the IMS/SIP Core and carries the SID, to the IMS charging information collecting function. The IMS charging information collecting function opens the CDR of the UE from the IMS/SIP Core and starts to record actions that affect the accounting and are performed by the UE on the IMS/SIP Core during the current multi-party service.

**[0136]** Figure 8 shows a flowchart of a charging correlation process in a case where a user who establishes a pre-established session re-enters a session after the user exits the session in accordance with an embodiment of the present invention. The entities involved in this embodiment include: a UE and a PF of the UE, an IMS/SIP Core corresponding to the UE, a CF of the current multi-party service, an AS-charging information collecting function and an IMS charging information collecting func-

tion. In this embodiment, the UE, the PF and the CF correspond to the same IMS/SIP Core. As shown in Figure 8, the process includes followings.

**[0137]** 801-802: The UE and the PF negotiate session parameters before establishing a session. Then the UE sends a session modify request carrying an SID to the PF via the IMS/SIP Core. The session modify request may be carried in an SIP REFER message in this embodiment, however, the present invention is not limited to this.

**[0138]** 803: The PF returns a session modify response carrying the SID to the UE via the IMS/SIP Core. The session modify response may be carried in an SIP ACCEPTED message in this embodiment. However, the present invention is not limited to this.

**[0139]** 804: The PF sends a session joining request carrying the SID to the CF via the IMS/SIP Core to establish a session between the UE and the CF. The session joining request may be carried in an SIP INVITE message. However, the present invention is not limited to this.

**[0140]** 805-806: The CF returns a session joining response carrying the SID to the PF via the IMS/SIP Core. The session joining response may be carried in an SIP 200OK or an OK message. However, the present invention is not limited to this.

**[0141]** 807-809: The PF sends to the UE a session joining notification (e.g., a NOTIFY message) carrying a result of the session setup via the IMS/SIP Core. The UE returns a session joining response (e.g., an OK response) to the PF via the IMS/SIP Core. As such, the session re-entering process is completed.

**[0142]** In Figure 8, the service layer entities related to the charging correlation process include the PF and the CF. The CF may perform step ***a*** after receiving the session joining request in 804 and after successful adding the UE into the session. Step ***a*** is independent of other following steps and the present invention does not limit the sequence order of performing step ***a*** and the steps following 804. The PF may perform step b after receiving the session joining response in 809 and similarly, the bearer control layer entity related to the charging correlation process, i.e., the IMS/SIP Core, may perform step c after receiving the response in 809.

**[0143]** Step ***a*** may include followings, the CF requests the AS-charging information collecting function to start charging and sends the CDR of the user (the UE) who requests to re-enter the session, which is generated by the CF and carries the SID, to the AS-charging information collecting function. The AS-charging information collecting function opens the CDR of the UE from the CF and starts to record actions that affect an accounting and are performed by the UE on the CF during the current multi-party service. It need to be noted that when the user re-enters the session, the opened CDR of the UE is a new CDR instead of the CDR of the UE that is generated before the UE dropped out of the session. However, the two CDRs have the same SID and can be correlated based on the SID.

**[0144]** Step ***b*** may include followings. The PF requests the AS-charging information collecting function to start charging and sends the CDR of the UE, which is generated by the PF and carries the SID, to the AS-charging information collecting function. The AS-charging information collecting function opens the CDR of the UE received from the PF and starts to record actions that affect the accounting and are performed by the UE on the PF during the current multi-party service.

**[0145]** The bearer control layer entity related to the charging correlation process in Figure 8 is the IMS/SIP Core. The IMS/SIP Core may perform step c after receiving the session joining response in 805, and step c is independent of following steps and the present invention does not limit the sequence order of performing step c and the steps following 805.

**[0146]** Step c may include followings. The IMS/SIP Core requests the IMS charging information collecting function to start charging and sends the CDR of the UE, which is generated by the IMS/SIP Core and carries the SID, to the IMS charging information collecting function. The IMS charging information collecting function opens the CDR of the UE from the IMS/SIP Core and starts to record actions that affect the accounting and are performed by the UE on the IMS/SIP Core during the current multi-party service.

**[0147]** In embodiments shown in Figures 4 to 8, the PF and the CF are performed by two separated entities. In practical applications, the PF and the CF may be performed by one entity. In such a case, the essential processes of the embodiments in which the PF and the CF are performed by one entity are similar to the processes shown in Figures 4 to 8 and will not be described in detail herein, but are still covered by the protection scope of the invention.

**[0148]** Moreover, the PF and the CF correspond to the same bearer control layer entity e.g., the IMS/SIP Core in Figures 4 to 8. In practical applications, the PF and the CF may correspond to different bearer control layer entities. When the PF and the CF are in the same network of an operator, the PF and the CF correspond to the same IMS/SIP Core. When the PF and the CF are in different networks of different operators, the PF and the CF correspond to different IMS/SIP Cores. No matter the PF and the CF correspond to the same IMS/SIP Core or to different IMS/SIP Cores, the method in accordance with embodiments of the present invention is applicable. No matter the PF and the CF correspond to the same bearer control layer entity or to different bearer control layer entities, the method in accordance with embodiments of the present invention is applicable. In one word, the application service layer entities such as the PF and the CF send/receive messages comprising session modify requests/responses, session joining requests/responses, release session requests/responses, session modify requests/responses and session modify and release requests via corresponding IMS/SIP Cores. Detailed proc-

esses will not be described herein, but are still covered by the protection scope of the present invention.

**[0149]** In the flowcharts of the above embodiments, the responses returned by the called UE to the CF carry the SID. However, since the CF has learnt the SID of the current service, the responses from the called UE to the CF may not carry the SID.

**[0150]** In the above embodiments, the SID is sent to the AS-charging information collecting function and IMS charging information collecting function, thus the application service layer of the AS and the bearer control layer of the IMS can perform a function in accordance with the charging correlation scheme provided by embodiments of the present invention. In practical applications, it may be unnecessary for the application service layer or the bearer control layer to implement the charging correlation process, and in such a case the SID and CRDs needs not to be sent to the AS-charging information collecting function or the IMS charging information collecting function.

**[0151]** The embodiments of the present invention adopt SIDs as service identifiers, and a description of the SID used in a PoC service is given herein. In a PoC service, SID is assigned by a service control function to a calling/called PoC client. The SID is used to identify a PoC group session in an SIP communication, but is not used in charging data generation processes. A PoC Session Identity (PoC SID) is constructed in a format of a SIP Uniform Resource Identifier (URI) and is sent during a PoC session establishment process to a PoC client in a Contact header field and/or a TBCP CONNECT message. The PoC SID may be assigned and available for a long period, or be assigned temporarily. A long term PoC SID is adapted to a pre-arranged PoC group session. A temporary PoC SID is assigned by a server performing CF in the network to a PoC client when the PoC client establishes a PoC session for a PoC service for a first time, and is remained valid as long as the PoC service is in progress. When the PoC client establishes a session for another PoC service, the new PoC service is assigned a different PoC SID. However, if the PoC client exits a session of a PoC service temporarily and re-enters the same PoC service later, the PoC SID to used in the session will remain the same. It can be seen that the PoC SID may be used to identify a PoC service, therefore the PoC SID can also be used to charge correlation information of the service. Such PoC SID cannot be modified easily in transmission and the PoC client cannot modify the PoC SID after receiving the PoC SID, hence it is safe and reliable to use the PoC SID in a charging correlation process.

**[0152]** Embodiments of the present invention also propose a second charging correlation scheme to implement a charging correlation for a plurality of CDRs generated for one user in a multi-service that comprises a plurality of sub-services. The charging correlation scheme provides two ways to implement this charging correlation.

**[0153]** According to a first method, a service control function assigns a multi-service identifier for a current multi-service and assigns a sub-service identifier to each of the sub-services included in the current multi-service. The multi-service identifier and the sub-service identifiers are sent to a charging system. The charging system correlates CDRs of a sub-service based on the sub-service identifier of the sub-service, and correlates CDRs of the plurality of sub-services based on the multi-service identifier.

**[0154]** According to a second method, a service control function just assigns a multi-service identifier for a current multi-service. The multi-service identifier is sent to a charging system which correlates the CDRs of a plurality of sub-services of the current multi-service based on the multi-service identifier.

**[0155]** In a multi-service, a user may establish one or a plurality of sessions in each of the sub-services and a CDR is generated for each of the sessions of the user. Different methods may be used to correlate the CDRs based on the multi-service identifier. The CDRs to be correlated based on the multi-service identifier may be: CDRs corresponding to a plurality of sub-services (or a plurality of sessions of a plurality of sub-services) establish for one user in the current multi-service, or CDRs corresponding to a plurality of sub-services (or a plurality of sessions of a plurality of sub-services) established for a part of users or all users in the current multi-service. The method of correlating CDRs may be chosen based on special correlation policy applied. The contents and forms of correlation policies are not the technical problem to be solved by the present invention and will not be described further herein.

**[0156]** In a multi-service, a sub-service corresponds to a sub-service server. A service control function controls the sub-service servers to initiate, modify and terminate sub-services in order to initiate, modify and terminate the multi-service. According to the first method described above, for a sub-service, after the service control function assigns the multi-service identifier and the sub-service identifiers corresponding to the sub-services, the service control function sends the multi-service identifier and a sub-service identifier corresponding to a sub-service to a sub-service server corresponding to the sub-service. The sub-service server generates CDRs for the sub-service and sends the CDRs, the received multi-service identifier and the sub-service identifier to an AS-charging information collecting function of the sub-service server. The AS-charging information collecting function sends the received multi-service identifier, the sub-service identifier and the CDRs to a billing center. The billing center correlates the CDRs generated by one sub-service server based on the sub-service identifier, and further correlates CDRs generated by the sub-service servers based on the multi-service identifier. According to the second method described above, after assigning the multi-service identifier, the service control function sends the multi-service identifier to each sub-service server corresponding to each sub-service. A sub-service

server generates CDRs for each corresponding sub-service and sends the received multi-service identifier and the CDRs generated to the AS-charging information collecting function of the sub-service server. The AS-charging information collecting function sends the received multi-service identifier and the CDRs to the billing center. The billing center correlates the CDRs from different sub-service servers based on the multi-service identifier.

**[0157]** When the charging correlation scheme is applied to the application service layer, the charging information collecting function includes the AS-charging information collecting functions corresponding to the sub-service servers. The scheme can further be applied to the bearer control layer, and in such a case the charging information collecting function includes bearer control layer-charging information collecting functions of the bearer control layer entities corresponding to the sub-service servers. The bearer control layer entities corresponding to the sub-service servers are used to implement the service control functions. The bearer control layer entities corresponding to the sub-service servers are further used to record the multi-service identifier or a combination of the multi-service identifier and a sub-service identifier, and generate CDRs for corresponding sub-services. The bearer control layer entities send the multi-service identifier or the combination of the multi-service identifier and a sub-service identifier, and the CDRs to the bearer control layer-charging information collecting function of the bearer control layer entities. The AS-charging information collecting function and the bearer control layer-charging information collecting function send the received CDRs, and the multi-service identifier or the combination of the multi-service identifier and a sub-service identifier to the billing center. In Figures 9 and 10, the application service layer is taken as an example. When the present invention is applied only to the bearer control layer, charging correlation process involves UEs, service control functions, bearer control layer entities corresponding to sub-service servers, bearer control layer-charging information collecting functions and a billing center, without involving sub-service servers and AS-charging information collecting functions. Embodiments that the bearer control layer is employed are not described in detailed herein, but are still covered by the protection scope of the present invention. When the multi-service identifier or the combination of the multi-service identifier and the sub-service identifier is sent to an AS-charging information collecting function or to bearer control layer-charging information collecting function, the multi-service identifier or the combination of the multi-service identifier and the sub-service identifiers may be carried in CDRs.

**[0158]** Moreover, a multi-service usually includes a primary service and one or more supplementary services. That is, a multi-service includes a sub-service as the primary service and at least one sub-service as the supplementary service. The sub-service server and sub-service identifier corresponding to the primary service are called primary server and primary service identifier respectively, and the sub-service server and sub-service identifier corresponding to a supplementary service are called supplementary server and supplementary service identifier respectively. The service control function may be performed by a separated entity or be performed by the primary server. The multi-service identifier assigned to the multi-service may be identical with or different from the sub-service identifiers. When the multi-service includes a primary service and at least one supplementary service, the multi-service identifier may be identical with the primary service identifier.

**[0159]** The embodiments of the present invention are mainly applied to session-based applications or services such as multi-party services, the session IDs (SIDs) corresponding to different service sessions are already applied to conventional session-based services. The existing SIDs may be used as service identifiers to correlate a plurality of CDRs. Also new identifiers may be defined as the service identifiers. Usually information exchanged among entities on the application service layer is sent via corresponding bearer control layer entities. For example, servers performing PF of the multi-party service, the server performing CF, and the UEs may exchange information via corresponding bearer control layer entities such as an IMS/SIP Core network (IMS/SIP Core). At the same time, the network functions in the IMS/SIP Core may also generate CDRs for the current application or service in order to implement the charging correlation process on the bearer control layer. Each sub-service server of a sub-service corresponds to a bearer control layer entity, and the bearer control layer entity is adapted to bear the sub-service server.

**[0160]** At present, mainstream multi-services include: combinations of a plurality of multi-party services, a combination of a multi-party service and a Location Service or a combination of a multi-party service and a Presence Service. The second charging correlation scheme of the present invention is described hereinafter with reference to a multi-service comprising two multi-party services, e.g. a PoC service and a Conference service. A server performing CF and a server performing PF in the multi-party service are used to provide the services, yet the second charging correlation scheme focuses on the charging correlation of the sub-services, not internal flows of the sub-services. Therefore, for the sake of simplicity, the service processes between the server performing CF and the server performing PF in the multi-party service are omitted, and the server performing CF and the server performing PF are considered as sub-service servers of the multi-party service. A sub-service server corresponding to the PoC service is called a PoC server, and a sub-service server corresponding to the Conference service is called a Conference server. In embodiments of the present invention, the service control function is implemented by a PoC server.

**[0161]** Figure 9 shows a flowchart of a charging cor-

relation process for a multi-service in accordance with an embodiment of the present invention. In this embodiment, the service control function assigns a multi-service identifier. In this embodiment, the SID adapted to an individual PoC service in a conventional PoC service is used as the multi-service identifier. The entities involved in the embodiment include: PoC Client 1, PoC Client 2, a PoC server, a Conference server and a charging information collecting function. In this embodiment, PoC Client 1 initiates a multi-service and adds PoC Client 2 into the multi-service. As shown in Figure 9, the process includes followings.

**[0162]** 901: PoC Client 1 sends a session establishment request to the PoC server to initiate a PoC service. The session establishment request carries information of PoC Client 2, and is used to instruct to establish a multi-service comprising a Conference service and to add PoC Client 2 into the multi-service. The PoC server implements PoC service logic. A service control function in the PoC server assigns a multi-service identifier to the current multi-service. The multi-service identifier is the SID assigned to the PoC service. The session establishment request may be carried in an SIP INVITE message. However, the present invention is not limited to this.

**[0163]** 902: The service control function in the PoC server sends the session establishment request (e.g., an INVITE message) carrying the SID to the Conference server to initiate a Conference service. The Conference server returns a session establishment response (e.g., a 200OK message). The session establishment request carries the information of PoC Client 2 to indicate that PoC Client 2 need to be added into the Conference service.

**[0164]** After 902, both the PoC service and the Conference service are originated and the PoC server and the Conference server will perform steps ***b*** and ***a*** respectively to generate CDRs of the PoC service and CDRs of the Conference service on the AS-charging information collecting function.

**[0165]** Step ***a*** may include the followings. The Conference server generates CDRs for the present Conference service, requests the AS-charging information collecting function to start charging, and sends to the AS-charging information collecting function the CDRs that are generated by the Conference server and carries the SID. The AS-charging information collecting function opens the CDR received from the Conference server, starts to record actions which affect the accountings and, are performed on the Conference server by users of the Conference service, and returns a response to the Conference server.

**[0166]** Step ***b*** may include the followings. The PoC server generates a CDR for the current PoC service, requests the AS-charging information collecting function to start charging, and sends to the AS-charging information collecting function the CDR that is generated by the PoC server and carries the SID. The AS-charging information collecting function opens the CDR received from the PoC server, starts to record actions which affect the accountings and are performed on the PoC server by users of the PoC service, and returns a response to the PoC server.

**[0167]** 903: The PoC server sends a session joining request carrying the SID to PoC Client 2 in order to add PoC Client 2 into the current PoC service session. PoC Client 2 returns a session joining response to the PoC server in order to indicate that PoC Client 2 has successfully joined the current PoC service session.

**[0168]** After the PoC server has successfully added PoC Client 2 into the current PoC service, the information of PoC Client 2 needs to be recorded in the CDRs of the current PoC service session on the AS-charging information collecting function, therefore step c needs to be performed. Step c may include the followings. The PoC server requests the AS-charging information collecting function to update the charging, and sends the CDR carrying the SID of PoC Client 2 to the AS-charging information collecting function. The AS-charging information collecting function updates the CDR of PoC Client 2 that carries the SID and is received from the PoC server, records the information of PoC Client 2 in the CDR, starts to record actions that affect the accounting and are performed by PoC Client 2 on the PoC server during the current multi-service, and returns a response to the PoC server.

**[0169]** 904: The PoC server sends an acknowledgement (ACK) to the Conference server after PoC Client 2 has successfully joined the current PoC service session, in order to indicate that it is ready for the Conference server to add PoC Client 2 into the service session. The Conference server performs operations similar to the operations in 903 to add PoC Client 2 into the current Conference service session.

**[0170]** The information of PoC Client 2 needs to be recorded in the CDRs of the current Conference service session on the AS-charging information collecting function, therefore step ***d*** needs to be performed. Step ***d*** may include the followings. The Conference server requests the AS-charging information collecting function to update the charging, sends the CDRs that carries the SID of PoC Client 2 to the AS-charging information collecting function. The AS-charging information collecting function updates the CDRs of PoC Client 2 that carries the SID and is received from the Conference server, records the information of PoC Client 2 in the CDRs, starts to record actions that are performed by PoC Client 2 on the Conference server and affect the accounting during the current multi-service, and returns a response to the Conference server.

**[0171]** 905-906: The PoC server sends a session joining request (e.g., an INVITE message) carrying the SID to the Conference server, and the Conference server returns a session joining response (e.g., a 200OK message). The session joining request carries information of PoC Client 1 to indicate that PoC Client 1 need to be added into the Conference service. At the same time, the

PoC server adds PoC Client 1 into the current PoC service session and returns a session joining response (e.g., a 2000K message) to PoC Client 1.

**[0172]** After the PoC server has successfully added PoC Client 1 into the current PoC service session, the information of PoC Client 1 needs to be recorded in the CDRs of the current PoC service session on the AS-charging information collecting function, therefore step e needs to be performed. Step e may include the followings. The PoC server requests the AS-charging information collecting function to update the charging, and sends the CDRs carrying the SID of PoC Client 1 to the AS-charging information collecting function. The AS-charging information collecting function updates the CDRs of PoC Client 1 that carries the SID and is received from the PoC server, records the information of PoC Client 1 in the CDR, starts to record actions that are performed by PoC Client 1 on the PoC server and affect the accounting during the current multi-service, and returns a response to the PoC server.

**[0173]** 907: The PoC server sends an acknowledgement (ACK) to the Conference server after PoC Client 1 has successfully joined the current PoC service session, in order to indicate that it is ready for the Conference server to add PoC Client 1 into the service session. The Conference server performs operations similar to the operations in 903 to add PoC Client 1 into the current Conference service session.

**[0174]** The information of PoC Client 1 needs to be recorded in the CDRs of the current Conference service session on the AS-charging information collecting function, therefore step ***f*** needs to be performed. Step ***f*** may include the followings. The Conference server requests the AS-charging information collecting function to update the charging, and sends the CDRs carrying the SID of PoC Client I to the AS-charging information collecting function. The AS-charging information collecting function updates the CDRs of PoC Client 1 that carries the SID and is received from the Conference server, records the information of PoC Client 1 in the CDR, starts to record actions that are performed by PoC Client 1 on the Conference server and affect the accounting during the current multi-service, and returns a response to the Conference server.

**[0175]** After the processes described above, the CDRs of the sub-services, which are saved in the AS-charging information collecting function, carry the multi-service identifier, therefore, the CDRs of the sub-services can be correlated based on the multi-service identifier.

**[0176]** Figure 10 shows a flowchart of a charging correlation process for a multi-service in accordance with an embodiment of the present invention. In this embodiment, the service control function assigns a multi-service identifier for the multi-service and assigns a sub-service identifier to each sub-service. In this embodiment, the sub-service identifier of the PoC service adopts the SID assigned for an individual PoC service in the conventional PoC service, called SID1. The sub-service identifier of the Conference service adopts the SID assigned for an individual Conference service in the conventional Conference service, called SID2. The entities involved in this embodiment include: PoC Client 1, PoC Client 2, a PoC server, a Conference server and a charging information collecting function. In this embodiment, PoC Client 1 initiates a multi-service and adds PoC Client 2 into the multi-service. As shown in Figure 10, the process includes followings.

**[0177]** 1001: PoC Client 1 sends a session establishment request to the PoC server to initiate a PoC service. The session establishment request carries information of PoC Client 2 and is used to instruct to establish a multi-service comprising a Conference service and to add PoC Client 2 into the multi-service. The PoC server implements PoC service logic. A service control function in the PoC server assigns a multi-service identifier for the current multi-service, assigns one or more sub-service identifiers to the PoC service and assigns one or more sub-service identifiers to the Conference service.

**[0178]** The sub-service identifier of the PoC service adopts the SID assigned to the PoC service, called SID1; the sub-service identifier of the Conference service adopts the SID assigned to the Conference service, called SID2; and the multi-service identifier adopts the SID assigned to the multi-service, called SID0. The session establishment request may be carried in an SIP INVITE message in this embodiment. However, the present invention is not limited to this.

**[0179]** 1002: The service control function in the PoC server sends the session establishment request (e.g., an INVITE message) carrying the SID0 and SID2 to the Conference server to initiate a Conference service. The Conference server returns a session establishment response (e.g., a 2000K message). The session establishment request carries information of PoC Client 2 to indicate that PoC Client 2 need to be added into the Conference service.

**[0180]** After 1002, both the PoC service and the Conference service are originated, and the PoC server and the Conference server will perform steps ***b*** and ***a*** respectively to generate CDRs of the PoC service session and CDRs of the Conference service session on the AS-charging information collecting function.

**[0181]** Step ***a*** may include the followings. The Conference server generates CDRs for the current Conference service, requests the AS-charging information collecting function to start charging, and sends to the AS-charging information collecting function the CDRs that is generated by the Conference server and carries the SID0 and SID2. The AS-charging information collecting function opens the CDRs received from the Conference server, starts to record actions of the Conference service which are performed on the Conference server by users and affect the accounting, and returns a response from the AS-charging information collecting function to the Conference server.

**[0182]** Step ***b*** may include the followings. The PoC

server generates CDRs for the current PoC service, requests the AS-charging information collecting function to start charging, and sends to the AS-charging information collecting function the CDRs that is generated by the PoC server and carries the SID0 and SID1. The AS-charging information collecting function opens the CDRs from the PoC server, starts to record actions of the PoC service which are performed on the PoC server by users and affect the accounting, and returns a response to the PoC server.

**[0183]** 1003: The PoC server sends a session joining request carrying the SID0 and SID1 to PoC Client 2 in order to add PoC Client 2 into the current PoC service session. PoC Client 2 returns a session joining response to the PoC server in order to indicate that PoC Client 2 has successfully joined the current PoC service session.

**[0184]** After the PoC server has successfully added PoC Client 2 into the current PoC service, the information of PoC Client 2 needs to be recorded in the CDRs of the current PoC service session on the AS-charging information collecting function, therefore step ***c*** needs to be performed. Step ***c*** may include the followings. The PoC server requests the AS-charging information collecting function to update the charging, and sends the CDRs carrying the SID0 and SID1 of PoC Client 2 to the AS-charging information collecting function. The AS-charging information collecting function updates the CDRs of PoC Client 2 that carry the SID0 and SID1 and are received from the PoC server, records the information of PoC Client 2 in the CDRs, starts to record actions that are performed by PoC Client 2 on the PoC server and affect the accounting during the current multi-service, and returns a response to the PoC server.

**[0185]** 1004: The PoC server sends an acknowledgement (ACK) to the Conference server after PoC Client 2 has successfully joined the current PoC service session, in order to indicate that it is ready for the Conference server to add PoC Client 2 into the service session. The Conference server performs operations similar to the operations in 1003 in order to add PoC Client 2 into the current Conference service.

**[0186]** The information of PoC Client 2 needs to be recorded in the CDRs of the current Conference service on the AS-charging information collecting function, therefore step ***d*** needs to be performed. Step ***d*** may include the followings. The Conference server requests the AS-charging information collecting function to update the charging, and sends to the AS-charging information collecting function the CDRs carrying the SID0 and SID2 of PoC Client 2. The AS-charging information collecting function updates the CDRs of PoC Client 2 that carry the SID0 and SID2 are received from the Conference server, records the information of PoC Client 2 in the CDRs, starts to record actions that are performed by PoC Client 2 on the Conference server and affect the accounting during the current multi-service, and returns a response to the Conference server.

**[0187]** 1005-1006: The PoC server sends a session joining request (e.g., an INVITE message) carrying the SID0 and SID2 to the Conference server, and the Conference server returns a session joining response (e.g., a 2000K message). The session joining request carries information of PoC Client 1 to indicate that PoC Client 1 can be added into the Conference service session. At the same time, the PoC server adds PoC Client 1 into the current PoC service session and returns a session joining response (e.g., a 2000K message) to PoC Client 1.

**[0188]** After the PoC server has successfully added PoC Client 1 into the current PoC service session, the information of PoC Client 1 needs to be recorded in the CDRs of the current PoC service on the AS-charging information collecting function, therefore step ***e*** needs to be performed. Step e may include the followings. The PoC server requests the AS-charging information collecting function to update the charging, and sends to the AS-charging information collecting function the CDRs carrying the SID0 and SID1 of PoC Client 1. The AS-charging information collecting function updates the CDRs of PoC Client 1 that carry the SID0 and SID1 are received from the PoC server, records the information of PoC Client 1 in the CDRs, starts to record actions that are performed by PoC Client 1 on the PoC server and affect the accounting during the current multi-service, and returns a response to the PoC server.

**[0189]** 1007: The PoC server sends an acknowledgement (ACK) to the Conference server after PoC Client 1 has successfully joined the current PoC service session, in order to indicate that it is ready for the Conference server to add PoC Client 1 into the service session. The Conference server performs operations similar to the operations in 1003 to add PoC Client 1 into the current Conference service session.

**[0190]** The information of PoC Client 1 needs to be recorded in the CDRs of the current Conference service on the AS-charging information collecting function, therefore step ***f*** needs to be performed. Step ***f*** may include the followings. The Conference server requests the AS-charging information collecting function to update the charging, and sends to the AS-charging information collecting function the CDRs carrying the SID0 and SID2 of PoC Client 1. The AS-charging information collecting function updates the CDRs of PoC Client 1 that carry the SID0 and SID2 are received from the Conference server, records the information of PoC Client 1 in the CDRs, starts to record actions that are performed by PoC Client 1 on the Conference server and affect the accounting during the current multi-service, and returns a response to the Conference server.

**[0191]** After the processes described above, CDRs of the sub-services in the AS-charging information collecting function have the multi-service identifier and the sub-service identifiers corresponding to the sub-services. Therefore the CDRs of a sub-service may be correlated based on the sub-service identifier of the sub-service, and the CDRs of different sub-services, which have al-

ready been correlated based on the sub-service identifiers, are then correlated based on the multi-service identifier.

**[0192]** Figures 9 and 10 illustrate the second charging correlation scheme of the present invention which is applied to the application service layer. When the charging correlation scheme is applied to the bearer control layer, the entities involved include: a bearer control layer entity corresponding to the sub-service servers, a bearer control layer-charging information collecting function, and UEs. The bearer control layer entities corresponding to the sub-service servers may record the multi-service identifier and/or sub-service identifiers when the multi-service identifier and/or sub-service identifiers are received by the sub-service servers, generate CDRs, and send the received multi-service identifier and/or sub-service identifiers and the CDRs to the corresponding bearer control layer-charging information collecting functions. The processes in which the charging correlation scheme is applied to the bearer control layer is similar to that in Figures 9 and 10 and will not be described in detail herein, but is covered by the protection scope of the present invention.

**[0193]** Moreover, the charging correlation process may be variable based on different multi-services to be charged for, yet the charging correlation process will always be in accordance with the two methods of implementing the second charging correlation scheme provided in the above embodiments of the present invention. Since different multi-services may include various sub-services, the charging flow may vary in different ways. For example, the service control function may send the multi-service identifier and the sub-service identifiers to the primary server and the supplementary servers in different ways: 1) the service control function may send a primary service identifier when initiating a primary service session, or when setting up the primary service session, or when setting up all supplementary service sessions, or when setting up the current multi-service session; 2) the service control function may send the multi-service identifier when initiating the primary service session, or when setting up the primary service session, or when setting up all supplementary service sessions, or when setting up the current multi-service session; 3) the service control function may send a supplementary service identifier when initiating corresponding supplementary service session, or when setting up corresponding supplementary service session, or when setting up the current multi-service session; 4) the service control function may send the multi-service identifier when initiating each of the supplementary service sessions, or when setting up each of the supplementary service sessions, or when setting up the current multi-service session. Various charging correlation processes for various multi-services will not be listed herein. However, any charging correlation process for multi-service that is in accordance with the principles of the current invention falls in the scope of the present invention.

**[0194]** In embodiments of the present invention, a sub-service included in a multi-service can be any application or service. A multi-service may include sub-services such as PoC service, Conference service, Location service, Presence service and any combination of the above applications and services.

**[0195]** A system for charging correlation for an application or service is further proposed. Figure 11 is a structure diagram of a system for implementing a charging correlation of an application or service in accordance with an embodiment of the present invention. In an embodiment of the present invention, the system includes a service identifier generating unit, a CDR generating unit and a CDR correlating unit.

**[0196]** The service identifier generating unit is adapted to assign a service identifier to a current application or service and send the service identifier to the CDR generating unit. The CDR generating unit is adapted to receive the service identifier from the service identifier generating unit, generate a plurality of CDRs for the current application or service and send the received service identifier and the CDRs generated to the CDR correlating unit. The CDR correlating unit is adapted to receive the CDRs and the service identifier from the CDR generating unit and correlate the CDRs of the current application or service based on the service identifier.

**[0197]** The service identifier generating unit may be a separated entity or be integrated into the service control function of the application or service. When the system is applied to a single-service, the service control function is an AS of the current application or service, e.g., a server performing CF for a multi-party service such as PoC service and Conference service. When the system is applied to a multi-service, the service control function is a service control function of the current multi-service. The service control function may be integrated into an AS of a sub-service (i.e., a sub-service server) of the multi-service or be integrated into a server performing CF for the multi-party service such as the PoC service and the Conference service. The CDR correlating unit may also be a separated entity or be integrated into a charging system.

**[0198]** Moreover, the CDR generating unit may further add the received service identifier into the CDRs generated so that the CDRs and the service identifier may be sent.

**[0199]** In the system provided by embodiments of the present invention, the units may function according to the processes described in the preceding embodiments, and detailed functions of the units are not described anymore.

**[0200]** A system for charging correlation is also proposed by embodiments of the present invention. The system for charging correlation includes a service control function entity and a charging system. The service control function entity is adapted to assign a service identifier to a current application or service and the charging system is adapted to correlate at least one set of CDRs generated for the application or service based on the service iden-

tifier that is assigned by the service control function entity. The charging system may further include a charging information collecting function entity and a billing center. The charging information collecting function entity is adapted to receive the service identifier from the service control function entity and collect at least one set of CDRs, and the billing center is adapted to correlate at least one set of CDRs based on the service identifier.

**[0201]** The service control function entity may be an AS adapted to generate at least one set of CDRs for the application or service. The system may further include a bearer control layer entity adapted to record the service identifier assigned by the service control function entity, and generate at least one set of CDRs. In such a case the charging information collecting function entity further includes an AS-charging information collecting function entity and a bearer control layer-charging information collecting function entity. The AS-charging information collecting function is adapted to receive the service identifier from the service control function entity (i.e., the AS) and the at least one set of CDRs generated by the service control function entity, and the bearer control layer-charging information collecting function entity is adapted to receive the service identifier from a bearer control entity and the at least one set of CDRs generated by the bearer control layer entity. Therefore the billing center can correlate the at least one set of CDRs received from the bearer control layer-charging information collecting function entity based on the service identifier, or correlate the at least one set of CDRs received from the AS-charging information collecting function entity based on the service identifier, or correlate the at least one set of CDRs from the bearer control layer-charging information collecting function entity and the at least one set of CDRs from the AS-charging information collecting function entity based on the service identifier.

**[0202]** When the application or service is a multi-party service, the service control function entity is a server performing CF. At least one server performing PF may further be included. The bearer control layer entity may include a bearer control layer entity corresponding to the server performing CF, and at least one bearer control layer entity corresponding to the server performing PF. The bearer control layer entity corresponding to the server performing CF is adapted to bear the server performing CF, and a bearer control layer entity corresponding to a server performing PF is adapted to bear the server performing PF. The AS-charging information collecting function entity may further include an AS-charging information collecting function entity of the server performing CF and at least one AS-charging information collecting function entity of the server performing PF. The bearer control layer-charging information collecting function entity may further include a bearing control layer charging information collecting function entity of the bearer control layer entity corresponding to the server performing CF, and at least one bearer control layer-charging information collecting function entity of a bearer control layer entity corresponding to a server performing PF.

**[0203]** When the application or service is a multi-service comprising a plurality of sub-services, the system may further include sub-service servers of a plurality of sub-services. The bearer control layer entity may further include at least one bearer control layer entity corresponding to a plurality of sub-service servers. The bearer control layer entity corresponding to the sub-service servers is adapted to bear the sub-service servers. The AS-charging information collecting function entity may further include AS-charging information collecting function entities of sub-service servers, and the bearer control layer-charging information collecting function entity may further include bearer control layer-charging information collecting function entities of bearer control layer entities of sub-service servers.

**[0204]** The functions of the components of the system in various cases have been given in the preceding description and will not be explained further herein, but are still covered by the protection scope of the present invention.

**[0205]** A billing center is also proposed in embodiments of the present invention. The billing center may include a first module adapted to receive a service identifier of the current application or service, and receive at least one set of CDRs generated for the application or service, and a second module adapted to correlate at least one set of CDRs based on the service identifier received by the first module and generate a bill. The CDRs received by the first module may be CDRs generated by an AS and CDRs generated by a bearer control layer entity. The second module may correlate the CDRs generated by the AS based on the service identifier, or correlate the CDRs generated by the bearer control layer entity based on the service identifier, or correlate the CDRs generated by the AS and the CDRs generated by the bearer control layer entity together based on the service identifier.

**[0206]** An apparatus for generating charging data record is also proposed in embodiments of the present invention. The an apparatus for generating charging data record may include a first module and a second module. The first module is adapted to receive a service identifier assigned to the current application or service, and the second module is adapted to generate for the application or service at least one set of CDRs carrying the service identifier that is received by the first module and adapted to export the at least one set of CDRs. The an apparatus for generating charging data record may be an AS or a bearer control layer entity in embodiments of the present invention.

**[0207]** In one word, in embodiments of the present invention, a plurality of CDRs generated for a user in a service session may be correlated for charging, and the CDRs of a plurality of sub-services in a multi-service of the user can also be correlated for charging. Furthermore, the embodiments of the present invention is easy to implement and can improve accuracy of correlated

charging. Therefore the methods and apparatus proposed in the embodiments of the present invention are beneficial in supplementing and improving the conventional application or service charging correlation process (especially the charging correlation process of a multi-party service).

**[0208]** The previous description of the disclosed embodiments is provided to enable those skilled in the art to make or use the present invention. Various modifications to these embodiments will be readily apparent to those skilled in the art and generic principles defined herein may be applied to other embodiments without departing from the scope of the invention. Thus, the present invention is not intended to be limited to the embodiments shown herein but is to be accorded the widest scope consistent with the principles and novel features disclosed herein.

## Claims

1. A method for charging correlation for an application or service, comprising:

   assigning a service identifier by a service control function to an application or service;
   sending the service identifier to a charging system; and
   correlating, by the charging system, at least one Charging Data Record CDR generated for the application or service based on the service identifier.

2. The method according to Claim 1, wherein the charging system comprises a charging information collecting function entity and a billing center; and the method further comprises:

   sending the service identifier to the billing center via the charging information collecting function entity; and
   correlating, by the billing center, the at least one CDR generated by the service control function entity based on the service identifier.

3. The method according to Claim 2, wherein the application or service is a single-service, the service control function entity comprises an Application Server AS and the charging information collecting function entity comprises an AS charging information collecting function entity corresponding to the AS; and the method further comprises:

   assigning a service identifier by the AS to the single-service;
   sending the service identifier to the billing center via the AS charging information collecting function entity; and
   correlating, by the billing center, the at least one CDR generated by the AS based on the service identifier.

4. The method according to Claim 3, wherein the charging information collecting function entity further comprises: a bearer control layer charging information collecting function entity corresponding to a bearer control layer entity that corresponds to the AS, and the method further comprises:

   assigning the service identifier by the AS to the single-service;
   sending the service identifier to the billing center via the AS charging information collecting function entity;
   recording the service identifier by the bearer control layer entity that corresponds to the AS;
   sending the service identifier to the billing center via the bearer control layer charging information collecting function entity; and
   correlating, by the billing center, the at least one CDR generated by the AS based on the service identifier and correlating the at least one CDR generated by the bearer control layer entity based on the service identifier; or correlating the at least one CDR generated by the AS together with the at least one CDR generated by the bearer control layer entity based on the service identifier.

5. The method according to Claim 4, wherein the application or service is a multi-party service, the AS further comprises a server performing Control Function CF and at least one server performing Participating Function PF, and the service control function entity is the server performing CF; the AS charging information collecting function entity further comprises: at least one AS charging information collecting function entity covered by the server performing CF and at least one AS charging information collecting function entity covered by at least one server performing PF; the bearer control layer charging information collecting function entity further comprises at least one bearer control layer charging information collecting function entity covering the bearer control layer entities corresponding to the server performing CF and at least one server performing PF respectively, the bearer control layer entity corresponding to the server performing CF is used for bearing the server performing CF and the bearer control layer entity corresponding to a server performing PF is used for bearing the server performing PF;
   the server performing CF assigns the service identifier to the multi-party service and sends the service identifier to the at least one server performing PF, the server performing CF and the at least one server performing PF send the service identifier to the billing

center respectively via the AS charging information collecting function entity which corresponds to the server performing CF and the AS charging information collecting function entity which corresponds to the server performing PF;
the bearer control layer entities corresponding respectively to the server performing CF and the at least one server performing the PF record the service identifier, and send the server identifier to the billing center via the at least one bearer control layer charging information collecting function entity;
correlating, by the billing center, the CDRs generated by the server performing CF and generated by the at least server performing PF based on the service identifier, and correlating the CDRs generated by the bear control layer entities; or, correlating, by the billing center, the CDRs generated by the bear control layer entities, the CDRs generated by the server performing CF and generated by the at least server performing PF based on the service identifier.

**6.** The method according to any one of Claims 1 to 5, wherein sending the service identifier to the charging system comprises:

sending the at least CDR that carries the service identifier to the charging system.

**7.** The method according to any one of Claims 1 to 5, wherein in the application or service, one user is established at least one session, and one CDR corresponds to one session of one user; and
the at least CDR correlated for the application or service based on the service identifier comprises: CDRs corresponding to a plurality of sessions of one user in the application or service, or CDRs corresponding to a plurality of sessions of a part of or all users in the application or service.

**8.** The method according to Claim 2, wherein the application or service is a multi-service comprising a plurality of sub-services; the charging information collecting function entity comprises: at least one AS charging information collecting function entity which respectively corresponds to multiple sub-service server providing multiple sub-services; the service identifier assigned by the service control function entity for the application or service comprises: multi-service identifier of the multi-service and multiple sub-service identifiers of the multiple sub-services;
respectively receiving, by the multiple sub-service servers, the multi-service identifier and the respective sub-service identifier from the service control function entity, and sending the multi-service identifier and the respective sub-service identifier to the billing center via respective AS charging information collecting function entity; and
correlating, the billing center, the CDRs each sub-service server using the respective sub-service identifier, and correlating, the CDRs generated by all sub-service servers using the multi-service identifier.

**9.** The method according to Claim 8, wherein the charging information collecting function entity comprises: multiple bear control layer charging information collecting function entities of bear control layer entities that respectively correspond to the multiple sub-service servers; and the bear control layer entities that respectively correspond to the multiple sub-service servers are adapted to respectively bear the bear control layers;
recording, by the bear control layer entities that respectively correspond to the multiple sub-service servers, the corresponding sub-service identifier and the multi-service identifier, and sending the corresponding sub-service identifier and the multi-service identifier to the billing center via respective bear control layer charging information collecting function entities;
correlating, by the billing center, the CDRs generated by each bear control layer entity based on the corresponding sub-service identifier, and correlating CDRs generated by all the bear control layer entities based on the multi-service identifier.

**10.** The method according to Claim 8 or 9, wherein sending the multi-service identifier and the sub-service identifier comprises:

sending the CDRs that carry the multi-service identifier and the sub-service identifier.

**11.** The method according to Claim 8 or 9, wherein the multi-service identifier is identical to one of the sub-service identifiers, or is not identical to any one of the sub-service identifiers.

**12.** The method according to Claim 2, wherein the application or service is a multi-service comprising a plurality of sub-services; the service identifier assigned by the service control function entity for the application or service comprises: multi-service identifier of the multi-service; the charging information collecting function comprises: at least one AS charging information collecting function entity that respectively correspond to the multiple sub-service servers;
receiving, by the multiple sub-service servers, the multi-service identifier from the service charging information collecting function entity, and respectively sending the multi-service identifier to the billing center via respective AS charging information collecting function entity; correlating, by the billing center, the CDRs generated by the multiple sub-service servers based on the multi-service identifier.

**13.** The method according to Claim 12, wherein the

charging information collecting function entity comprises: multiple bear control layer charging information collecting function entities of bear control layer entities that respectively correspond to the multiple sub-service servers; and the bear control layer entities that respectively correspond to the multiple subservice servers are adapted to respectively bear the bear control layers;
the method further comprises:

recording, by the bear control layer entities that respectively correspond to the multiple subservice servers, the multi-service identifier, and sending the multi-service identifier to the billing center via respective bear control layer charging information collecting function entities; correlating, by the billing center, the CDRs generated by the bear control layer entities based on the the multi-service identifier.

**14.** The method according to Claim 12 or 13, wherein sending the multi-service identifier comprises: sending the CDRs that carry the multi-service identifier.

**15.** A system for charging correlation for an application or service, comprising:

a service control function, adapted to assign a service identifier for an application or service; and
a charging system, adapted to correlate at least one Charging Data Records CDR generated for the application or service based on the service identifier.

**16.** The system according to Claim 15, wherein the charging system comprises:

a charging information collecting function entity, adapted to receive the service identifier assigned by the service control function entity and collect the at least one CDR; and
a billing center, adapted to correlate the at least one CDR based on the service identifier received from the charging information collecting function entity.

**17.** The system according to Claim 16, wherein the service control function comprises an Application Server AS adapted to generate at least one CDR for the application or service; and the system further comprises a bearer control layer entity, adapted to record the service identifier and generate at least one CDR for the application or service.
wherein the charging information collecting function entity comprises:

an AS-charging information collecting function entity, adapted to receive the service identifier and the at least one CDR from the service control function entity;
a bearer control layer-charging information collecting function entity, adapted to receive the service identifier and the at least one CDR from the bearer control layer entity;

wherein
the billing center is further adapted to correlate the at least one CDR from the bearer control layer-charging information collecting function entity based on the service identifier, and correlate the at least one CDR from the AS-charging information collecting function entity based on the service identifier respectively, or adapted to correlate the at least one CDR from the bearer control layer-charging information collecting function entity with the at least one CDR from the AS-charging information collecting function entity based on the service identifier.

**18.** The system according to Claim 17, wherein the application or service is a multi-party service and the service control function entity is a server performing Controlling Function CF,
the system further comprises at least one server performing Participating Function PF,
wherein the bearer control layer entity comprises a bearer control layer entity corresponding to the server performing CF and at least one bearer control layer entity corresponding to the at least one server performing PF; the bearer control layer entity corresponding to the server performing CF is adapted to bear the server performing CF and the bearer control layer entity corresponding to the server performing PF is adapted to bear the server performing PF;
the AS-charging information collecting function entity comprises an AS-charging information collecting function entity corresponding to the server performing CF and at least one AS-charging information collecting function corresponding to the at least one server performing PF;
the bearer control layer-charging information collecting function comprises a bearer control layer-charging information collecting function entity of the bearer control layer entity corresponding to the server performing CF and at least a bearer control layer-charging information collecting function of the bearer control layer entity corresponding to the at least one server performing PF;
the server performing CF is adapted to assign the service identifier, send the service identifier to the at least one server performing PF, generate at least one set of CDR and send the service identifier and the CDRs to the AS-charging information collecting function entity of the server performing CF;
each server performing PF is adapted to record the service identifier, generate at least one set of CDR

and send the at least one set of CDR and the service identifier to the AS-charging information collecting function entity of the server performing PF;
the bearer control layer entity corresponding to the server performing CF is adapted to record the service identifier, generate the CDRs and send the CDRs and the service identifier to the bearer control layer-charging information collecting function entity of the bearer control layer entity;
each bearer control layer entity corresponding to a server performing PF is adapted to record the service identifier, generate the CDRs and send the CDRs and the service identifier to the bearer control layer-charging information collecting function entity of the bearer control layer entity;
the AS-charging information collecting function entity is adapted to send the service identifier and the CDRs to the billing center; and
the bearer control layer-charging information collecting function entity is adapted to send the service identifier and the CDRs to the billing center.

**19.** The system according to Claim 17, wherein the application or service is a multi-service comprising a plurality of sub-services, and
the system further comprises a plurality of sub-service servers providing the plurality of sub-services respectively; wherein
the bearer control layer entity comprises at least one bearer control layer entity corresponding to the sub-service servers and is adapted to bear the sub-service servers;
the AS-charging information collecting function entity comprises AS-charging information collecting function entities of respective sub-service servers;
the bearer control layer-charging information collecting function entity comprises bearer control layer-charging information collecting function entities of the bearer control layer entities corresponding to respective sub-service servers;
the service control function entity is further adapted to assign sub-service identifiers for the sub-services and send the service identifier and the sub-service identifiers to the sub-service servers;
each sub-service server is adapted to record the service identifier and the sub-service identifiers from the service control function entity, generate at least one set of CDRs for the sub-service provided by the sub-service server and send the service identifier, the sub-service identifier and the at least one set of CDRs to the AS-charging information collecting function entity of the sub-service server;
the bearer control layer entity corresponding to the sub-service server is adapted to record the service identifier and the sub-service identifier from the sub-service server, generate at least one set of CDRs for the sub-service provided by the sub-service server and send the service identifier, the sub-service identifier and the at least one set of CDRs to the bearer control layer-charging information collecting function entity of the bearer control layer entity;
the AS-charging information collecting function entity is adapted to send the service identifier, sub-service identifiers and the CDRs to the billing center;
the bearer control layer-charging information collecting function entity is adapted to send the service identifier, sub-service identifiers and the CDRs to the billing center; and
the billing center is further adapted to correlate CDRs of each sub-service according to the sub-service identifier corresponding to the sub-service, and correlate CDRs of the plurality of sub-services according to the service identifier.

**20.** The system according to Claim 17, wherein the application or service is a multi-service comprising a plurality of sub-services, and
the system further comprises a plurality of sub-service servers providing the sub-services; wherein
the bearer control layer entity comprises at least one bearer control layer entity corresponding to the sub-service servers and is adapted to bear the sub-service servers;
the AS-charging information collecting function entity comprises AS-charging information collecting function entities corresponding to the sub-service servers; the bearer control layer-charging information collecting function entity comprises bearer control layer-charging information collecting function entities corresponding to the bearer control layer entities corresponding to the sub-service servers;
the service control function entity is adapted to send the service identifier to the sub-service servers;
the sub-service server is adapted to record the service identifier from the service control function entity, generate at least one set of CDRs for the sub-service provided by the sub-service server and send the at least one set of CDRs and the service identifier to the AS-charging information collecting function entity of the sub-service server;
the bearer control layer entity corresponding to a sub-service server is adapted to record the service identifier from the sub-service server, generate at least one set of CDRs for the sub-service provided by the sub-service server and send the service identifier and the at least one set of CDRs to the bearer control layer-charging information collecting function entity of the bearer control layer entity;
an AS-charging information collecting function entity is adapted to send the service identifier and the CDRs to the billing center;
a bearer control layer-charging information collecting function entity is adapted to send the service identifier and the CDRs to the billing center; and
the billing center is adapted to correlate the CDRs of the sub-services based on the service identifier.

**21.** A billing center, comprising:

a first module, adapted to receive a service identifier assigned for an application or service and Charging Data Records CDRs generated for the application or service; and
a second module, adapted to correlate the CDRs based on the service identifier from the first module.

**22.** The billing center according to Claim 21, wherein the CDRs received by the first module comprise CDRs generated by an Application Server AS and CDRs generated by a bearer control layer entity; and
the second module is adapted to correlate the CDRs generated by the AS based on the service identifier and correlate the CDRs generated by the bearer control layer entity based on the service identifier respectively, or adapted to correlate the CDRs generated by the AS and the CDRs generated by the bearer control layer entity based on the service identifier.

**23.** The billing center according to any of Claim 21 or 22, wherein the application or service comprises at least one session and each set of the CDRs identified by ICID corresponds to one session; and
the second module is adapted to correlate a plurality of CDRs corresponding to a plurality of sessions of one user in the application or service based on the service identifier, or adapted to correlate a plurality of CDRs corresponding to a plurality of sessions of a part of or all users in the application or service based on the service identifier.

**24.** A apparatus for generating a charging data record, comprising:

a first module, adapted to receive a service identifier assigned for an application or service; and
a second module, adapted to generate Charging Data Records, CDRs, carrying the service identifier from the first module for the application or service.

**25.** The apparatus according to Claim 24, wherein the apparatus is an AS or a bearer control layer entity.

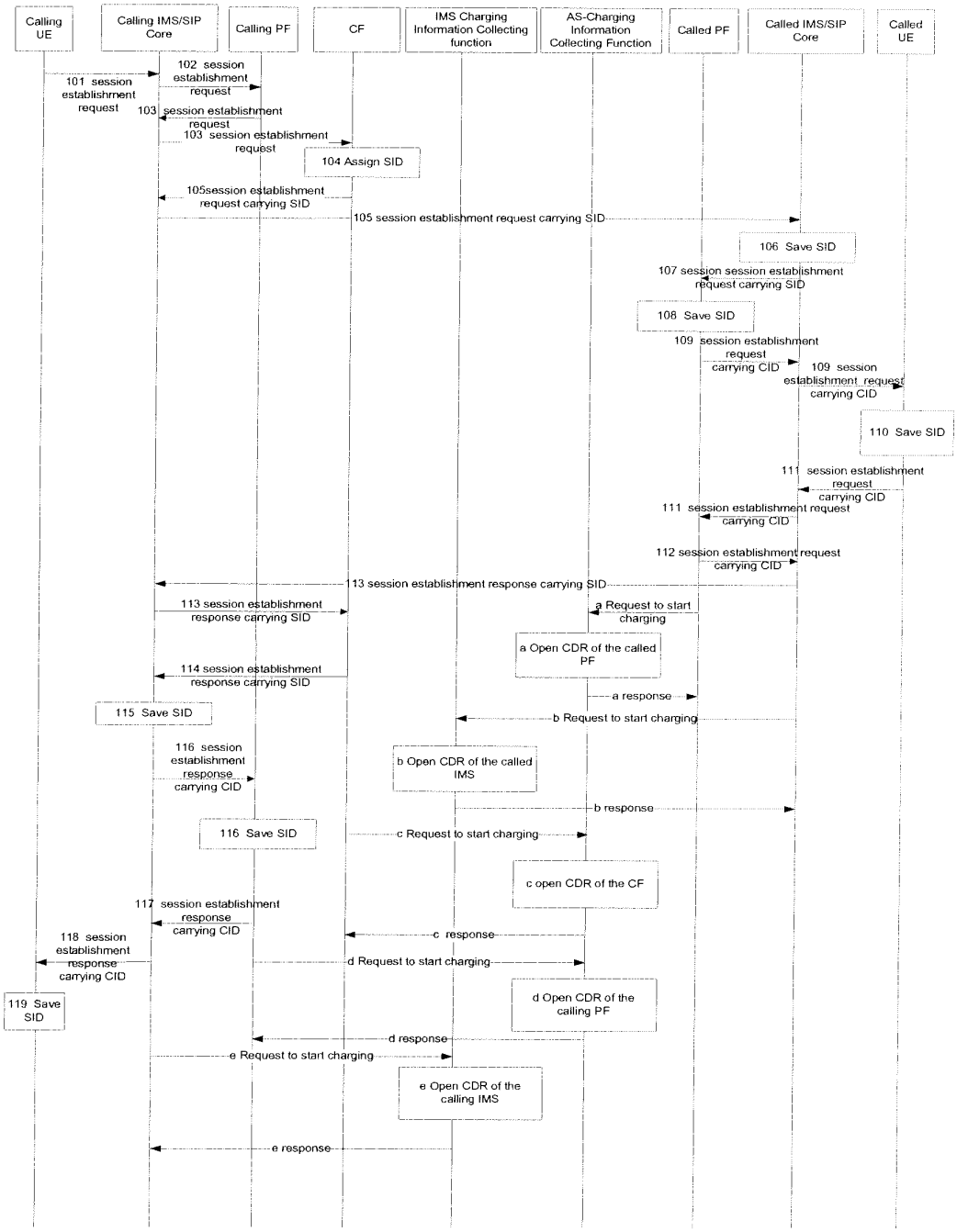

Calling UE
Calling IMS/SIP Core
Calling PF
CF
IMS Charging Information Collecting function
AS-Charging Information Collecting Function
Called PF
Called IMS/SIP Core
Called UE
101 session establishment request
102 session establishment request
103 session establishment request
103 session establishment request
104 Assign SID
105session establishment request carrying SID
105 session establishment request carrying SID
106 Save SID
107 session session establishment request carrying SID
108 Save SID
109 session establishment request carrying CID
109 session establishment request carrying CID
110 Save SID
111 session establishment request carrying CID
111 session establishment request carrying CID
112 session establishment request carrying CID
113 session establishment response carrying SID
113 session establishment response carrying SID
a Request to start charging
a Open CDR of the called PF
114 session establishment response carrying SID
a response
115 Save SID
b Request to start charging
116 session establishment response carrying CID
b Open CDR of the called IMS
b response
116 Save SID
c Request to start charging
c open CDR of the CF
117 session establishment response carrying CID
c response
118 session establishment response carrying CID
d Request to start charging
d Open CDR of the calling PF
119 Save SID
d response
e Request to start charging
e Open CDR of the calling IMS
e response

Fig. 1

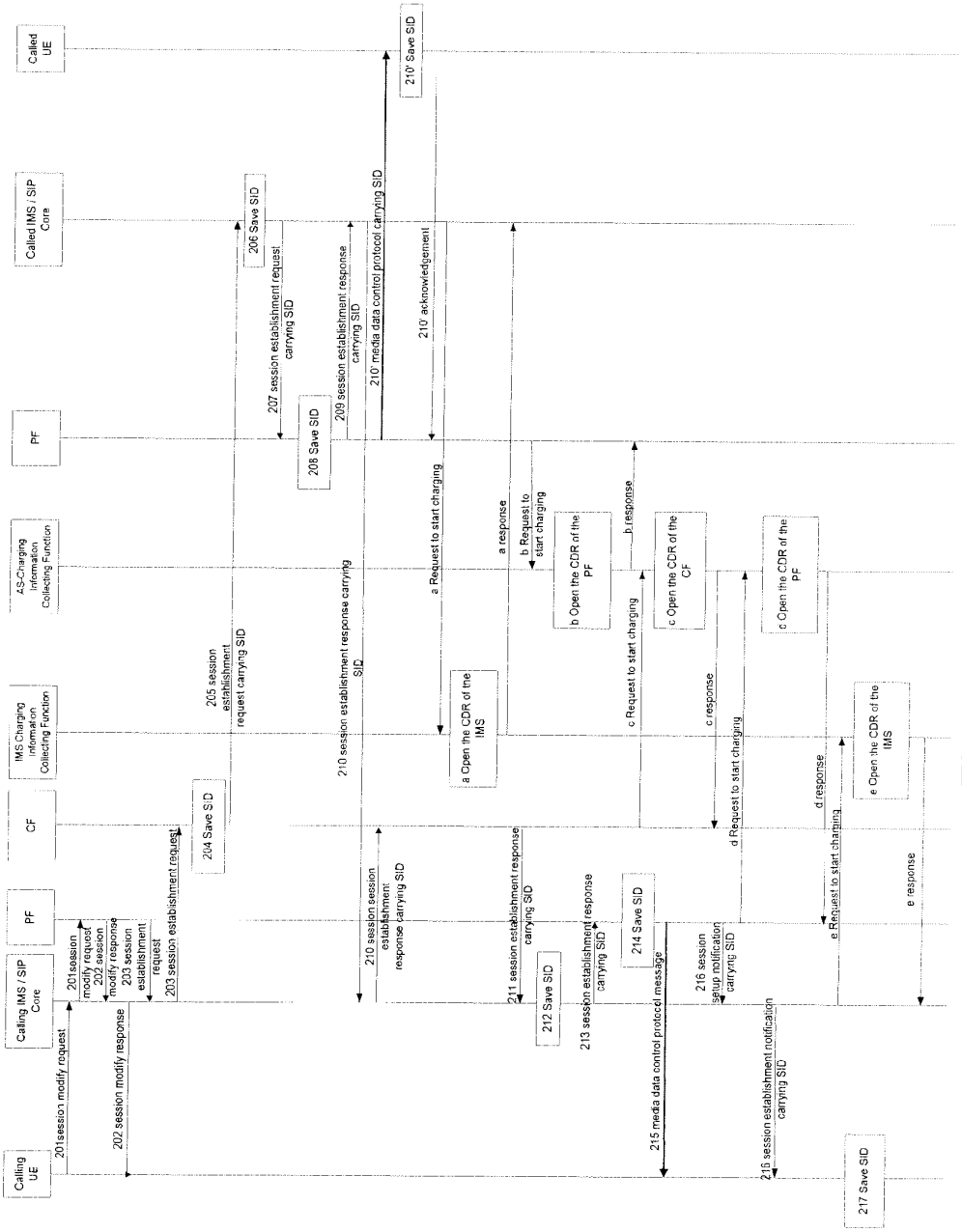

Calling UE
Calling IMS / SIP Core
PF
CF
IMS Charging Information Collecting Function
AS-Charging Information Collecting Function
PF
Called IMS / SIP Core
Called UE
201 session modify request
202 session modify response
201 session modify request
202 session modify response
203 session establishment request
203 session establishment request
204 Save SID
205 session establishment request carrying SID
206 Save SID
207 session establishment request carrying SID
208 Save SID
209 session establishment response carrying SID
210' media data control protocol carrying SID
210' Save SID
210' acknowledgement
210 session establishment response carrying SID
210 session establishment response carrying SID
a Request to start charging
a response
a Open the CDR of the IMS
b Request to start charging
b response
b Open the CDR of the PF
c Request to start charging
c response
c Open the CDR of the CF
d Request to start charging
d response
c Open the CDR of the PF
e Request to start charging
e response
e Open the CDR of the IMS
211 session establishment response carrying SID
212 Save SID
213 session establishment response carrying SID
214 Save SID
215 media data control protocol message
216 session setup notification carrying SID
216 session establishment notification carrying SID
217 Save SID

Fig. 2

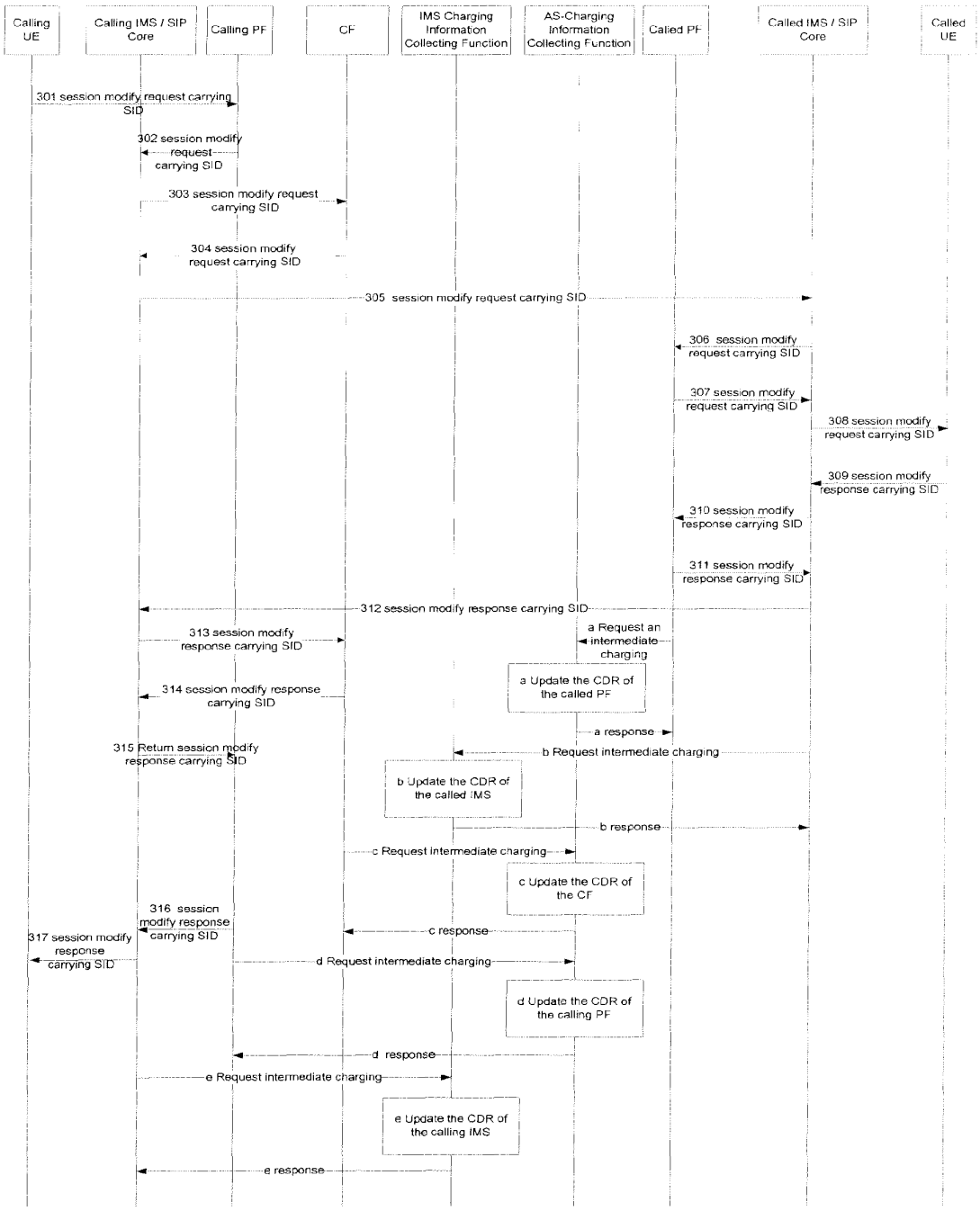

Calling UE
Calling IMS / SIP Core
Calling PF
CF
IMS Charging Information Collecting Function
AS-Charging Information Collecting Function
Called PF
Called IMS / SIP Core
Called UE
301 session modify request carrying SID
302 session modify request carrying SID
303 session modify request carrying SID
304 session modify request carrying SID
305 session modify request carrying SID
306 session modify request carrying SID
307 session modify request carrying SID
308 session modify request carrying SID
309 session modify response carrying SID
310 session modify response carrying SID
311 session modify response carrying SID
312 session modify response carrying SID
313 session modify response carrying SID
a Request an intermediate charging
a Update the CDR of the called PF
314 session modify response carrying SID
a response
315 Return session modify response carrying SID
b Request intermediate charging
b Update the CDR of the called IMS
b response
c Request intermediate charging
c Update the CDR of the CF
316 session modify response carrying SID
c response
317 session modify response carrying SID
d Request intermediate charging
d Update the CDR of the calling PF
d response
e Request intermediate charging
e Update the CDR of the calling IMS
e response

**Fig. 3**

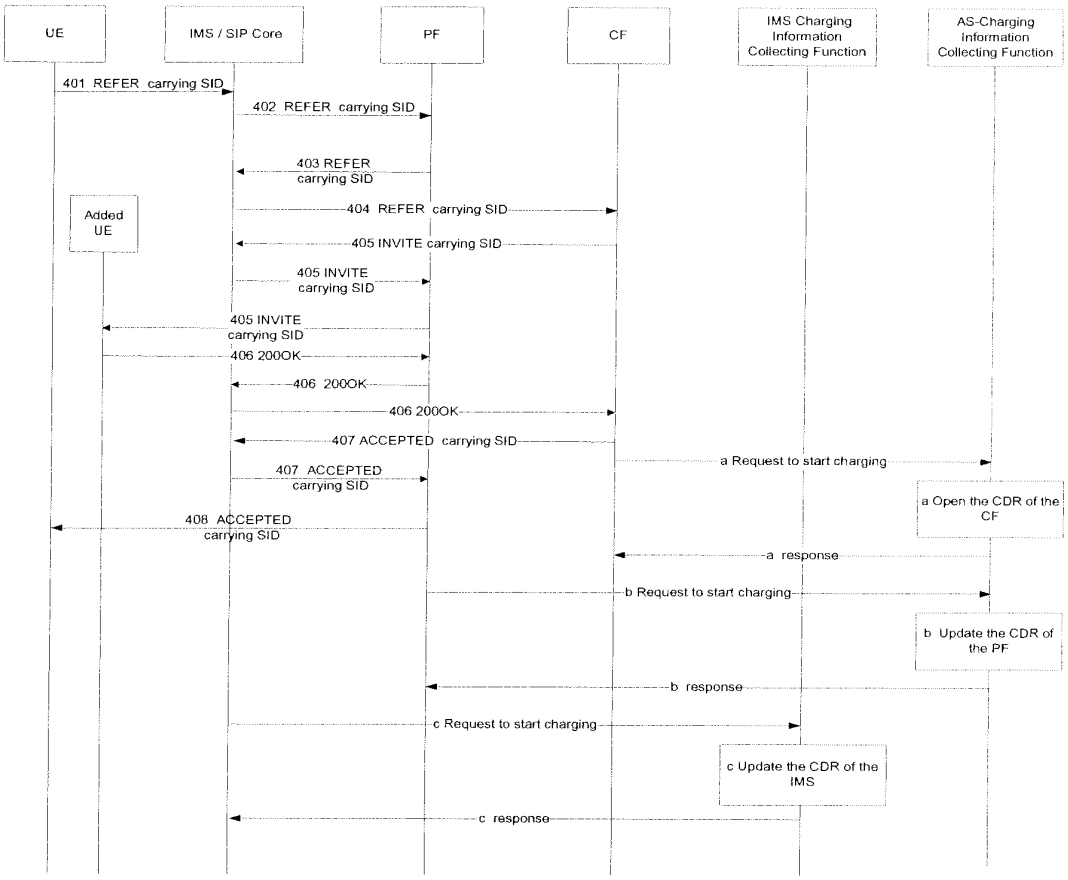

UE
IMS / SIP Core
PF
CF
IMS Charging Information Collecting Function
AS-Charging Information Collecting Function
401 REFER carrying SID
402 REFER carrying SID
403 REFER carrying SID
404 REFER carrying SID
Added UE
405 INVITE carrying SID
405 INVITE carrying SID
405 INVITE carrying SID
406 200OK
406 200OK
406 200OK
407 ACCEPTED carrying SID
a Request to start charging
407 ACCEPTED carrying SID
a Open the CDR of the CF
408 ACCEPTED carrying SID
a response
b Request to start charging
b Update the CDR of the PF
b response
c Request to start charging
c Update the CDR of the IMS
c response

Fig. 4

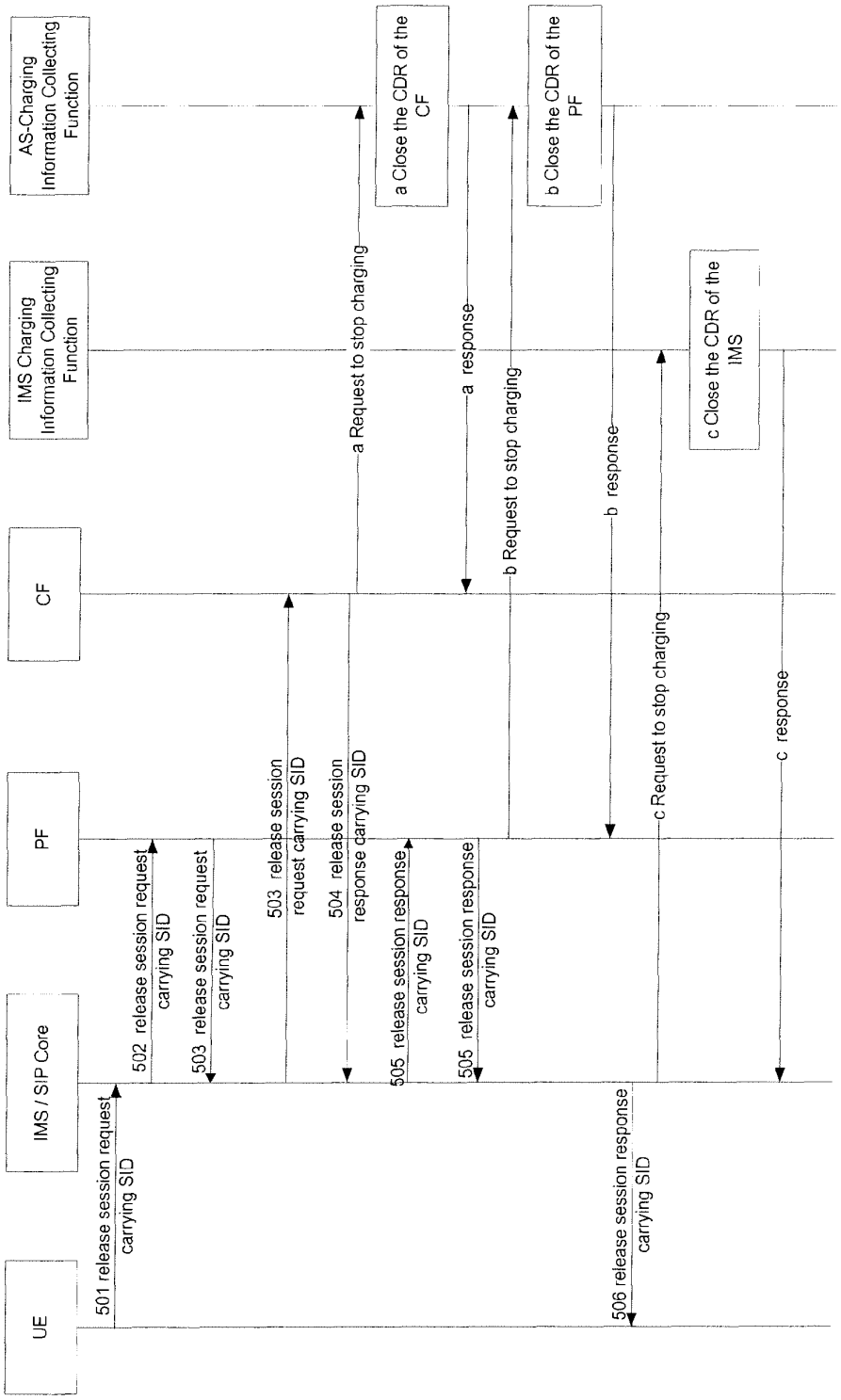

UE
IMS / SIP Core
PF
CF
IMS Charging Information Collecting Function
AS-Charging Information Collecting Function
501 release session request carrying SID
502 release session request carrying SID
503 release session request carrying SID
503 release session request carrying SID
504 release session response carrying SID
505 release session response carrying SID
505 release session response carrying SID
506 release session response carrying SID
a Request to stop charging
a response
a Close the CDR of the CF
b Request to stop charging
b response
b Close the CDR of the PF
c Request to stop charging
c response
c Close the CDR of the IMS

Fig. 5

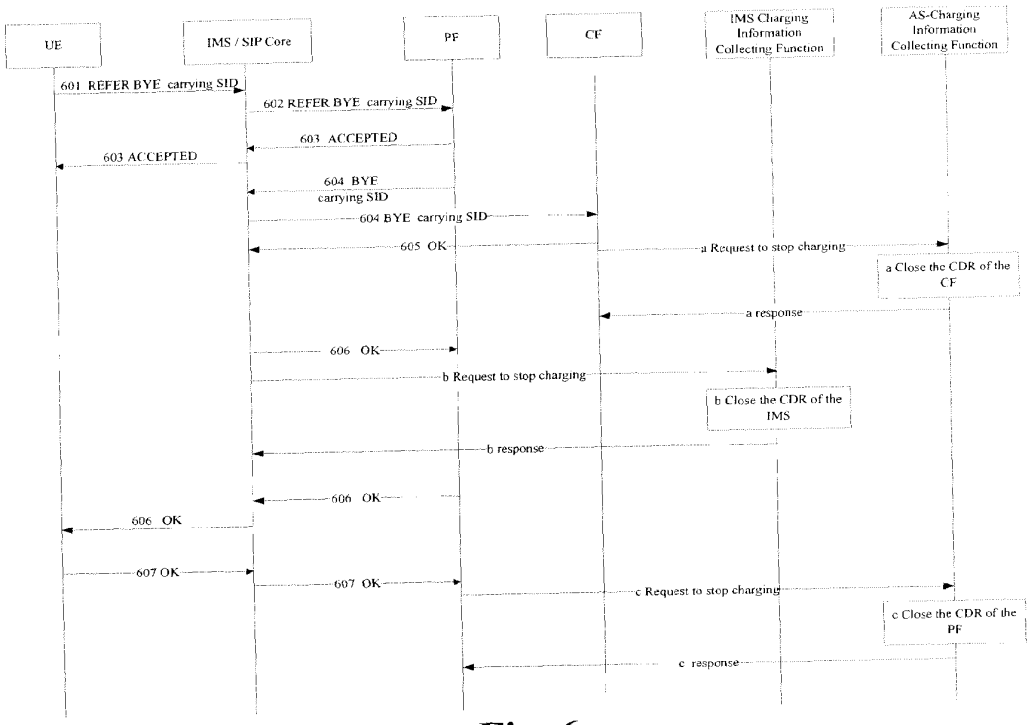

UE
IMS / SIP Core
PF
CF
IMS Charging Information Collecting Function
AS-Charging Information Collecting Function
601 REFER BYE carrying SID
602 REFER BYE carrying SID
603 ACCEPTED
603 ACCEPTED
604 BYE carrying SID
604 BYE carrying SID
605 OK
a Request to stop charging
a Close the CDR of the CF
a response
606 OK
b Request to stop charging
b Close the CDR of the IMS
b response
606 OK
606 OK
607 OK
607 OK
c Request to stop charging
c Close the CDR of the PF
c response

Fig. 6

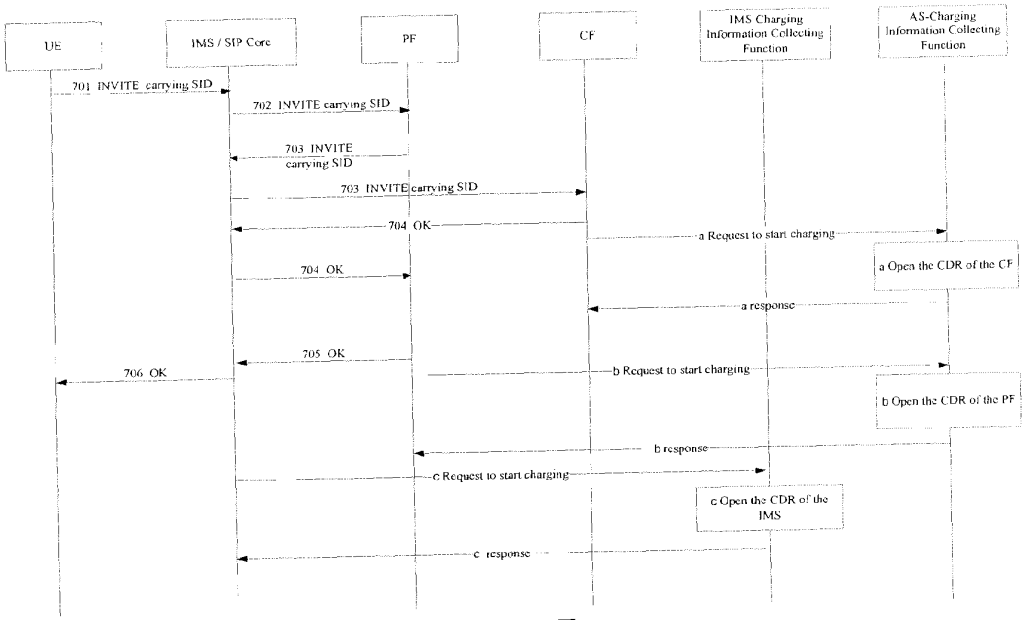

UE
IMS / SIP Core
PF
CF
IMS Charging Information Collecting Function
AS-Charging Information Collecting Function
701 INVITE carrying SID
702 INVITE carrying SID
703 INVITE carrying SID
703 INVITE carrying SID
704 OK
a Request to start charging
a Open the CDR of the CF
704 OK
a response
705 OK
706 OK
b Request to start charging
b Open the CDR of the PF
b response
c Request to start charging
c Open the CDR of the IMS
c response

Fig. 7

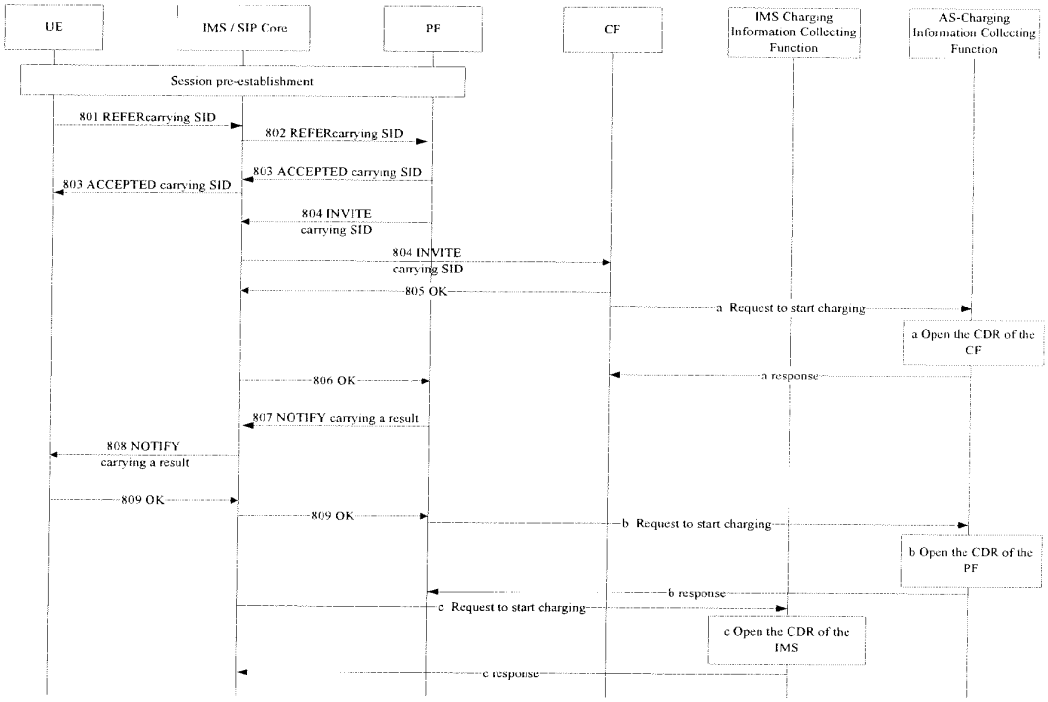

UE
IMS / SIP Core
PF
CF
IMS Charging Information Collecting Function
AS-Charging Information Collecting Function
Session pre-establishment
801 REFERcarrying SID
802 REFERcarrying SID
803 ACCEPTED carrying SID
803 ACCEPTED carrying SID
804 INVITE carrying SID
804 INVITE carrying SID
805 OK
a Request to start charging
a Open the CDR of the CF
a response
806 OK
807 NOTIFY carrying a result
808 NOTIFY carrying a result
809 OK
809 OK
b Request to start charging
b Open the CDR of the PF
b response
c Request to start charging
c Open the CDR of the IMS
c response

**Fig. 8**

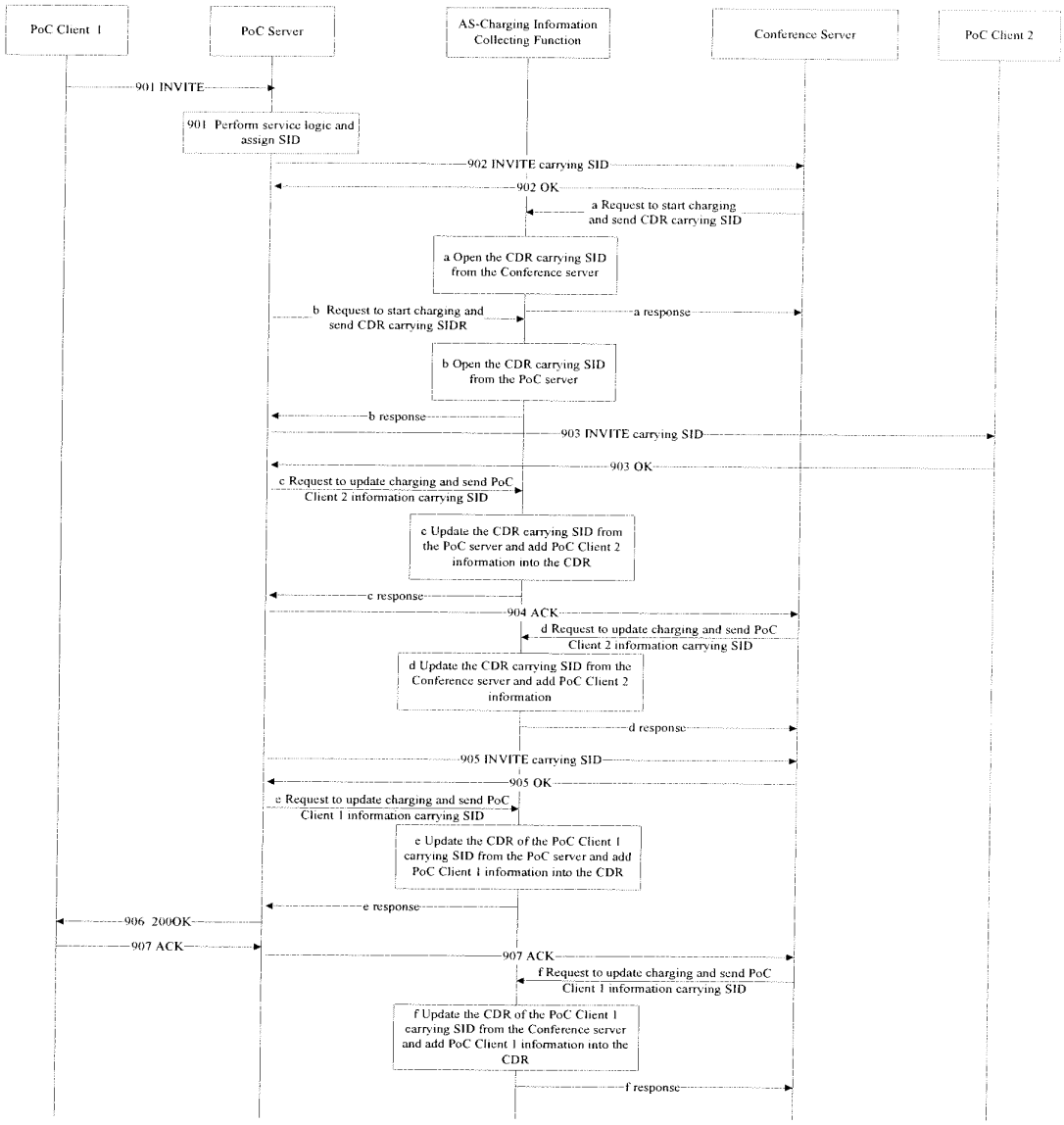

PoC Client 1
PoC Server
AS-Charging Information Collecting Function
Conference Server
PoC Client 2
901 INVITE
901 Perform service logic and assign SID
902 INVITE carrying SID
902 OK
a Request to start charging and send CDR carrying SID
a Open the CDR carrying SID from the Conference server
b Request to start charging and send CDR carrying SIDR
a response
b Open the CDR carrying SID from the PoC server
b response
903 INVITE carrying SID
903 OK
c Request to update charging and send PoC Client 2 information carrying SID
c Update the CDR carrying SID from the PoC server and add PoC Client 2 information into the CDR
c response
904 ACK
d Request to update charging and send PoC Client 2 information carrying SID
d Update the CDR carrying SID from the Conference server and add PoC Client 2 information
d response
905 INVITE carrying SID
905 OK
e Request to update charging and send PoC Client 1 information carrying SID
e Update the CDR of the PoC Client 1 carrying SID from the PoC server and add PoC Client 1 information into the CDR
e response
906 200OK
907 ACK
907 ACK
f Request to update charging and send PoC Client 1 information carrying SID
f Update the CDR of the PoC Client 1 carrying SID from the Conference server and add PoC Client 1 information into the CDR
f response

**Fig. 9**

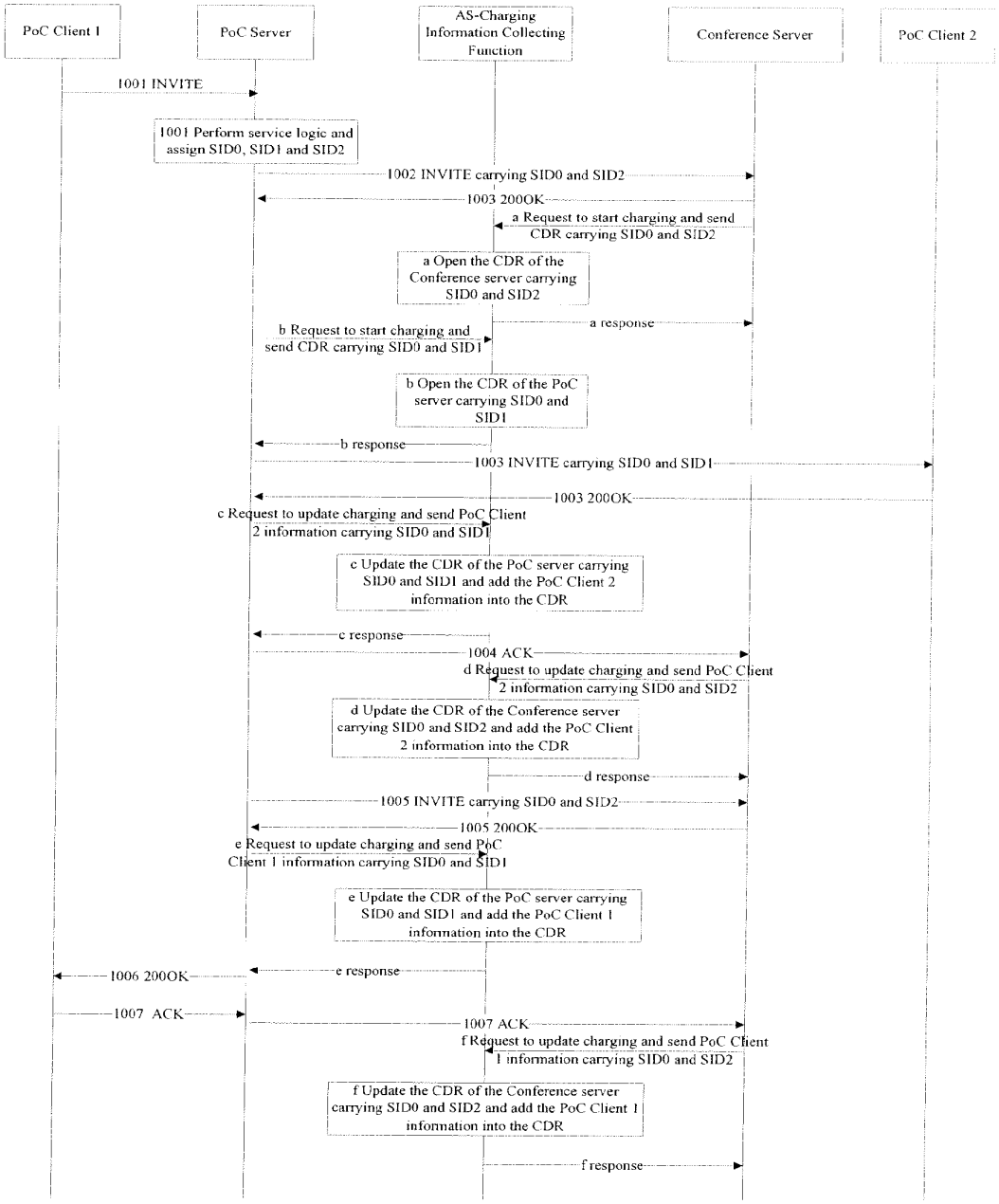

PoC Client 1
PoC Server
AS-Charging Information Collecting Function
Conference Server
PoC Client 2
1001 INVITE
1001 Perform service logic and assign SID0, SID1 and SID2
1002 INVITE carrying SID0 and SID2
1003 200OK
a Request to start charging and send CDR carrying SID0 and SID2
a Open the CDR of the Conference server carrying SID0 and SID2
a response
b Request to start charging and send CDR carrying SID0 and SID1
b Open the CDR of the PoC server carrying SID0 and SID1
b response
1003 INVITE carrying SID0 and SID1
1003 200OK
c Request to update charging and send PoC Client 2 information carrying SID0 and SID1
c Update the CDR of the PoC server carrying SID0 and SID1 and add the PoC Client 2 information into the CDR
c response
1004 ACK
d Request to update charging and send PoC Client 2 information carrying SID0 and SID2
d Update the CDR of the Conference server carrying SID0 and SID2 and add the PoC Client 2 information into the CDR
d response
1005 INVITE carrying SID0 and SID2
1005 200OK
e Request to update charging and send PoC Client 1 information carrying SID0 and SID1
e Update the CDR of the PoC server carrying SID0 and SID1 and add the PoC Client 1 information into the CDR
1006 200OK
e response
1007 ACK
1007 ACK
f Request to update charging and send PoC Client 1 information carrying SID0 and SID2
f Update the CDR of the Conference server carrying SID0 and SID2 and add the PoC Client 1 information into the CDR
f response

**Fig. 10**

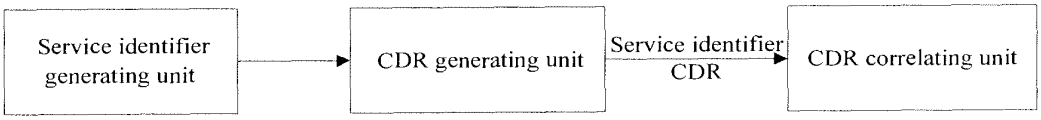

Service identifier generating unit
CDR generating unit
Service identifier
CDR
CDR correlating unit

Fig. 11

## INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2007/001048

A. CLASSIFICATION OF SUBJECT MATTER

H04L 12/14(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC H04L 12/-; H04M 15/-; G06Q10/-

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNPAT WPI EPODOC PAJ: service, charg+, money, bill, fee, cost, associat+, relat+, corresponding, flag, ID, identification, indicator, mark, identifier, identity, distribut+, assign, communicat+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | CN1267414A (NOKIA NETWORKS OY [FI]) 20 September 2000(20.09.2000) see claims 1,7and figure 3A | 1-2, 15-16, 21, 24-25 |
| A | | 3-14, 17-20, 22-23 |
| A | CN1643888A (ERICSSON TELEFON AB L M [SE]) 20 July 2005(20.07.2005) see whole document | 1-25 |
| A | US2004255025A1 (RICAGNI GIUSEPPE [IT]) 16 December 2004(16.12.2004) see whole document | 1-25 |

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&"document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| **26 June 2007 (26.06.2007)** | **12 Jul. 2007 (12.07.2007)** |
| Name and mailing address of the ISA/CN<br>The State Intellectual Property Office, the P.R.China<br>6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088<br>Facsimile No. 86-10-62019451 | Authorized officer<br>ZHAO,Weihua<br>Telephone No. (86-10)62085024 |

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**INTERNATIONAL SEARCH REPORT**
Information on patent family members

International application No.
PCT/CN2007/001048

| Patent Documents referred in the Report | Publication Date | Patent Family | Publication Date |
|---|---|---|---|
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| | | JP2005520405T | 07.07.2005 |
| | | US2005176404A1 | 11.08.2005 |
| | | AT311719T | 15.12.2005 |
| | | DE60302559D | 05.01.2006 |
| | | ES2252682T | 16.05.2006 |
| US2004255025A1 | 16.12.2004 | None | |

Form PCT/ISA /210 (patent family annex) (April 2007)

# EUROPEAN PATENT OFFICE

## Patent Abstracts of Japan


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PUBLICATION DATE : 09-02-06

APPLICATION DATE : 28-07-04
APPLICATION NUMBER : 2004219784



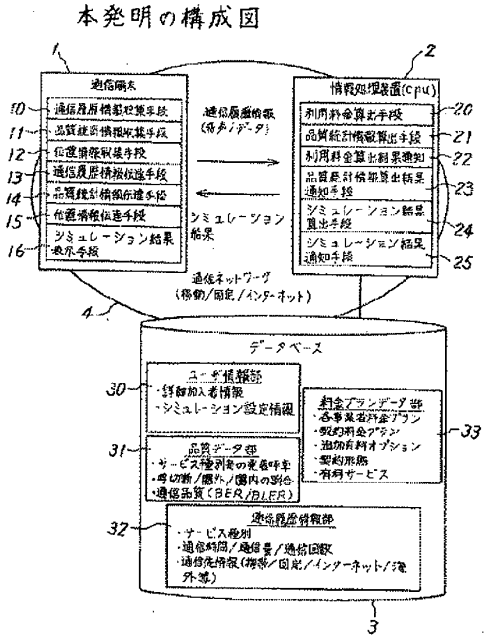
APPLICANT : FUJITSU LTD;

INVENTOR : KATAOKA KOSUKE;



INT.CL. : H04M 15/16 (2006.01)


TITLE : CHARGING PLAN NOTIFICATION SYSTEM





ABSTRACT : PROBLEM TO BE SOLVED: To provide a charging plan notification system for calculating the lowest optimum charging plan corresponding to a utilization state of a communication terminal user from charging plans provided by all carriers.

SOLUTION: The charging plan notification system is provided with: a communication terminal for transmitting communication history information concerned with communication; a database 3 for storing the communication history information, all contract information between communication terminal users and communication carriers and all charging plans for communication service provided by all the carriers; and an information processor 2 for calculating utilization charges. The information processor 2 respectively calculates accurate utilization charges in the charging plans provided from respective carriers on the basis of the communication history information of each communication terminal user, the contract information and all the charging plans and notifies the communication terminal user of the calculated results.



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特開2006-41989
(P2006-41989A)
(43)公開日　平成18年2月9日(2006.2.9)

| (51)Int.Cl. | F I | テーマコード（参考） |
|---|---|---|
| H04M 15/16 (2006.01) | H04M 15/16 | 5K025 |

審査請求 未請求　請求項の数 5　OL　（全 15 頁）

(21)出願番号　特願2004-219784 (P2004-219784)
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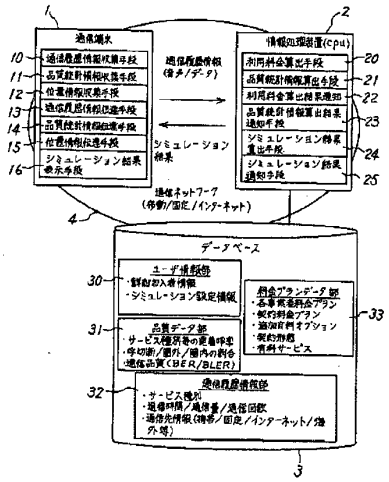
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最終頁に続く

(54)【発明の名称】料金プラン通知装置

(57)【要約】
【課題】全通信事業者の料金プランの中から通信端末ユーザの利用状態に応じた最も安い最適の料金プランを算出する料金プラン通知装置を提供すること。
【解決手段】このため本発明では、通信に関する通信履歴情報を送信する通信端末１と、通信履歴情報と、通信端末ユーザの通信事業者との全ての契約情報と、全通信事業者が提供する通信サービスの全料金プランとを蓄積しておくデータベース３と、利用料金を算出する情報処理装置２を具備する料金プラン通知装置であって、通信端末ユーザの通信履歴情報と、契約情報と、全料金プランとの情報を利用し、情報処理装置２により各通信事業者が提供している料金プランにおいて、各々正確な利用料金を算出し、通信端末ユーザに通知する。
【選択図】図１

本発明の構成図




BNSDOCID: <JP_____2006041989A__I_>

【特許請求の範囲】
【請求項1】
通信に関する通信履歴情報を送信する通信端末と、
通信履歴情報と、通信端末ユーザの通信事業者との全ての契約情報と、全通信事業者が提供する通信サービスの全料金プランとを蓄積しておくデータベースと、
利用料金を算出する情報処理装置を具備する料金プラン通知装置であって、
通信端末ユーザの通信履歴情報と、契約情報と、全料金プランとの情報を利用し、情報処理装置により各通信事業者が提供している料金プランにおいて、各々正確な利用料金を算出し、通信端末ユーザに通知する料金プラン通知装置。
【請求項2】
前記通信端末は、全通信における発着呼率、通信途中での切断、待受け時における圏内・圏外の割合・データ伝送速度等、全ての品質情報を通信履歴情報、通信端末が取得できる位置情報とをデータベースに送信する伝達手段を持ち、
上記データベースは品質情報を蓄積する蓄積手段を持ち、
上記情報処理装置は、品質情報を基に各通信事業者、エリア、時間帯毎等の統計的な通信サービスの品質情報を算出する算出手段を持ち、通信サービスの品質情報を全料金プランの正確な利用料金と共に通信端末ユーザに通知できる通知手段を具備したことを特徴とする請求項１記載の料金プラン通知装置。
【請求項3】
上記情報処理装置は、予めデータベースに登録されている、通信端末ユーザが通信事業者と契約している料金プラン、追加有料オプション、契約時期、契約形態、有料サービス、全通信事業者が提供している全料金プラン、及び有料オプション、割引情報等の情報を利用して正確な利用料金を算出することを特徴とする請求項１記載の料金プラン通知装置。
【請求項4】
上記情報処理装置は、サービス種別、通信時間、量、回数、通信先、位置情報等の詳細な通信履歴情報を利用して、正確な利用料金を算出することを特徴とする請求項１記載の料金プラン通知装置。
【請求項5】
通信端末ユーザが利用を想定した任意の利用条件をデータベースに設定し、ユーザの要求に応じて情報処理装置は、それらの情報と、データベースに登録してある通信端末ユーザの詳細加入者情報及び料金プランに関連する情報を利用して、各料金プランにおいてシミュレーションし、正確に料金算出し、結果を通信端末ユーザに通知することを特徴とする請求項１記載の料金プラン通知装置。

【発明の詳細な説明】
【技術分野】
【0001】
本発明は、通信端末の利用料金を算出し、通信端末ユーザに通知するサービスを行う料金プランを考慮した料金シミュレーションを実施し、最適な料金プランをユーザおよび事業者に通知する料金プラン通知システムに関する。
【背景技術】
【0002】
従来、携帯電話の如き通信端末では、基本使用料と一定金額の無料通話分の設定や、平日昼間や夜間、土日祝日等通話時間帯毎の通話料割引倍率、パケット料金の割引など様々な割引プランが設定されている。
【0003】
通信事業者は、これらの組み合せによりバリエーションを持たせた料金プランを準備している。
【0004】
ユーザは、あらかじめ１つの料金プランを選択し、そのプランに設定された割引率と実

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際の月々の利用料金により算出された金額を契約した通信事業者からの請求により支払う。

【0005】

ユーザが自己の通信に対して最適な料金プランによる通信サービスを受けることができるように、ユーザに対して通話終了毎に、契約された契約料金プランと準備された全ての料金プランとを比較して、得られる最適な料金プランをリアルタイムで通知することが提案されている。

【特許文献1】特開２００１－３６６７３号公報

【発明の開示】

【発明が解決しようとする課題】

【0006】

上記従来技術では、ユーザが現在契約している通信事業者が提供しているサービスの中における最適な料金プランの提供であり、他社の通信事業者の提供しているものを含めた料金プランにおける最適なものの提供ではない。

【0007】

したがってユーザが、現在契約している料金システムが自己にとって最適なプランであるかどうかを判断するために、ユーザ自身が月々の利用状態を分析し、検討し、現在の契約通信事業者のみならず他の契約通信事業者の料金プランと比較することが必要である。

【0008】

しかるに各社の料金プランは多様・複雑化しており、ユーザ自らが分析・検討するのは困難である。したがって、各社の料金プランの中からユーザの通信端末の利用状態に応じた、最適の料金プランを提供するサービスが求められている。

【課題を解決するための手段】

【0009】

上記課題を解決するため、本発明では、下記（１）～（５）の料金プラン通知装置を提供する。

【0010】

（１）通信に関する通信履歴情報を送信する通信端末と、通信履歴情報と、通信端末ユーザの通信事業者との全ての契約情報と、全通信事業者が提供する通信サービスの全料金プランとを蓄積しておくデータベースと、利用料金を算出する情報処理装置を具備する料金プラン通知装置であって、通信端末ユーザの通信履歴情報と、契約情報と、全料金プランとの情報を利用し、情報処理装置により各通信事業者が提供している料金プランにおいて、各々正確な利用料金を算出し、通信端末ユーザに通知することを特徴とする料金プラン通知装置。

【0011】

（２）上記（１）の料金プラン通知装置において、前記通信端末は、全通信における発着呼率、通信途中での切断、待受け時における圏内・圏外の割合・データ伝送速度等、全ての品質情報を通信履歴情報、通信端末が取得できる位置情報とをデータベースに送信する伝達手段を持ち、上記データベースは品質情報を蓄積する蓄積手段を持ち、上記情報処理装置は、品質情報を基に各通信事業者、エリア、時間帯毎等の統計的な通信サービスの品質情報を算出する算出手段を持ち、通信サービスの品質情報を全料金プランの正確な利用料金と共に通信端末ユーザに通知できる通知手段を具備したことを特徴とする。

【0012】

（３）上記（１）の料金プラン通知装置において、上記情報処理装置は、予めデータベースに登録されている、通信端末ユーザが通信事業者と契約している料金プラン、追加有料オプション、契約時期、契約形態、有料サービス、全通信事業者が提供している全料金プラン、及び有料オプション、割引情報等の情報を利用して正確な利用料金を算出することを特徴とする。

【0013】

（４）上記（１）の料金プラン通知装置において、上記情報処理装置は、サービス種別

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、通信時間、量、回数、通信先、位置情報等の詳細な通信履歴情報を利用して、正確な利用料金を算出することを特徴とする。

【0014】

（５）上記（１）の料金プラン通知装置において、通信端末ユーザが利用を想定した任意の利用条件をデータベースに設定し、ユーザの要求に応じて情報処理装置は、それらの情報と、データベースに登録してある通信端末ユーザの詳細加入者情報及び料金プランに関連する情報を利用して、各料金プランにおいてシミュレーションし、正確に料金算出し、結果を通信端末ユーザに通知することを特徴とする。

【発明の効果】

【0015】

本発明により下記の効果を奏する。

【0016】

（１）通信端末が通信端末ユーザの詳細な通信履歴情報をサービス提供業者の料金プラン通知装置のデータベースに登録し、情報処理装置において、前記データベースに登録された詳細な通信履歴情報と料金プラン情報を使用して、ユーザが契約していない他の通信事業者のプランも含めて全料金プランについて正確な通信料金を算出し、通信端末ユーザに通知するので、通信端末ユーザは前記契約外の通信事業者のプランも含めた一番安い料金プランを正確に知ることができる。

【0017】

（２）通信端末に、通信履歴情報と共に通話品質に関連する情報をサービス提供業者の料金プラン通知装置のデータベースに送信し、情報処理装置に、データベースに登録されている通信品質に関連する情報を使用して各通信事業者、エリア、時間帯毎等の統計的な通信サービスの品質情報を算出し、通信端末ユーザに通知するので、通信端末ユーザは契約していない通信事業者のつながり易さ、音声品質等の通信品質を含め、全通信事業者の通信品質情報を知る事が出来るので、通信端末ユーザは、一番通信品質の良い通信事業者を選択することができる。

【0018】

（３）通信端末ユーザは、料金プランや契約形態等の詳細な加入者情報、契約情報をサービス提供者の料金プラン通知装置のデータベースに登録し、それらを利用料金算出に使用することにより、利用形態に沿った正確な一番安い利用料金プランを算出することが可能となる。

【0019】

（４）現在の通信端末は音声通話終話単位で表示される通信履歴情報とパケット数情報を確認できるが、これらは各通信事業者の標準的なプランを基にした情報であり必ずしも正確な情報ではなかったが、本発明では通信端末ユーザからの実用的な詳細情報の収集は、通話時間、パケット数だけでなく、通信量、通話回数、接続通話先、データ量、利用回数等通信履歴情報の詳細を用いてデータベースに登録し、それらを利用料金算出に使用できるので、情報処理装置での正確な利用料金算出を可能とする。

【0020】

（５）通信端末ユーザが自分の利用形態を想定した条件をデータベースに登録し、データベースに登録した詳細な加入者情報、各種料金プランを利用することで大雑把な料金シミュレーションではなく、正確なシミュレーションの実現が可能となり、また前月の履歴情報を流用する手段を持たせることで、シミュレーションに必要な情報を前月と同じ状態で算出することができ、ユーザオペレーションを低減させた正確なシミュレーションの実現が可能となる。

【発明を実施するための最良の形態】

【0021】

自己の通信履歴情報を、サービス業者に送信する通信端末と、多数の通信事業者の料金プランと前記通信履歴情報を保持するデータベースと、前記通信履歴情報にもとづき前記多数の通信事業者の料金プランを使用して通信を行ったときの料金を算出する情報処理装

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置を設け、前記通信履歴情報にもとづき前記多数の通信事業者の料金プランを使用して通信を行ったときもっとも安いものを前記情報処理装置で算出して、このうちのもっとも安い料金システムを通信端末ユーザに通知する料金プラン通知装置を提供する。これにより、通信端末ユーザは、このサービス業者からの通知により、自己が契約している通信事業者以外の他の通信事業者を含めた全通信事業者の料金プランのうちより、自己に適したもっとも安い料金プランを認識することができる。

【実施例】

【0022】

本発明の実施例１を図１～図３にもとづき説明する。図１は本発明の構成図、図２は本発明の品質統計情報説明図、図３は時間毎の品質統計情報説明図である。

【0023】

図中、１は通信端末、２は情報処理装置、３はデータベース、４は通信ネットワーク、１０は通信履歴情報収集手段、１１は品質統計情報収集手段、１２は位置情報収集手段、１３は通信履歴情報伝達手段、１４は品質統計情報伝達手段、１５は位置情報伝達手段、１６はシミュレーション結果表示手段、２０は利用料金算出手段、２１は品質統計情報算出手段、２２は利用料金算出結果通知手段、２３は品質統計情報算出結果通知手段、２４はシミュレーション結果算出手段、２５はシミュレーション結果通知手段、３０はユーザ情報部、３１は品質データ部、３２は通信履歴情報部、３３は料金プランデータ部である。

【0024】

通信端末１は、ユーザが通信相手と音声やデータを送受信するものであり、例えば携帯端末である。

【0025】

情報処理装置２は、通信端末１から送信された通信履歴情報と、データベース３に保持された多くの通信事業者Ａ、Ｂ、Ｃ・・・の料金プランデータに基づいてシミュレーション演算を行い、そのうちもっとも安いものを送出するものであり、ＣＰＵで構成される。

【0026】

データベース３は通信端末１から送信された通信履歴情報や、多くの通信事業者Ａ、Ｂ、Ｃ、Ｄの料金プランデータが保持されており、外部メモリで構成されている。そしてデータベース３と情報処理装置２はサービス提供業者側の料金プラン通知装置に設置されている。

【0027】

通信ネットワーク４は、移動端末用ネットワーク、固定端末用ネットワーク、インターネットの如き、通信ネットワークである。

【0028】

通信端末１には、通信履歴情報収集手段１０、品質統計情報収集手段１１、位置情報収集手段１２、通信履歴情報伝達手段１３、品質統計情報伝達手段１４、位置情報伝達手段１５、シミュレーション結果表示手段１６等を有する。

【0029】

通信履歴情報収集手段１０は、通信端末１が通信相手に送信した送信データの種別データ量、送信時刻、送信時間、サービス種別等の履歴情報を一定期間保持するものである。

【0030】

品質統計情報収集手段１１は、通信相手から受信したデータの品質を通信相手が使用している通信事業者Ａ、Ｂ、Ｃ・・・毎に、例えば公知の５段階評価し、これを保持するものである。

【0031】

品質情報は、例えば前記受信データの５段階評価の外に、発着呼率、通信途中での切断、圏内・圏外の割合、通信品質（ビットエラーレートＢＥＲ、ブロックエラーレートＢＬＥＲ）、データ伝送レート等である。

【0032】

品質情報の例を図２、図３に示す。図２、図３は、通信事業者Ａ、Ｂ、Ｃ、Ｄの４者における品質統計情報を示すもので、図２（Ａ）は各通信事業者の平均の呼接続率、圏内の割合を示し、図２（Ｂ）は各通信事業者の平均の通信品質を示し、図２（Ｃ）は各通信事業者の平均データ伝送レートを示し、図３は各通信事業者の時間毎の呼接続率、圏内の割合を示す図である。

【0033】

なお図２（Ａ）における呼接続率（平均）Ｍ１と圏内の割合（平均）Ｍ２は下式により算出されるものである。

【0034】

Ｍ１＝（完了呼－不完了呼）／発呼

Ｍ２＝（圏内の時間－圏外の時間）／電源を入れていた時間

図２、図３のデータは、サービス業者に加入している通信事業者Ａ、Ｂ、Ｃ、Ｄを利用しているユーザの通信端末より送信されたデータにもとづく統計情報である。

【0035】

図２（Ａ）に示す如く、呼接続率は通信事業者Ａが約９０％、通信事業者Ｂが約９５％、通信事業者Ｃが約８０％、通信事業者Ｄが約９８％であることを示す。またノイズの少ない安定した状態で通信可能であることを示す圏内の割合は通信事業者Ａが約９５％、通信事業者Ｂが約７６％、通信事業者Ｃが約８５％、通信事業者Ｄが約９７％であることを示す。

【0036】

通信品質は、５段階評価で通信事業者Ａ、Ｂ、Ｄが５、通信事業者Ｃが４であることを示し、平均データ伝送レートは通信事業者Ａが約２５ｋｂｐｓ、通信事業者Ｂが約１７ｋｂｐｓ、通信事業者Ｃが約２３ｋｂｐｓ、通信事業者Ｄが約２４ｋｂｐｓであることを示す。

【0037】

品質情報には通信端末ユーザの住所が記入されているので、サービス装置側では各通信事業者についてこれらの住所を解析することにより例えば通信事業者Ｃが横浜駅周辺では通信品質があまりよくない等の品質統計情報を得ることができ、このような情報をユーザに提供することもできる。

【0038】

位置情報収集手段１２はサービス業者を利用している通信端末ユーザと通信先の通信端末ユーザの位置情報（住所）を収集し、これを保持するものである。

【0039】

通信履歴情報伝達手段１３は、通信履歴情報収集手段１０が収集した通信端末１が行った通信データを、通信ネットワーク４を経由してサービス業者側の情報処理装置２に送出するものである。

【0040】

品質統計情報伝達手段１４は、品質統計情報収集手段１１が収集したデータの品質情報をサービス業者側の情報処理装置２に通信ネットワーク４を経由して送出するものである。

【0041】

位置情報伝達手段１５は、位置情報収集手段１２で収集した、通信端末１と通信した相手端末のユーザの位置情報（住所）を通信ネットワーク４を経由してサービス業者側の情報処理装置２に送出するものである。

【0042】

シミュレーション結果表示手段１６は、情報処理装置２が算出したシミュレーション結果が通信ネットワーク４を経由して通信端末１に伝達されたとき、これを通信端末ユーザに表示する表示手段である。

【0043】

情報処理装置２は、通信端末から送信された通信履歴情報とデータベース４に蓄積され

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ている全通信事業者の料金プランを使用して、全通信事業者の各料金プランについて正確な通信料金を算出し、通信端末の要求に応じて算出した通信料金を通信端末に通知したり、通信端末から受信した通信品質情報をデータベースに送信したり、データベースに登録してある通信品質情報を使用し、地域、時間帯通信事業者毎に品質統計情報を算出し通信端末の要求に応じて品質統計情報を通信端末に通知するものである。

【0044】

このため、情報処理装置２には、利用料金算出手段２０、品質統計情報算出手段２１、利用料金算出結果通知手段２２、品質統計情報算出結果通知手段２３、シミュレーション結果算出手段２４、シミュレーション結果通知手段２５等を有する。

【0045】

利用料金算出手段２０は、通信端末１から伝達された音声、データ等の通信履歴情報や、データベース部３に保持された各通信事業者の料金プランを使用して通信端末１のユーザに対する利用料金を算出するものである。

【0046】

品質統計情報算出手段２１は、通信端末１から受信されデータベース３に登録した通信品質情報を使用し、地域、時間帯、通信事業者毎における発着呼率、通信品質情報等を算出し、通信端末１の要求に応じて品質統計情報を通信端末１に通知するものである。

【0047】

利用料金算出結果通知手段２２は、利用料金算出手段２０で算出された全通信事業者の料金プランにもとづく通信料金のうち、もっとも安い料金を通信端末１に通知するものである。

【0048】

シミュレーション結果算出手段２４は、通信端末１のユーザが指定した任意の利用条件にもとづき、各通信事業者の料金プランを使用してもっとも安い利用料金を算出するものである。

【0049】

シミュレーション結果通知手段２５は、このシミュレーション結果算出手段２４から通知されたシミュレーション結果を、シミュレーション要求を行った通信端末に対し通知するものである。

【0050】

データベース３は、通信事業者に対する通信端末の加入者の詳細な契約情報、全通信事業者が提供する各種料金プラン、追加有料オプション情報、割引情報等の全ての課金に関する情報、及び本発明のサービスを制御するための、通信料金の通知回数や通知するタイミング等の設定情報、通信端末が送信した通信履歴情報を蓄積するもので、ユーザ情報部３０、品質データ部３１、通信履歴情報部３２、料金プランデータ部３３等を有し、前記情報処理装置２とともにサービス業者の料金プラン通知装置を構成する。

【0051】

ユーザ情報部３０は、通信端末１の加入者が現在契約している通信業者との詳細な契約情報である詳細加入者情報や、この加入者が料金のシミュレーション演算を求めるシミュレーション設定情報を保持するものである。

【0052】

品質データ部３１は、通信端末より送出されるサービス種別毎の発着呼率、呼切断の割合、圏内と圏外の割合、ビットエラーレート（ＢＥＲ）、ブロックエラーレート（ＢＬＥＲ）等の通信品質を保持するものである。

【0053】

通信履歴情報部３２は、通信端末より伝達された、通信端末が実際に通信を行った結果の情報を保持するもので、サービス種別、通信時間、通信量、通信回数、通信先が携帯端末か、固定端末か、インターネットか、海外か等を示す通信先情報を保持するものである。

【0054】

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料金プランデータ部３３は、通信端末が加入しているか否かにかかわらず、全通信事業者の提供する各事業者料金プラン、契約料金プラン、追加有料オプション、契約形態、有料サービス等の課金に関する料金データを保持するものである。これらの料金データは、通信事業者がインターネットで公開したり、通信端末販売業者に郵送したりしているので、容易に入手できるものである。

【0055】

実施例１において、通信端末１は、通信履歴情報収集手段１０が収集したこの通信端末１が実際に通信した通信履歴情報を、通信履歴情報伝達手段１３が電子情報に変換し、移動通信網、固定通信網、インターネットの如き通信ネットワーク４を経由して、サービス業者の料金プラン通知装置を構成する情報処理装置２に送信する。

【0056】

情報処理装置２では、これを受信し、データベース３の通信履歴情報部３２に通信端末毎に、サービス種別、通信時間、通信量、通信回数、通信先情報等に識別して保持する。

【0057】

なお、サービス業者の料金プラン通知装置のデータベース３には、通信端末の加入者の料金プラン、オプション、契約期間等の詳細加入者情報やシミュレーション設定情報がそのユーザ情報部３０に保持され、また各通信事業者の料金プラン、契約料金プラン、追加有料オプション、契約形態、有料サービス等が料金プランデータ部３３に保持されている。

【0058】

したがって、通信端末の加入者が、例えば過去１ヶ月の通信履歴情報にもとづき、全通信事業者の料金プランにしたがって料金算出を求めたとき、情報処理装置２では、利用料金算出手段２０がデータベース３よりこの加入者の通信端末が過去１カ月に実際に通信を行った履歴情報にもとづき、料金プランデータ部３３に保持されている全通信事業者の各料金プランにより料金を算出し、これを利用料金算出結果通知手段２２に伝達する。

【0059】

利用料金算出結果通知手段２２では、この伝達された料金のうちもっとも安いものを選択してこれを通信端末１に送信する。

【0060】

通信端末１ではこれをシミュレーション結果表示手段１６が受信して表示出力し、加入者はこれにより、どの通信事業者の料金プランが自己の過去１ヶ月の通信履歴に対しもっとも安かったか認識し、現在の契約が適切か否かの判定が可能となる。勿論履歴情報は過去１ヶ月ではなく、１週間とか、適宜選択できる。

【0061】

実施例２においては、通信品質情報を算出通知するものである。通信端末１では通信毎の通信品質情報、例えば発着呼率、通信品質、通信時間、位置情報等を品質統計情報収集手段１１が算出し、これを収集する。

【0062】

品質統計情報伝達手段１４はこれらの情報を電子情報に変換し、任意のタイミングで移動通信網、固定通信網、インターネットの如き通信ネットワーク４を経由して、情報処理装置２に送信する。

【0063】

情報処理装置２は、通信端末１から受信した受信品質情報をデータベース３の品質データ部３１に送信し、通信品質情報を蓄積する。

【0064】

そして情報処理装置２は、通信端末１のユーザの要求に応じて、データベース３に登録してある通信品質情報を使用し、その品質統計情報算出手段２１が、地域毎、時間帯毎、通信事業者毎に、各時間帯毎、地域毎、事業者毎における発着呼率、呼切断、圏外・圏内の割合、ＢＥＲ、ＢＬＥＲ等の通信品質情報等を算出し、通信端末１のユーザの要求に応じて品質統計情報算出結果通知手段２３がこの品質統計情報を通信端末１に通知する。通

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信端末１はこれをシミュレーション結果表示手段１６で受信してユーザに表示する。通信端末１のユーザは例えば図２、図３に示す如き、各通信事業者のサービス品質情報を取得することにより、通信サービスの品質を比較することができる。

【0065】

実施例３においては、有料オプション、契約期間等の詳細な加入者情報と、全通信事業者の提供する全料金プラン、追加オプション、割引制度情報から料金を比較算出するようにしたものである。

【0066】

データベース３のユーザ情報部３０には、情報処理装置２が通信端末ユーザの利用料金を算出する際に使用する、データベースに登録されている詳細な加入者情報が保持されている。

【0067】

この詳細な加入者情報としては、通信端末ユーザが通信事業者と契約している料金プラン情報すなわち、月額基本料金、無料通話時間、音声・データ・メール（Ｅメール、通信事業者網内向けメール、送受信料）等のサービス種別の通信料、自他国内キャリア、海外キャリア、国内・海外の固定電話、通信電話等の通信先毎の通信料、有料オプション、割引情報、契約期間、個人契約、法人契約（複数回線割引）等の契約形態等が登録されている。

【0068】

有料オプションの代表的なものとしては、通信事業者が提供する、留守番電話サービス、三者通話、海外ローミングサービス、国際通話等、その他ニュース、天気情報等の料金や条件等の詳細情報が登録される。

【0069】

割引情報の代表的なものとしては、家族割引、指定番号割引等の特定番号割引、時間帯割引、年齢・学生割引、長期契約割引、パケット割引の如きサービス種別毎の割引等の詳細情報が登録される。

【0070】

また、データベースの料金プランデータ部３３には、全通信事業者が提供している全料金プラン及び有料オプション、割引情報等の課金対象サービスの全ての詳細情報、条件が登録されており、これらの情報により情報処理装置２の利用料金算出手段２０が、例えば履歴情報に対して正確な利用料金を算出し、通信端末ユーザの契約料金と比較検討することができる。

【0071】

実施例４においては、通信履歴情報の詳細を示す。

【0072】

通信端末１がデータベース３に送信する通信履歴情報には、下記のような通信料金を算出するために必要な詳細情報が含まれている。

【0073】

音声、伝送速度・ＷＥＢアクセス・メール等のデータ、動画等のサービス種別。

【0074】

通信時間、パケット数等の量、回数。

【0075】

通信電話又は固定電話・フリーダイヤル・特定番号・ＵＲＬ・Ｅメール・国内又は海外等の通信先。

【0076】

緯経度等の位置情報。

【0077】

通信端末１は、これらの情報を電子情報に変換し、データベース３に送信する。情報処理装置２ではこれらの情報を利用料金の算出に使用する。

【0078】

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実施例５においては、ユーザの任意の設定により、各料金プランにおいて使用料金をシミュレーション可能とするものである。

【0079】

このために、通信端末にユーザが例えば後述するサービス提供者のホームページより利用方法を想定したシミュレーション条件例えば音声通話時間、メール送受信回数、Ｗｅｂアクセス頻度、データ転送頻度、シミュレーション結果通知項目等を情報処理装置２に送信し、データベース３のユーザ情報部３０にこれらシミュレーション設定情報を登録する。

【0080】

情報処理装置２では、シミュレーション結果算出手段２４がこのシミュレーション条件と、データベース３の料金プランデータ部３３に登録ずみの全通信事業者の料金プランを利用してシミュレーション結果を算出し、シミュレーション結果通知手段２５がそのうちのもっとも安いものを通信端末１に送信し、シミュレーション結果表示手段１６がこれを表示してユーザにシミュレーション結果を知らせることができる。

【0081】

シミュレーション条件としてユーザの設定によるもののみでなく、例えばデータベースに蓄積されている前月の使用明細などの以前の通信履歴情報やデータベース３のユーザ情報部３０に予め用意してある代表的なシミュレーション条件を利用して設定することもできる。

【0082】

以前の通信履歴情報を利用する場合、本発明の料金プラン通知装置を設置するサービス提供者が作成したホームページの入力フォームにこの通信履歴情報を読み込ませるようにしてもよく、定形のファイルに以前の通信履歴情報を入力して通信端末等に送信し、通信端末は以前の通信履歴情報が記載された定形のファイルを編集し、データベースに送信することによっても実現できる。

【0083】

本発明では、通信端末ユーザは任意の利用条件を指定し、各料金プランにおいて通信料金をシミュレーションすることができる。

【0084】

通信端末は、ホームページの利用など公知の手段を使用して任意の利用条件をデータベースに設定する。任意の利用条件は、データベースに蓄積されている以前の通信履歴情報を流用することも可能である。

【0085】

データベースは通信端末から送信されてくる通信履歴情報を蓄積する。

【0086】

情報処理装置は、通信端末ユーザが指定した任意の利用条件、又はデータベースに蓄積されている以前の通信履歴情報、料金プラン、契約情報、割引情報を使用し、通信料金をシミュレーションし、通信端末ユーザに通知することができる。

【0087】

このシミュレーションとは、過去何時間とか特定の日等任意の期間の利用条件を元に、１ヶ月、１年分等の利用料金を全料金プランにおいて試算できる。これにより通信端末ユーザは種々の利用形態における利用料金を知ることができる。

【0088】

本発明では、通信端末ユーザは、情報処理装置で算出した、各料金プランの正確な使用料金、シミュレーション結果、及びサービス種別、通信先、通信時間、回数、情報量等の個別通信毎の料金内訳、品質統計情報等を下記に示す手段で入手することができる。

（１）電子データ：情報処理装置は通信端末ユーザの要求に応じて前記算出情報を、データベースから収集し、データファイル（テキスト、ＨＴＭＬ形式等）に変換して、Ｅメール、データファイルを通信端末ユーザのＥメールアドレスに送信する。また情報処理装置が前記算出情報をホームページに変換し、通信端末ユーザにホームページのアドレスを送

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信し、通信端末ユーザはそのホームページのアドレスにアクセスして閲覧することにより前記情報を見ることができる。また情報処理装置が前記算出情報をデータファイルに変換して通信端末ユーザに送信し、通信端末ユーザはそのデータファイルを閲覧することにより前記算出情報を見ることができる。

【0089】

（２）前記以外の手段：情報処理装置は通信端末ユーザの要求に応じて、前記算出情報をデータベースから収集し、音声ガイダンスに変換することで通信端末ユーザに聞かせることができる。またその他に、明細書を作成して郵送したり、オペレータによる対応等により通信端末ユーザは前記算出情報を入手することができる。

【0090】

本発明では、通信端末ユーザは、情報処理装置が行う全ての処理、情報を伝送するタイミングを任意に設定することができる。これにより、通信料が安い時間帯での送信や、日、週、月、年単位等のある期間の通信履歴情報を送信するタイミング、自動又は手動、月に何回等の回数を設定することができる。これにより通信端末は、任意のタイミングで通信履歴情報をデータベースに送信することができる。

【0091】

また通信端末は、利用料金をシミュレーションさせるタイミング、シミュレーション結果を通知するタイミング等の各種タイミングをデータベースに登録することができる。

【0092】

情報処理装置は、前記タイミングで利用料金算出、シミュレーションを行い、通信端末ユーザに利用料金や、シミュレーション結果を通知する。

【0093】

本発明では、通信履歴情報や品質情報及び情報処理装置が送信するデータに優先度をつけることができ、これによりトラフィックを制御することができる。

【0094】

通信端末や情報処理装置では、公知の手段によりそれぞれが送信すべきデータの形式を変換して送信することができる。通信事業者は一般的に許容される伝送遅延を、映像＞音声＞パケットデータ（ＷＥＢアクセス、ファイル転送、Ｅメール等）の順に設定していることが多いので、通信履歴情報や品質情報、使用料金シミュレーション等の通信端末と情報処理装置で送受信する全ての情報を映像のフォーマットに変換して送れば、遅延時間は最小で送信できるが、その分トラフィックを圧迫することになる。反対にパケットデータに変換して送れば、遅延時間は多くなるが、その分トラフィックの隙間を利用して送信できるので、通信ネットワークのトラフィックに負担をあまりかけないようにできる。

【0095】

本発明では、使用料金算出、シミュレーションや品質情報を提供するのに通信費がかかるので、通信端末ユーザは、使用料金算出やシミュレーションに関連する情報を使用料金算出、シミュレーションする際に料金に含むか、含まないかをデータベースに設定することができる。もし「含まない」を選択した場合、情報処理装置は、純粋な通信にかかった使用料金を算出し、通信端末ユーザに送信する。このように通信端末ユーザは、純粋に通信にかかった料金のみを知ることができる。

【0096】

本発明では、通信端末ユーザは、情報処理装置で算出する通信先、通信時間、回数、情報量等の詳細な通信履歴毎の料金、事業者内・事業者間、比較プラン数、通知プラン数等のシミュレーション結果、料金プラン、通信履歴情報、割引情報等のシミュレーション条件の内容を、ユーザが任意に設定できる。

【0097】

これにより使用料金算出、シミュレーションにかかる通信費や情報処理装置がシミュレーションに要する時間を調整できる。

【0098】

通信端末ユーザは、使用料金算出、シミュレーション結果、シミュレーション条件の項

目のうち、任意の項目をデータベースに設定できる。これにより通信端末ユーザはどこまで正確に使用料金を算出するか設定することができる。当然、条件が多ければ通信履歴情報やシミュレーション結果等のデータ量は多くなり、その分通信費、情報処理装置が処理に要する時間は多くなる。

【0099】

情報処理装置は通信端末ユーザがデータベースに設定された条件を使用して使用料金算出、シミュレーションを行い通信端末ユーザに結果を送信する。

【0100】

本発明では、個人情報の秘密を保護するため、通信端末ユーザが送信する通信履歴情報及び情報処理装置において算出する使用料金算出、シミュレーション結果、品質情報等全てを暗号化して送信することができる。例えば通知端末では公知の暗号化機能を有するソフトを使用することができ、また情報処理装置は自身で暗号化機能を持つ。

【0101】

暗号化・復号化手段には一般に使用されている公開鍵暗号方式、秘密暗号方式等の暗号化手段や、ＩＤ、パスワード、電子署名等の認証機能手段が考えられる。

【0102】

暗号化手段を使用する場合は、通信端末のアプリケーションソフトと情報処理装置で同じ暗号化・復号化手段を持つ。また認証機能を使用する場合は、通信端末ユーザはデータベースにＩＤ、パスワード、電子署名等を登録しておき、情報処理装置はそれらの認証情報が一致していることが確認できたら通信端末ユーザからの情報を受信する。

【0103】

また通信端末ユーザは、情報処理装置から送信される認証情報と、予め情報処理装置から入手しておいた認証情報が一致していることが確認できたら、情報処理装置からの情報を受信する。

【0104】

本発明では、通信端末ユーザが設定する任意の使用料金設定を超えた、又は下回っている時に、通信端末ユーザにその旨を通知する機能を持つ。

【0105】

通信端末ユーザは、任意の使用料金と、その設定した使用料金を超えた、又は下回っている時に通知するようデータベースに設定する。情報処理装置はそれらの設定を認識し、通信端末ユーザから送信されてくる通信履歴情報から使用料金を算出し、データベースに設定されている使用料金を超えた、又は下回っている時に、通信端末ユーザに設定金額をいくら上回った、または下回っているかを通知する。

【0106】

本発明では、通信端末ユーザが契約している料金プランにおいて、無料通信料金が設定されている場合、通信端末ユーザに無料通信料金の残高、残り時間、残りパケットを通知する機能を持つ。

【0107】

通信端末ユーザは、データベースに無料通信料金の残高、残り時間、残りパケット数を通知させる時間、ベアラ毎の残高、残り時間、残りパケット数の割合等の内容を設定する。

【0108】

情報処理装置はそれらの設定を認識し、通信端末ユーザから送信されてくる通信履歴情報から使用料金を算出し、通信端末ユーザに、残高、残り時間、残りパケット数を通知する。

【0109】

通信端末ユーザは本発明が提供する、使用料金算出、シミュレーション、品質情報のうち、任意のサービスを選択することができる。

【0110】

通信端末ユーザは、シミュレーション内容、無料通信料金の算出、比較プラン数等デー

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タベースに希望するサービスの種類、シミュレーション回数、品質情報等を受け取る回数、タイミングを設定する。

【0111】

情報処理装置はそれらの設定を認識し、通信端末ユーザから送信してくる通信履歴情報から使用料金、品質情報を算出し、通信端末ユーザの設定した日時に通信端末ユーザが要求した情報を送信する。

【0112】

本発明では、通信端末ユーザの加入者情報は公知のアプリケーションソフトやサービス提供者が作成するホームページを利用することでデータベースに登録、修正することができる。

【0113】

通信端末ユーザは、アプリケーションソフトを使用する場合は、アプリケーションソフトが提供するフォーマットに設定項目を入力し、データベースに送信する。ホームページを使用する場合は、通信端末ユーザが本サービス提供者が提供する加入者情報のホームページにアクセスし、必要事項を記入することで、データベースに通信端末ユーザの加入者情報を登録することができる。修正も同様の手段で可能である。

【0114】

本発明を使用すれば、通信端末ユーザは料金とサービス品質の両面から最適な料金プラン、通信事業者を選択することができる。また通信事業者は各ユーザの使用状況を詳細に把握することができ、適切な料金プランを検討する際に有効なデータや、サービスエリア拡充時に参考になる情報を得ることができる。

【図面の簡単な説明】

【0115】

【図1】本発明の一実施例構成図である。

【図2】本発明の品質統計情報説明図である。

【図3】本発明の時間毎の品質統計情報説明図である。

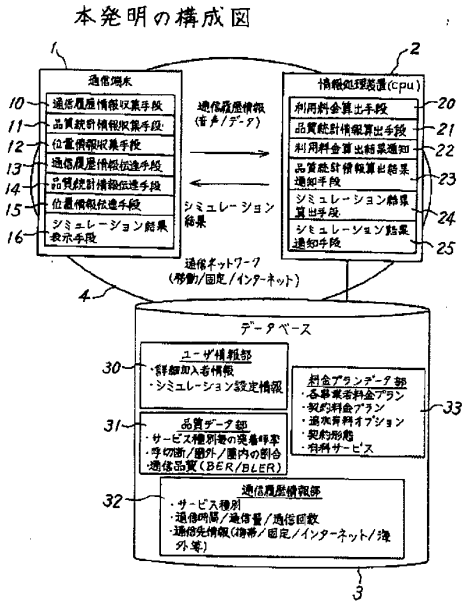
【符号の説明】

【0116】

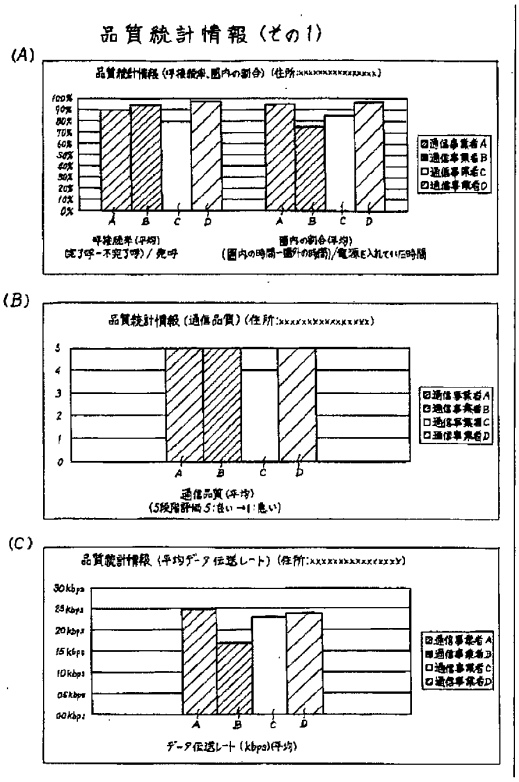
1　通信端末
2　情報処理装置
3　データベース
4　通信ネットワーク

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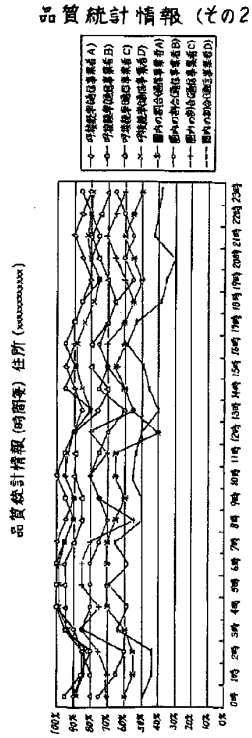
【図1】




【図2】




【図3】




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## (54) Method of verifying downloaded software and corresponding device

(57) The present invention relates to ensuring security for software downloads to a device, in which a smart card is used for storage of secure keys and for calculations using the secure keys. The result of the calculations using the smart card are passed to the device for comparison with calculations performed by the device on the downloaded software, to verify the downloaded software. Thus the security of the keys and calculations involving the secure keys are kept secure. Preferably root security keys stored in the smart card can be updated using communication system messaging protocols.

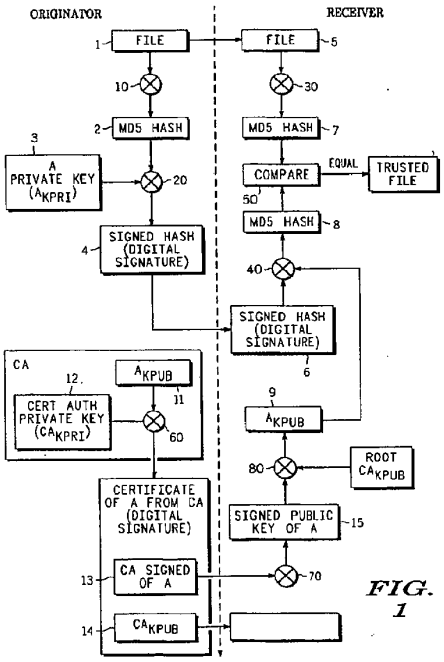



FIG. 1

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## Description

**[0001]** The present invention relates to a method of verifying software downloaded from an originator to a device, and to a corresponding device. In particular, the invention relates to download verification in standardised execution environments such as the Mobile Execution Environment (MExE) and Java.

**[0002]** Increasingly it is becoming desirable for software to be downloaded to a portable device over the air. This allows the device to be upgraded with newly released software or enables new applications to be added to the device as these become available.

**[0003]** It is desirable that the device checks the authenticity of the downloaded software to determine whether, for example, the downloaded software has indeed been received from a trusted sender. In addition, it is desirable that the downloaded software should be restricted to a given domain, to avoid permission violation for the rest of the device.

**[0004]** This security can be ensured by keys, which are stored securely in the device such that they cannot be read or tampered with by applications except the security-checking environment. In addition it is desirable to update the keys periodically, and this must be done using a secure method.

**[0005]** Previously, it has been suggested to implement the security algorithms in software/hardware and then to protect them by hardware control on the processor of the terminal with memory management unit. However, this results in increased cost. In addition, the development of separate security hardware is undesirable.

**[0006]** The Mobile Execution Environment (MExE ), which enables software download, is currently under standardisation. Three class marks are defined in the MexE environment. Class mark 1 relates to devices utilizing the Wireless Application Protocol (WAP); class mark 2 relates to devices, such as personal digital assistants (pda) or laptops using standard edition JAVA™ (J2SE); and class mark 3 relates to small devices, such as mobile telephones, using micro-edition JAVA™ (J2ME).

**[0007]** J2ME is being proposed as an environment for class mark 3 devices in MExE because of its small size, which makes it suitable for environments, such as the mobile communication environment for example, in which the available memory or processing power is limited and the size of files must be limited.

**[0008]** However, the security model for J2ME requires server-based pre-verification, in which a server inserts basic run-time security information in the software prior to download. The receiving device can then use the run-time security information to check the security of the download and verify the sender.

**[0009]** It is desirable to increase the security provided for software download, particularly in a MExE class mark 3 environment, so that server-based verification is avoided and software can be downloaded from a greater variety of sources.

**[0010]** According to a first aspect of the present invention, there is provided a method of verifying software downloaded from an originator to a device adapted to receive, in use, a smart card having at least one secure key stored therein, comprising: receiving software and security information relating to the received software; obtaining in the smart card a first calculation result from the security information using at least one secure key; obtaining in the device a second calculation result from calculations performed on the received software; and comparing in the device first and second calculation results to verify the received software.

**[0011]** According to a second aspect of the invention, there is provided a device comprising: communication means for receiving software and security information relating to the received software; smart card interface means for passing the security information to a smart card coupled to the smart card interface means and for receiving from the smart card a first calculation result obtained from the security information by the smart card using at least one security key; means for obtaining a second calculation result from calculations performed on the received software; means for comparing first and second calculation results to verify the received software.

**[0012]** For a better understanding of the present invention, and to show how it may be brought into effect reference will now be made, by way of example to the accompanying drawings in which:

Figure 1 illustrates a known file transfer verification procedure;
Figure 2 shows a communication device;
Figure 3 illustrates a download verification procedure in accordance with the invention;
Figure 4 illustrates message creation for transfer of the root key in accordance with the invention;
Figure 5 illustrates update of the root key in accordance with the invention

**[0013]** The present invention is described with reference to the use of RSA cryptography. The RSA cryptography algorithm and principle are well known and therefore will not be explained in detail in this document. As will be apparent to a skilled person, other cryptography techniques may also be used in accordance with the invention.

**[0014]** Figure 1 illustrates a known file transfer verification procedure, for verifying the authenticity of a file transferred from an originator to a receiver. The principle behind this procedure is that in addition to the transfer of the file 1 a second piece of information which is related to both the file 1 and the originator is also transferred between the originator and the receiver, which information enables the receiver to confirm that the file comes from the originator. In addition, the receiver possesses or is passed a third piece of information, which enables



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the receiver to confirm that the originator can be trusted and that it is therefore safe to execute the downloaded file.

**[0015]** In the illustrated procedure the originator generates the second piece of information by performing an MD5 hash operation 10 on the file 1 to be transferred to create an MD5 hash result 2. The MD5 hash operation is well known and will not be explained further. The MD5 hash result 2 is uniquely dependent on the file 1 and can be used to verify file 1.

**[0016]** Next the originator performs an RSA algorithm operation 20 on the MD5 hash result 2 using the private key of the originator ($A_{KPRI}$) 3 to generate a signed hash (or digital signature) 4. The signed hash 4 thus depends upon the file and is signed as having been originated by A and can therefore act as the second piece of information mentioned above. The file 1 and the signed hash 4 are transferred to the receiver resulting in a received file 5 and a received signed hash 6.

**[0017]** In order to verify the received file, the receiver independently generates two versions of the MD5 hash result. The first MD5 hash result 7 is generated from the received file 5 using a MD5 hash operation 30, and the second MD5 hash result 8 is obtained from the received signed hash 6 by performing an RSA operation 40 on the received signed hash 6 using the public key of the originator A ($A_{Kpub}$) 9 held by the receiver. The first MD5 hash result 7 and the second MD5 hash result 8 are compared in a comparison operation 50 and if they are found to be equal, the received file 5 is authenticated and can be executed.

**[0018]** In order for the above authentication scheme to work, the receiver must have authenticated access to the public key of the originator A ($A_{Kpub}$). This is achieved in the illustrated procedure through the use of a certification authority. The certification authority is trusted by the receiver, such that received information signed by the certification authority is trusted by the receiver.

**[0019]** Therefore, as shown the certification authority performs an RSA algorithm operation 60 on the public key of the originator ($A_{KPub}$) 11 using the private key of the certification authority ($CA_{KPRI}$) 12 resulting in a signed key 13 of the originator A. The signed key 13 and the certification authority public key ($CA_{Kpub}$) 14 are transferred to the receiver. As shown, if necessary the signed key 13 undergoes a certificate chain analysis operation 70 to obtain the received signed public key 15 of the originator A.

**[0020]** A certificate chain analysis operation is required if the certificate authority CA is not known by the receiver. In this case, the certificate authority is requested to provide its public key signed by a further certificate authority using the private key of the further certificate authority. If the further certificate authority is trusted by the receiver, the receiver will be able to use the public key of the further signature authority to verify that the public key of the signed authority has been signed by the private key of the further signature authority. The receiver can then trust the certificate authority and can use the received certificate authority public key. If the further certificate authority is not trusted by the receiver, use must be made of an additional certificate authority.

**[0021]** The receiver has stored therein a root certification authority public key. The root certification authority is the most trusted by the receiver, and ultimately the stored public key of the root certification authority can be used to verify all other certification authorities in a certificate chain situation.

**[0022]** The receiver then performs an RSA operation 80 on the resulting signed public key of the originator ($A_{KPub}$) (15) using the root certification authority public key (Root $CA_{KPub}$) to obtain the public key of the originator ($A_{KPub}$) 9. The public key of the originator ($A_{KPub}$) 9 is then used in the RSA operation 40 as described above.

**[0023]** The present invention is described below with reference to a communication device, such as a mobile telephone. However, it will be clear to a skilled person that the present invention is also applicable to other devices. An exemplary communication device 200 is now described with reference to Figure 2.

**[0024]** The communication device 200 shown in Figure 2 comprises a communication interface 210 coupled to an antenna 220 and to a processor 230. The processor 230 and the communication interface 210 are also coupled to volatile memory 240 and to a non-volatile memory 250. A smart card 260 is coupled to a smart card interface 270, which is also coupled to the processor 230. The smart card is equipped with its own processor 280 and memory 290.

**[0025]** The communication interface 210 comprises the necessary components to convert radio frequency signals for the communication device 200 received by the antenna 220 to digital signals to be stored in volatile memory 240 and/or non-volatile memory 250 and/or to be processed by processor 230, and to convert digital signals from the memories 240 and 250 and/or the processor 230 to radio frequency signals to be transmitted by the antenna 220. Thus communication interface 210 comprises radio frequency transmitter and receiver means and signal processor means, for example.

**[0026]** The volatile memory 240 and non-volatile memory 250 are used for storing program and other data for operation of the communication device 200.

**[0027]** The smart card is preferably a subscriber smart card (SIM) holding subscriber information used by the communication device 200, for example a Subscriber Identity Module card as currently used in the Global System for Mobile Communications (GSM system) and in use or proposed for other communication systems. However, it is possible that the smart card 260 may be another type of smart card received in the communication device instead of, or preferably in addition to a SIM card, for example an electronic commerce smart card.

**[0028]** As indicated above, the smart card is equipped with its own processor 280 and memory 290, and is capable of storing information therein and is also capable of carrying out operations or calculations on data received from the processor 230 via smart card interface 270 and of providing data or the results of such calculation to the processor 230 via smart card interface 270.

**[0029]** The smart card is preferably removably receivable in the communication device, for example by means of the provision of a slot in the housing of the communication device 200.

**[0030]** It will be appreciated by a skilled person that other components or arrangements of components within the communication device 200 are possible within the scope of the invention.

**[0031]** The secure download procedure in accordance with the invention will now be described with reference to Figure 3. In Figure 3 operations or data corresponding to operations or data in Figure 1 have been given similar reference numerals.

**[0032]** Figure 3 illustrates the download of an executable J2ME file in a MExE environment from an originator A to a device such as the communication device 200 described above with reference to Figure 2. As shown in Figure 3, box 3260 represents operations carried out and data stored in the smart card 260 of the communication device 200 shown in Figure 2, and the remaining operation and data storage is carried out in the rest of the communication device 200 shown in Figure 2.

**[0033]** As illustrated in Figure 2, the smart card 260 has no direct communications capability. Instead, the relevant data received by the communication device is passed by the processor 230 to the smart card 260 for storage therein and operation thereon.

**[0034]** In the procedure illustrated in Figure 3, the originator A performs an MD5 hash operation 310 on a file 31 to be transferred to create an MD5 hash result 32. As explained above, the MD5 hash result 32 is uniquely dependent on the file 31 and can be used to verify file 31.

**[0035]** Next the originator A performs an RSA algorithm operation 320 on the MD5 hash result 32 using the private key of the originator ($A_{KPRI}$) 33 to generate a signed hash 34. The signed hash 34 thus depends upon the file and is signed as having been originated by A and can therefore act as the second piece of information mentioned above. The file 31 and the signed hash 34 are then sent to the communication device 200 resulting in a received file 35 and a received signed hash 36. File 35 is received using antenna 220 and communication interface 210 and is stored by the processor 230 in the volatile memory 240. In contrast, the signed hash 34 is received using antenna 220 and communication interface 210 and is sent by the processor 230 to the smart card 260 via smart card interface 270 and is stored in the smart card memory 290.

**[0036]** As described above, in order to verify the received file, two versions of the MD5 hash result must be independently generated and compared. The first MD5 hash result 37 is generated by the communication device processor 230 from the received file 35 using a MD5 hash operation 330.

**[0037]** The second MD5 hash result 38 is obtained by the smart card from the received signed hash 36. The smart card processor 280 performs an RSA operation 340 on the received signed hash 36 stored in the smart card memory 390 using the public key of the originator A ($A_{Kpub}$) 39 stored in the smart card memory 290, as will be explained later.

**[0038]** The second MD5 hash result 38 is passed by the smart card processor 280 to the communication device processor 230 and the communication device processor 230 compares the first MD5 hash result 37 and the second MD5 hash result 38, calculated in the smart card 260, in a comparison operation 350. If the first MD5 hash result 37 and the second MD5 hash result 38 are found to be equal, the received file 35 is authenticated and can be executed.

**[0039]** In this arrangement, the smart card 260 must have authenticated access to the public key of the originator A ($A_{Kpub}$). This is achieved in the illustrated procedure according to Figure 3 through the use of the root certification authority public key stored in the smart card memory 290. The root certification authority is trusted by the communications device, such that received information signed by the certification authority is trusted.

**[0040]** In this context, there may be more than one root certification authority. For example in the context of a mobile telephone the manufacturer and/or the operator can act as a root authority. In addition, it is possible to specify one or more trusted third parties as root certification authorities. The public key for each of the root certification authorities (eg the operator public root key (OPRK); the manufacturer public root key (MPRK); and third party public root key (TPRK)) is stored in the smart card of the communication device 200, for example during provisioning of a mobile telephone SIM card.

**[0041]** In order that the smart card 260 has authenticated access to the public key of the originator A ($A_{Kpub}$), as shown the root certification authority performs an RSA algorithm operation 360 on the public key of the originator ($A_{KPub}$) 311 using the private key of the certification authority ($RootCA_{KPRI}$) 312 resulting in a certificate from A 321 signed by the root certification authority. This certificate 321 is sent to the communications device 200, is received using antenna 220 and communication interface 210 and is sent by the processor 230 to the smart card 260 via smart card interface 270 and is stored in the smart card memory 290 as certificate 322.

**[0042]** The Root certification authority public key ($RootCA_{KPub}$) 332 is already stored in the smart card memory 290, as indicated above. The smart card processor can perform an RSA operation 380 on the received certificate 322 using the Root Certification Authority public key ($RootCA_{KPub}$) 332 to obtain the public



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key of the originator A ($A_{Kpub}$) 39. The smart card processor can then use the obtained public key of the originator A ($A_{Kpub}$) 39 and the received signed hash 36 in RSA operation 340 to obtain the smart card MD5 hash value 38, as outlined above.

**[0043]** Also shown in Figure 3 is the transfer of the Root Certification Authority public key ($RootCA_{KPub}$) 331 to the communications device for storage in the smart card memory as Root Certification Authority public key ($RootCA_{KPub}$) 332. It is desirable to update the root certification authority keys periodically in a secure manner otherwise the security of the system will be compromised.

**[0044]** A preferred mechanism for the secure transfer of a Root public key (for example OPRK, MPRK, TPRK) using communication system messaging technology will now be explained with reference to Figures 4 and 5.

**[0045]** Figure 4 illustrates message creation for transfer of a root key, for example the operator public root key (OPRK), to the smart card 360 in accordance with the invention. In this exemplary arrangement, the update is achieved using a SMS message as provided in the GSM/UMTS systems, although other messaging techniques could be used.

**[0046]** An RSA operation is performed on the new OPRK 41 with the operator's private root key 42 corresponding to the old OPRK stored in the smart card 360. As mentioned earlier, the old OPRK may have been stored in the smart card 360 during provisioning, or during a previous update of the root key. The resulting signed new operator public root key 44 is included in an SMS message 45 to be sent to the communication device. The SMS message 45 has an SMS header portion 451 and SMS download command 452 in addition to the signed new operator public root key 44. The SMS message in encrypted by the communication system prior to being sent to the communication device.

**[0047]** Figure 5 illustrates update of the root key in the communication device in accordance with an embodiment of the invention. In this exemplary embodiment of the invention, the SMS message 45 sent by the network 500 to the communication device 200 is passed to the smart card 260. Once the encrypted SMS message 45 is received in the smart card 260, the smart card 260 undertakes an SMS message analysis and memory update procedure 51.

**[0048]** In the SMS message analysis and memory update procedure 51 the SMS message is initially decrypted and the SMS message is analysed. The download command 452 instructs the smart card 260 that a new OPRK is being sent to the smart card 260. The smart card 260 performs an RSA operation on the received signed new OPRK using the old OPRK already stored in the smart card 260 to verify the identity of the sender. The OPRK stored in the smart card can then be updated using the new value. Preferably a confirmation message 52 is sent from the smart card 260 to the network using the communication interface 210 of the communication device 200.

**[0049]** Although the update of the operator public root key (OPRK) has been described above, it would be possible to update any root key stored in the smart card in the same way.

**[0050]** In accordance with an alternative embodiment of the invention, the manufacturer root public key may be stored partially in the smart card memory and partially in the communications device memory. This arrangement is more secure since the communication device then contributes to ensuring the security of download in the manufacturer domain using the manufacturer root public key. This helps to prevent an insecure smart card from changing the manufacturer public root key via download authorization.

**[0051]** Thus the present invention proposes a solution to ensuring security for software downloads to a device, in which a smart card is used for storage of secure keys and for calculations using the secure keys. The result of the calculations using the smart card are passed to the device for comparison with calculations performed by the device on the downloaded software, to verify the downloaded software.

**[0052]** Since the secure keys are stored on the smart card and calculations involving the secure keys are performed by the smart card, the security of the secure keys can be ensured. In addition, the result of the calculation performed on the received file by the device is not passed to the smart card.

**[0053]** As will be apparent to a skilled person, the invention could be implemented in a different form from that shown herein, and so the invention is intended to encompass all arrangements and variations within the scope of the appended claims.

## Claims

1. A method of verifying software downloaded from an originator to a device adapted to receive, in use, a smart card having at least one secure key stored therein, comprising:

   receiving software and security information relating to the received software;
   obtaining in the smart card a first calculation result from the security information using at least one secure key;
   obtaining in the device a second calculation result from calculations performed on the received software; and
   comparing in the device first and second calculation results to verify the received software.

2. The method as claimed in claim 1, further comprising the steps of;

   receiving additional signed originator key infor-



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mation;
obtaining, in the smart card, originator key information from the received signed originator key information using a root security key stored therein; and
obtaining in the smart card the first calculation result from the security information using the originator key information.

3. The method as claimed in claim 2 wherein the root security key stored in the smart card is updated by
receiving a root security key update message containing a new root security key;
verifying the new root security key using the existing root security key stored in the smart card;
storing the new root security key in the smart card.

4. The method as claimed in claim 2 or 3, wherein part of the root security key is stored in the smart card and part of the root security key is stored in the device.

5. The method as claimed in any preceding claim, wherein the smart card is a Subscriber Identity Module (SIM) card

6. A device comprising
communication means for receiving software and security information relating to the received software;
smart card interface means for passing the security information to a smart card coupled to the smart card interface means and for receiving from the smart card a first calculation result obtained from the security information by the smart card using at least one security key;
means for obtaining a second calculation result from calculations performed on the received software;
means for comparing first and second calculation results to verify the received software.

7. The device as claimed in claim 6 wherein
the communications means also receives additional signed originator key information; and
the smart card interface also passes the additional signed originator key information to the smart card, which obtains originator key information from the received signed originator key information using a root security key stored therein; and obtains the first calculation result from the security information using the originator key information.

8. The device as claimed in claim 7 wherein
the communications means also receives a root security key update message containing a new root security key; and
the smart card interface passes the root security key update message to the smart card, which verifies the new root security key using the existing root security key stored in the smart card; and stores the new root security key in the smart card.

9. The device as claimed in claim 7 or 8, wherein the device comprises storage means and part of the root security key is stored in the smart card and part of the root security key is stored in the storage means.

10. The device as claimed in one of claims 6-9, wherein the smart card is a Subscriber Identity Module (SIM) card.



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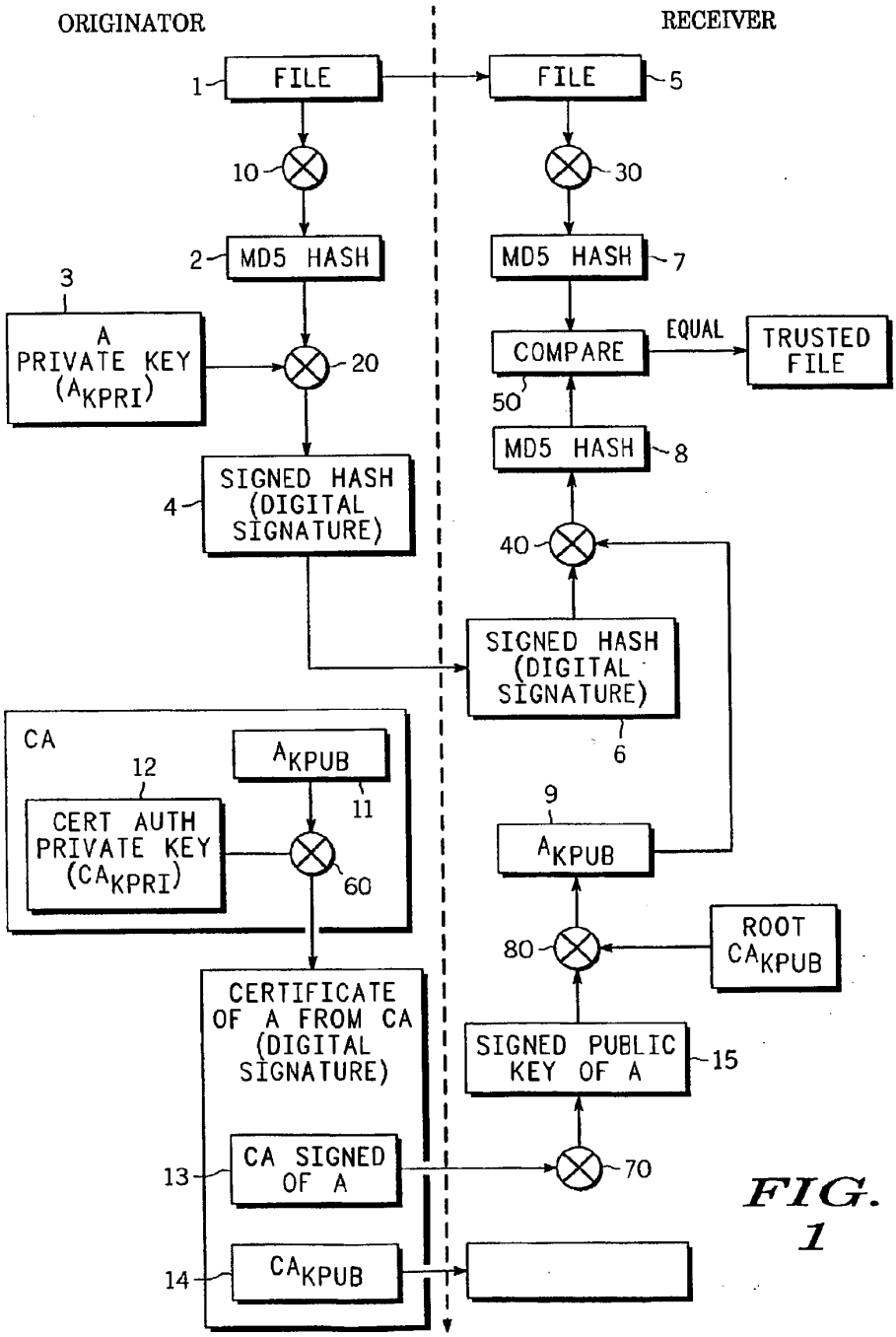



FIG. 1



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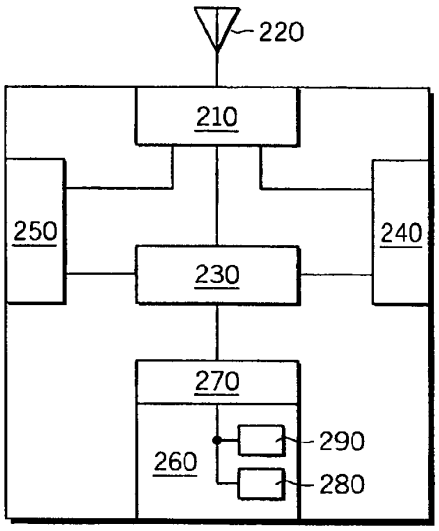



FIG. 2



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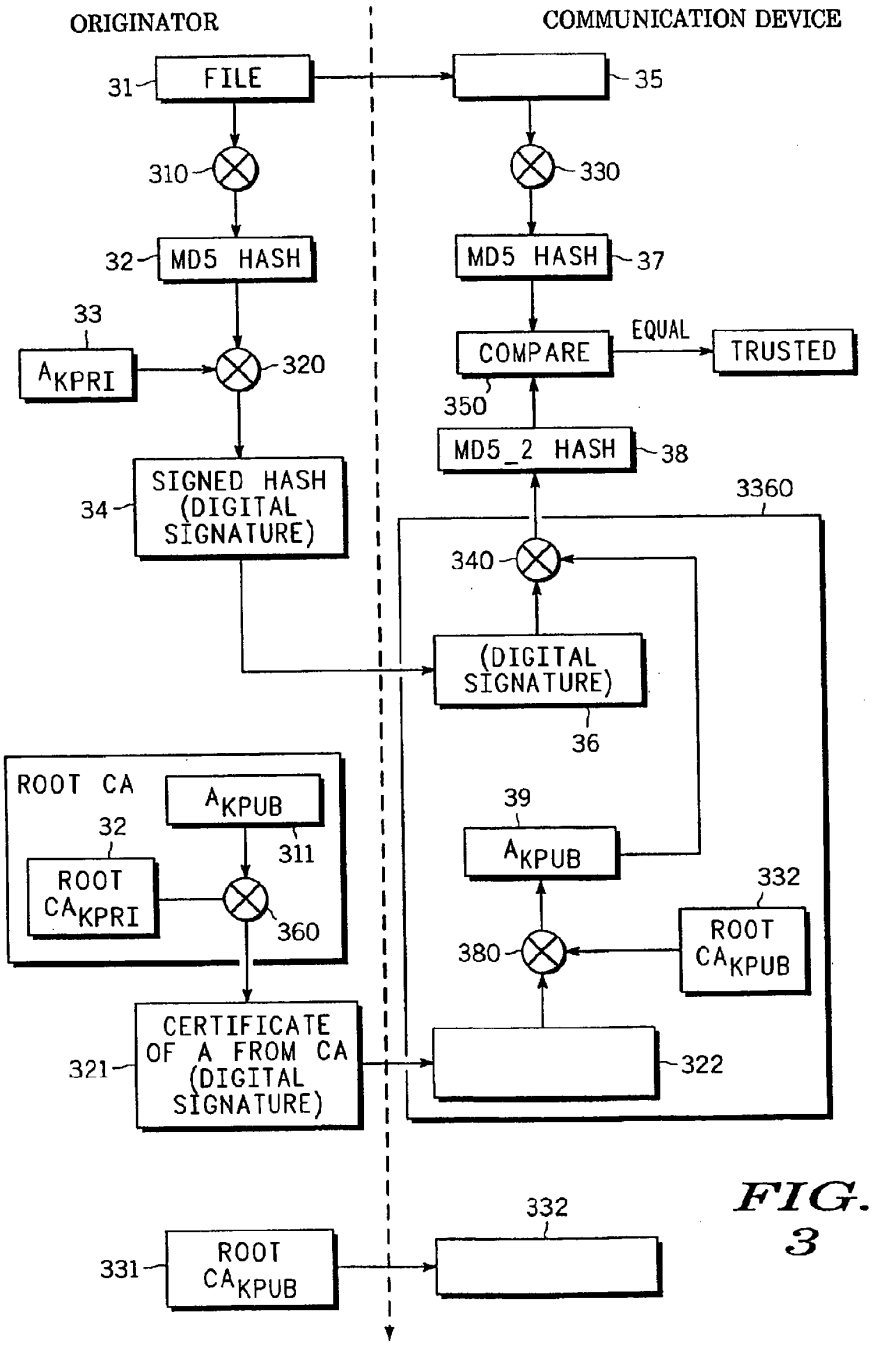



*FIG. 3*



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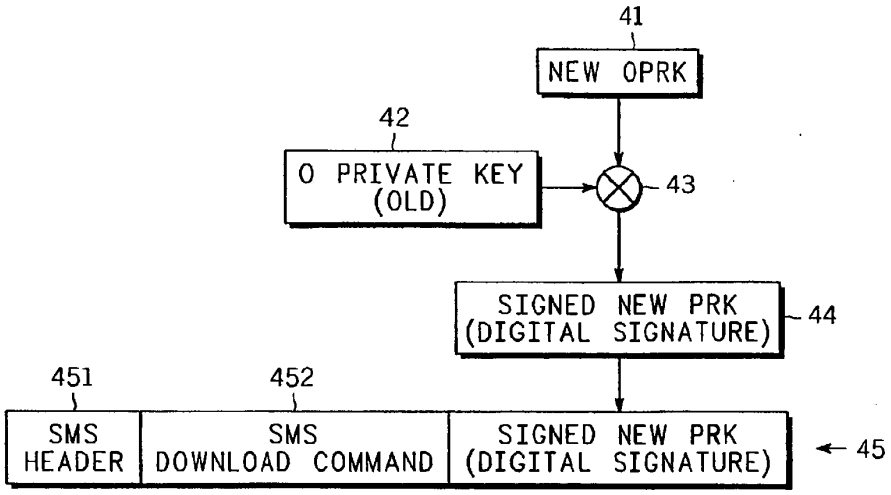
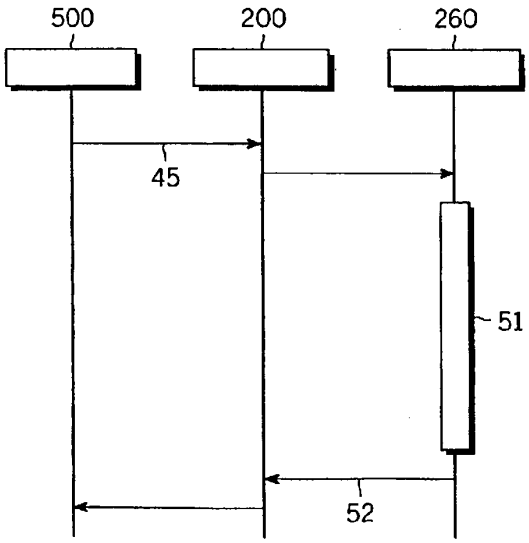



*FIG. 4*

*FIG. 5*






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Application Number
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| PATENT APPLICATION FEE DETERMINATION RECORD<br>Substitute for Form PTO-875 | Application or Docket Number<br>15/227,814 | Filing Date<br>08/03/2016 | ☐ To be Mailed |
|---|---|---|---|

**ENTITY**: ☐ LARGE ☒ SMALL ☐ MICRO

## APPLICATION AS FILED – PART I

| | (Column 1) | (Column 2) | | |
|---|---|---|---|---|
| FOR | NUMBER FILED | NUMBER EXTRA | RATE ($) | FEE ($) |
| ☐ BASIC FEE (37 CFR 1.16(a), (b), or (c)) | N/A | N/A | N/A | |
| ☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m)) | N/A | N/A | N/A | |
| ☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q)) | N/A | N/A | N/A | |
| TOTAL CLAIMS (37 CFR 1.16(i)) | minus 20 = | * | X $ = | |
| INDEPENDENT CLAIMS (37 CFR 1.16(h)) | minus 3 = | * | X $ = | |
| ☐ APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). | | | |
| ☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | | |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | TOTAL | |

## APPLICATION AS AMENDED – PART II

| AMENDMENT | 01/26/2017 | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|---|
| | Total (37 CFR 1.16(i)) | * 19 | Minus | ** 20 | = 0 | X $40 = | 0 |
| | Independent (37 CFR 1.16(h)) | * 4 | Minus | ***3 | = 1 | X $210 = | 210 |
| | ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | |
| | ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | |
| | | | | | | TOTAL ADD'L FEE | **210** |

| AMENDMENT | | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|---|
| | Total (37 CFR 1.16(i)) | * | Minus | ** | = | X $ = | |
| | Independent (37 CFR 1.16(h)) | * | Minus | *** | = | X $ = | |
| | ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | |
| | ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | |
| | | | | | | TOTAL ADD'L FEE | |

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

SLIE
TONYA MCBRIDE

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|---|---|---|---|
| 15/227,814 | 08/03/2016 | Gregory G. Raleigh | RALEP046C2C1C1 |

**CONFIRMATION NO. 2668**

106963
Headwater Partners I LLC
1011 Pruitt Place
Tyler, TX 75703

**PUBLICATION NOTICE**

*OC000000087451331*

**Title:**Mobile Device and Method Attributing Media Services Network Usage to Requesting Application

**Publication No.**US-2016-0344604-A1
**Publication Date:**11/24/2016

## NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

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Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 15/227,814 | 08/03/2016 | Gregory G. Raleigh | RALEP046C2C1C1 | 2668 |

106963 7590 10/26/2016

Headwater Partners I LLC
1011 Pruitt Place
Tyler, TX 75703

| EXAMINER | |
|---|---|
| MOUTAOUAKIL, MOUNIR | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2476 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 10/26/2016 | ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patent@headwaterllc.com

| Office Action Summary | Application No. 15/227,814 | Applicant(s) RALEIGH ET AL. | |
|---|---|---|---|
| | Examiner MOUNIR MOUTAOUAKIL | Art Unit 2476 | AIA (First Inventor to File) Status No |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *08-03-2016*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims***

5)☒ Claim(s) *2-16* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *2-5,11 and 13-16* is/are rejected.

8)☒ Claim(s) *6-10 and 12* is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

**Application Papers**

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

## DETAILED ACTION

1. The present application is being examined under the pre-AIA first to invent provisions.

### *Claim Rejections - 35 USC § 102*

2. The following is a quotation of the appropriate paragraphs of pre-AIA 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

3. Claim(s) 2-4, 11 and 13-16 is/are rejected under pre-AIA 35 U.S.C. 102(e) as being anticipated by Deu-Ngoc et al (US 8,402,165). Hereinafter referred to as Deu.

4. Regarding claims 2 and 16. Deu discloses a wireless end-user device (`Methods and apparatus for prioritizing assignment of a packet data session for a plurality of applications of a mobile communication device`), comprising: a wireless modem configurable to connect to a wireless network (see figure 1 and `The present disclosure relates generally to mobile communication devices operative in wireless communication networks`); a network stack configurable to receive and transmit data via the wireless modem and the wireless network (see figure 1 and `The present disclosure relates generally to mobile communication devices operative in wireless communication networks`); a first network stack Application Programming Interface (API), containing at least one first call to allow device applications to open and use data flows via the network stack, the wireless modem, and the at least one wireless network (see at least figure 1 and `The mobile device may have a`

voice telephony application); a second API containing at least one second call to allow device applications to make a data transfer request for a media object associated with a network resource identifier supplied by the device application (see at least figure 1, title, abstract and Mobile station 102 may consist of a single unit, such as a data communication device, a cellular telephone, a multiple-function communication device with data and voice communication capabilities, a personal digital assistant (PDA) enabled for wireless communication, or a computer incorporating an internal modem); a media service manager (see figure 1, element 106) prompted by the second call, to manage network data transfers for the media object by interfacing with the network stack to retrieve the media object associated with the network resource identifier via the wireless modem and the wireless network (see at least abstract, title, figure 1 and claim 1: Moreover, it is inherent that each application, in smart phone, is associated with its own ID which is used to exchanged data, for example: Skype, gmail, google voice, hotmail, Viber, Vonage...); and a service classification agent to associate wireless network data usage for the media object network data transfers with the device application that requests the data transfer for the media object (see at least title and abstract).

5. Regarding claim 3. Deu discloses a wireless end-user device the service classification agent to also associate wireless network data usage for a data flow opened via the first API with the device application opening that data flow (see at least abstract and claim 1).

6. Regarding claim 4. Deu discloses a wireless end-user device of claim 2, wherein to associate data usage for the media object network data transfers with the device application that makes the data transfer request for the media object comprises to identify at least one of an application name, an application identifier, or a process identifier for the application that makes

the data transfer request (see at least abstract, title, figure 1 and claim 1: Moreover, it is inherent that each application, in smart phone, is associated with its own ID which is used to exchanged data. For example: Skype, gmail, google voice, hotmail, Viber, Vonage...).

7. Regarding claim 11. Deu discloses a wireless end-user device further comprising a media player and a user interface, wherein the media object comprises media data that is, as a result of the media service manager management of network data transfers for the media object, received by the device and played by the media player through the user interface.

8. Regarding claim 13. Deu discloses a wireless end-user device wherein the service classification agent comprises: a requesting application storage agent to, for each device application that makes a data transfer request using the second API, store application dentification information and network resource identification information; a network data flow storage agent to, for each network data flow associated with the media service manager, identify network data flow identification information; and an association agent to match the network data flow identification information for a network data flow with application identification information for the network data transfer associated with the network data flow (see at least figures 1 and 2).

9. Regarding claim 14. Deu discloses a wireless end-user device further comprising: a local database to store data usage, including data usage for network data transfers managed by the media service manager on behalf of a device application, the stored data usage classified by device application; a user interface; and a user interface display agent to display the data usage classified by application to a user (see at least figures 1 and 2).

10. Regarding claim 15. Due discloses a wireless end-user device the service classification agent to further associate one or more traffic flows, comprising the media object network data transfers, with the device application that makes the data transfer request, the device further comprising an enforcement agent to, based on the association between the one or more traffic flows and the device application, enforce an application-based usage control on network data usage by one or more of the device applications (see abstract and claim 1).

***Claim Rejections - 35 USC § 103***

11. This application currently names joint inventors. In considering patentability of the claims under pre-AIA 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of pre-AIA 35 U.S.C. 103(c) and potential pre-AIA 35 U.S.C. 102(e), (f) or (g) prior art under pre-AIA 35 U.S.C. 103(a).

12. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under pre-AIA 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.

3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

13. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

14. Claim 5 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Deu in view of Constantinof (US 2014/0241342). Regarding claim 5, Deu discloses all the limitations of the claimed invention with the exception the data transfer request comprises a network resource identifier that identifies a source of the data to be transferred, a proxy to the source of the data to be transferred, or the media object to be transferred, in particular, wherein the network resource identifier comprises one or more of an Internet Protocol address, a Uniform Resource Locator, a remote file name/address, a stream name, and an object name. However, Constantinof, from the same field of endeavor, teaches a communication method wherein the data transfer request comprises a network resource identifier that identifies a source of the data to be transferred, a proxy to the source of the data to be transferred, or the media object to be transferred, in particular, wherein the network resource identifier comprises one or more of an Internet Protocol address, a Uniform Resource Locator, a remote file name/address, a stream name, and an object name (see at least paragraph [0020]). Thus, it would have been obvious to a person of ordinary skill in the art at the time of the invention to employ the teaching of Constantinof into the communication method of Deu for the purpose of communicating with other devices in the network.

***Allowable Subject Matter***

15. Claims 6-10 and 12 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

***Conclusion***

16. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. See PTO_892.

Examiner has cited particular columns and line numbers in the references applied to the claims above for the convenience of the applicant. Although the specified citations are representative of the teachings of the art and are applied to specific limitations within the individual claim, other passages and figures may apply as well. It is respectfully requested from the applicant in preparing responses, to fully consider the references in entirety as potentially teaching all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the Examiner.

In the case of amending the claimed invention, Applicant is respectfully requested to indicate the portion(s) of the specification which dictate(s) the structure relied on for proper interpretation and also to verify and ascertain the metes and bounds of the claimed invention.

When responding to this office action, applicants are advised to clearly point out the patentable novelty which they think the claims present in view of the state of the art disclosed by the references cited or the objections made. Applicants must also show how the amendments avoid such references or objections. See 37C.F.R 1.111(c). In addition, applicants are advised to provide the examiner with the line numbers and pages numbers in the application and/or references cited to assist examiner in locating the appropriate paragraphs.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MOUNIR MOUTAOUAKIL whose telephone number is (571)270-1416. The examiner can normally be reached on Monday-Thursday (1pm-4:30pm) eastern time.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ayaz R. Sheikh can be reached on 571-272-3795. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/MOUNIR MOUTAOUAKIL/
Primary Examiner, Art Unit 2476

| Notice of References Cited | Application/Control No. 15/227,814 | Applicant(s)/Patent Under Reexamination RALEIGH ET AL. | |
|---|---|---|---|
| | Examiner MOUNIR MOUTAOUAKIL | Art Unit 2476 | Page 1 of 1 |

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| | J | US- | | | | |
| | K | US- | | | | |
| | L | US- | | | | |
| | M | US- | | | | |

**FOREIGN PATENT DOCUMENTS**

| * | | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Country | Name | CPC Classification |
|---|---|---|---|---|---|---|
| | N | | | | | |
| | O | | | | | |
| | P | | | | | |
| | Q | | | | | |
| | R | | | | | |
| | S | | | | | |
| | T | | | | | |

**NON-PATENT DOCUMENTS**

| * | | Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages) |
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| | U | |
| | V | |
| | W | |
| | X | |

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
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**INFORMATION DISCLOSURE STATEMENT BY APPLICANT**
**( Not for submission under 37 CFR 1.99)**

| | |
|---|---|
| Application Number | 15227814 |
| Filing Date | 2016-08-03 |
| First Named Inventor | Raleigh |
| Art Unit | |
| Examiner Name | not yet assigned |
| Attorney Docket Number | RALEP046C2C1C1 |

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M/

**U.S.PATENTS** Remove

| Examiner Initial* | Cite No | Patent Number | Kind Code[1] | Issue Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear |
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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M/

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | Application Number | 15227814 |
| | Filing Date | 2016-08-03 |
| | First Named Inventor | Raleigh |
| | Art Unit | |
| | Examiner Name | not yet assigned |
| | Attorney Docket Number | RALEP046C2C1C1 |

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M/

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| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | Application Number | 15227814 |
| | Filing Date | 2016-08-03 |
| | First Named Inventor | Raleigh |
| | Art Unit | |
| | Examiner Name | not yet assigned |
| | Attorney Docket Number | RALEP046C2C1C1 |

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M/

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The information provided by you in this form will be subject to the following routine uses:

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

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7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

**EAST Search History**

**EAST Search History (Prior Art)**

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | Time Stamp |
|---|---|---|---|---|---|---|
| S1 | 141661 | application adj programming adj interface | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/17 23:19 |
| S2 | 2757 | application adj programming adj interface with first with second | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/17 23:20 |
| S3 | 1405 | (application adj programming adj interface with first with second).clm. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/17 23:21 |
| S4 | 0 | (application adj programming adj interface with first with second with media adj service adj manager).clm. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/17 23:21 |
| S5 | 35 | (application adj programming adj interface with first with second with manager).clm. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/17 23:21 |
| S6 | 0 | (application adj programming adj interface with first with second with manager).clm. and headwater.as. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/17 23:25 |
| S7 | 2 | (application adj programming adj interface with first with second).clm. and headwater.as. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/17 23:25 |
| S10 | 19 | dara.in. with monajemi.in. | US-PGPUB; | OR | ON | 2016/10/18 |

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|---|---|---|---|---|---|---|
| | | | USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | | | 00:01 |
| S11 | 5124 | (classif$7 prioritiz$4) with (different multiple plurality many number) near2 (application API) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/18 13:06 |
| S12 | 5124 | (classif$7 prioritiz$4) with (different multiple plurality many number) near2 (application API application adj programming adj interface ) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/18 13:06 |
| S13 | 83 | (classif$7 prioritiz$4) with (different multiple plurality many number or (first with second)) near2 (API application adj programming adj interface ) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/18 13:07 |
| S14 | 867504 | (("709") or ("455") or ("370")).CLAS. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | OFF | 2016/10/18 13:07 |
| S15 | 1030 | S14 and S12 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/18 13:07 |
| S16 | 646 | S14 and S12 and (@ad<="20090128" @rlad<="20090128") | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/18 13:09 |
| S17 | 7 | (classif$7 prioritiz$4) with (different multiple plurality many number or (first with second)) near2 (API application adj programming adj interface) with call$4 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/18 13:09 |
| S18 | 0 | S14 and S17 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; | OR | ON | 2016/10/18 13:09 |

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|---|---|---|---|---|---|---|
| | | | IBM_TDB | | | |
| S19 | 1 | S17 and (@ad<="20090128" @rlad<="20090128") | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/18 13:10 |
| S20 | 0 | S16 and data with manamg$5 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/18 13:14 |
| S21 | 343 | S16 and data with manag$5 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/18 13:14 |
| S22 | 26 | ("20020087716" \| "20040022209" \| "20040040025" \| "20040095903" \| "20040205233" \| "20050043032" \| "20050064891" \| "20050101300" \| "20050128963" \| "20050243760" \| "20050254453" \| "20070136372" \| "20070195801" \| "20080089303" \| "20080132268" \| "20080132269" \| "5881060" \| "5959662" \| "6104929" \| "6711141" \| "6742023" \| "7054323" \| "7272215" \| "7359972" \| "7433961" \| "7764784").PN. | US-PGPUB; USPAT; USOCR | OR | ON | 2016/10/18 19:05 |
| S23 | 1 | 14/339110 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/19 11:38 |
| S24 | 72 | sip with soap with proxy | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/19 13:16 |
| S25 | 0 | sip with soap with proxy with url | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/19 13:16 |
| S26 | 11 | sip with soap with proxy and url | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; | OR | ON | 2016/10/19 13:16 |

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|---|---|---|---|---|---|---|
| | | | IBM_TDB | | | |
| S27 | 11 | sip with soap with proxy and url | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/20 13:39 |
| S28 | 10 | S27 and (@ad<="20090128" @rlad<="20090128") | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/20 13:39 |
| S29 | 304 | sip with proxy with url | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/20 13:40 |
| S30 | 274 | S29 and (@ad<="20090128" @rlad<="20090128") | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/20 13:40 |

**EAST Search History (Interference)**

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | Time Stamp |
|---|---|---|---|---|---|---|
| S8 | 25 | (application adj programming adj interface with first with second with manager).clm. | USPAT | OR | ON | 2016/10/17 23:21 |
| S9 | 0 | (application adj programming adj interface with first with second with manager).clm. and headwater.as. | USPAT | OR | ON | 2016/10/17 23:25 |

**10/20/2016 9:42:01 PM**
**C:\Users\mmoutaouakil\Documents\EAST\Workspaces\15227814.wsp**

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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**INFORMATION DISCLOSURE STATEMENT BY APPLICANT**
**( Not for submission under 37 CFR 1.99)**

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|---|---|
| Application Number | 15227814 |
| Filing Date | 2016-08-03 |
| First Named Inventor | Raleigh |
| Art Unit | |
| Examiner Name | not yet assigned |
| Attorney Docket Number | RALEP046C2C1C1 |

**U.S.PATENTS** Remove

| Examiner Initial* | Cite No | Patent Number | Kind Code[1] | Issue Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear |
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**( Not for submission under 37 CFR 1.99)**

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Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

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| Signature | /James E. Harris/ | Date (YYYY-MM-DD) | 2016-08-12 |
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| | Examiner Name | not yet assigned |
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Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

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See attached certification statement.

Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ None

**SIGNATURE**

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

| Signature | /James E. Harris/ | Date (YYYY-MM-DD) | 2016-08-12 |
|---|---|---|---|
| Name/Print | James E. Harris | Registration Number | 40013 |

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| | 15227814 | RALEIGH ET AL. |
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| | MOUNIR MOUTAOUAKIL | 2476 |

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| ✓ | Rejected | - | Cancelled | N | Non-Elected | A | Appeal |
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☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

| CLAIM | | DATE | | | | | | | | |
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| Final | Original | 10/20/2016 | | | | | | | | |
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**INFORMATION DISCLOSURE STATEMENT BY APPLICANT**
**( Not for submission under 37 CFR 1.99)**

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| Filing Date | 2016-08-03 |
| First Named Inventor | Raleigh |
| Art Unit | |
| Examiner Name | not yet assigned |
| Attorney Docket Number | RALEP046C2C1C1 |

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See attached certification statement.

Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

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# BIB DATA SHEET

**CONFIRMATION NO. 2668**

| SERIAL NUMBER | FILING or 371(c) DATE | CLASS | GROUP ART UNIT | ATTORNEY DOCKET NO. |
|---|---|---|---|---|
| 15/227,814 | 08/03/2016<br>RULE | 370 | 2476 | RALEP046C2C1C1 |

**APPLICANTS**
Headwater Partners I LLC, Tyler, TX;

**INVENTORS**
Gregory G. Raleigh, Woodside, CA;
Jeffrey Green, Sunnyvale, CA;
James Lavine, Corte Madera, CA;
Vien-Phuong Nguyen, Newark, CA;

**** CONTINUING DATA ***************************
This application is a CON of 14/339,110 07/23/2014
which is a CON of 14/338,807 07/23/2014 PAT 9094311
which is a CON of 14/098,527 12/05/2013 PAT 9270559
which is a CON of 13/374,959 01/24/2012 PAT 8606911
which is a CIP of 12/695,019 01/27/2010 PAT 8275830
and is a CIP of 12/695,020 01/27/2010 PAT 8406748
and is a CIP of 12/694,445 01/27/2010 PAT 8391834
and is a CIP of 12/694,451 01/27/2010 PAT 8548428
and is a CIP of 12/694,455 01/27/2010 PAT 8402111
and is a CIP of 12/695,980 01/28/2010 PAT 8340634
and is a CIP of 13/229,580 09/09/2011 PAT 8626115
and is a CIP of 13/237,827 09/20/2011 PAT 8832777
and is a CIP of 13/239,321 09/21/2011 PAT 8898293
and is a CIP of 13/248,028 09/28/2011 PAT 8924469
and is a CIP of 13/247,998 09/28/2011 PAT 8725123
and is a CIP of 13/248,025 09/28/2011 PAT 8924543
and is a CIP of 13/253,013 10/04/2011 PAT 8745191
and is a CIP of 13/309,556 12/01/2011 PAT 8893009
and is a CIP of 13/309,463 12/01/2011 PAT 8793758
and is a CIP of 13/134,028 05/25/2011 PAT 8589541
and claims benefit of 61/435,564 01/24/2011
and claims benefit of 61/472,606 04/06/2011
and claims benefit of 61/550,906 10/24/2011
and claims benefit of 61/589,830 01/23/2012
and said 12/695,019 01/27/2010
claims benefit of 61/264,126 11/24/2009
and claims benefit of 61/270,353 07/06/2009
and said 12/695,020 01/27/2010
claims benefit of 61/275,208 08/25/2009
and claims benefit of 61/237,753 08/28/2009
and said 12/694,455 01/27/2010
claims benefit of 61/264,120 11/24/2009
and said 13/248,028 09/28/2011
claims benefit of 61/348,022 05/25/2010
and said 13/134,028 05/25/2011
claims benefit of 61/381,159 09/09/2010

| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 15227814 | RALEIGH ET AL. |
| | Examiner | Art Unit |
| | MOUNIR MOUTAOUAKIL | 2476 |

| CPC- SEARCHED | | |
|---|---|---|
| Symbol | Date | Examiner |
| | | |

| CPC COMBINATION SETS - SEARCHED | | |
|---|---|---|
| Symbol | Date | Examiner |
| | | |

| US CLASSIFICATION SEARCHED | | | |
|---|---|---|---|
| Class | Subclass | Date | Examiner |
| | | | |

| SEARCH NOTES | | |
|---|---|---|
| Search Notes | Date | Examiner |
| Inventorship Search | 10/20/2016 | MM |
| IDS | 10/20/2016 | MM |
| East | 10/20/2016 | MM |
| NPL | 10/20/2016 | MM |
| EPO | 10/20/2016 | MM |
| WIPO | 10/20/2016 | MM |
| Double patenting search | 10/20/2016 | MM |
| family search | 10/20/2016 | MM |

| INTERFERENCE SEARCH | | | |
|---|---|---|---|
| US Class/ CPC Symbol | US Subclass / CPC Group | Date | Examiner |
| | | | |

| | |
|---|---|
| | |

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 15/227,814 | 08/03/2016 | Gregory G. Raleigh | RALEP046C2C1C1 | 2668 |

106963 7590 09/08/2016

Headwater Partners I LLC
1011 Pruitt Place
Tyler, TX 75703

| EXAMINER | |
|---|---|

| ART UNIT | PAPER NUMBER |
|---|---|
| 2414 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 09/08/2016 | ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patent@headwaterllc.com

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

Doc Code:
TRACK1.GRANT

| ***Decision Granting Request for Prioritized Examination (Track I or After RCE)*** | Application No.: 15/227,814 |
|---|---|

1. THE REQUEST FILED 08/03/16 IS **GRANTED.**

The above-identified application has met the requirements for prioritized examination
A. ☒ for an original nonprovisional application (Track I).
B. ☐ for an application undergoing continued examination (RCE).

2. **The above-identified application will undergo prioritized examination.** The application will be accorded special status throughout its entire course of prosecution until one of the following occurs:

A. filing a **petition for extension of time** to extend the time period for filing a reply;
B. filing an **amendment to amend the application to contain more than four independent claims, more than thirty total claims**, or a multiple dependent claim;
C. filing a **request for continued examination**;
D. filing a notice of appeal;
E. filing a request for suspension of action;
F. mailing of a notice of allowance;
G. mailing of a final Office action;
H. completion of examination as defined in 37 CFR 41.102; or
I. abandonment of the application.

Telephone inquiries with regard to this decision should be directed to Terri Johnson at 571-272-2991. In his/her absence, calls may be directed to Brian Brown at 571-272-5338.

/Terri Johnson/ — Paralegal Specialist

[*Signature*] — (Title)

U.S. Patent and Trademark Office
PTO-2298 (Rev. 02-2012)

# Office of Petitions: Decision Count Sheet

Mailing Month: 9

Application No.: 15227814

*15227814*

For US serial numbers: enter number only, no slashes or commas. Ex: 10123456
For PCT: enter "51+single digit of year of filing+last 5 numbers", Ex. for PCT/US05/12345, enter 51512345

Deciding Official: Johnson, Terri

***Count (1) - Palm Credit*** 15/227,814

Decision: GRANT

FINANCE WORK NEEDED
☐ Select Check Box for YES

*GRANT*

Decision Type: 643 - Track One request

*643*

Notes:

***Count (2)***

Decision: n/a

FINANCE WORK NEEDED
☑ Select Check Box for YES

Decision Type: NONE

Notes:

***Count (3)***

Decision: n/a

FINANCE WORK NEEDED
☐ Select Check Box for YES

Decision Type: NONE

Notes:

Initials of Approving Official (if required)

If more than 3 decisions, attach 2nd count sheet & mark this box ☐

*Printed on:* *9/4/2016*

Office of Petitions Internal Document - Ver. 5.0

# Office of Petitions: Routing Sheet




## Application No. 15/227,814

**This application is being forwarded to your office for further processing. A decision has been rendered on a petition filed in this application, as indicated below. For details of this decision, please see the document PET.OP.DEC filed on the same date as this document.**

- [X] **GRANTED**
- [ ] **DISMISSED**
- [ ] **DENIED**

## PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 15/227,814

### APPLICATION AS FILED - PART I

| FOR | (Column 1) NUMBER FILED | (Column 2) NUMBER EXTRA | SMALL ENTITY RATE($) | SMALL ENTITY FEE($) | OR | OTHER THAN SMALL ENTITY RATE($) | OTHER THAN SMALL ENTITY FEE($) |
|---|---|---|---|---|---|---|---|
| BASIC FEE (37 CFR 1.16(a), (b), or (c)) | N/A | N/A | N/A | 70 | | N/A | |
| SEARCH FEE (37 CFR 1.16(k), (i), or (m)) | N/A | N/A | N/A | 300 | | N/A | |
| EXAMINATION FEE (37 CFR 1.16(o), (p), or (q)) | N/A | N/A | N/A | 360 | | N/A | |
| TOTAL CLAIMS (37 CFR 1.16(i)) | 15 minus 20 = | * | x 40 = | 0.00 | OR | | |
| INDEPENDENT CLAIMS (37 CFR 1.16(h)) | 2 minus 3 = | * | x 210 = | 0.00 | | | |
| APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). | | | 200 | | | |
| MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | | 0.00 | | | |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | TOTAL | 930 | | TOTAL | |

### APPLICATION AS AMENDED - PART II

| | | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | SMALL ENTITY RATE($) | SMALL ENTITY ADDITIONAL FEE($) | OR | OTHER THAN SMALL ENTITY RATE($) | OTHER THAN SMALL ENTITY ADDITIONAL FEE($) |
|---|---|---|---|---|---|---|---|---|---|---|
| AMENDMENT A | Total (37 CFR 1.16(i)) | * | Minus | ** | = | x = | | OR | x = | |
| | Independent (37 CFR 1.16(h)) | * | Minus | *** | = | x = | | OR | x = | |
| | Application Size Fee (37 CFR 1.16(s)) | | | | | | | | | |
| | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | | OR | | |
| | | | | | | TOTAL ADD'L FEE | | OR | TOTAL ADD'L FEE | |

| | | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE($) | ADDITIONAL FEE($) | OR | RATE($) | ADDITIONAL FEE($) |
|---|---|---|---|---|---|---|---|---|---|---|
| AMENDMENT B | Total (37 CFR 1.16(i)) | * | Minus | ** | = | x = | | OR | x = | |
| | Independent (37 CFR 1.16(h)) | * | Minus | *** | = | x = | | OR | x = | |
| | Application Size Fee (37 CFR 1.16(s)) | | | | | | | | | |
| | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | | OR | | |
| | | | | | | TOTAL ADD'L FEE | | OR | TOTAL ADD'L FEE | |

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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| APPLICATION NUMBER | FILING or 371(c) DATE | GRP ART UNIT | FIL FEE REC'D | ATTY.DOCKET.NO | TOT CLAIMS | IND CLAIMS |
|---|---|---|---|---|---|---|
| 15/227,814 | 08/03/2016 | 2414 | 930 | RALEP046C2C1C1 | 15 | 2 |

**CONFIRMATION NO. 2668**

106963
Headwater Partners I LLC
1011 Pruitt Place
Tyler, TX 75703

**FILING RECEIPT**

OC000000085148310

Date Mailed: 08/18/2016

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

**Inventor(s)**

Gregory G. Raleigh, Woodside, CA;
Jeffrey Green, Sunnyvale, CA;
James Lavine, Corte Madera, CA;
Vien-Phuong Nguyen, Newark, CA;

**Applicant(s)**

Headwater Partners I LLC, Tyler, TX;

**Power of Attorney:** The patent practitioners associated with Customer Number 106963

**Domestic Priority data as claimed by applicant**

This application is a CON of 14/339,110 07/23/2014
which is a CON of 14/338,807 07/23/2014 PAT 9094311
which is a CON of 14/098,527 12/05/2013 PAT 9270559
which is a CON of 13/374,959 01/24/2012 PAT 8606911
which is a CIP of 12/695,019 01/27/2010 PAT 8275830
and is a CIP of 12/695,020 01/27/2010 PAT 8406748
and is a CIP of 12/694,445 01/27/2010 PAT 8391834
and is a CIP of 12/694,451 01/27/2010 PAT 8548428
and is a CIP of 12/694,455 01/27/2010 PAT 8402111
and is a CIP of 12/695,980 01/28/2010 PAT 8340634
and is a CIP of 13/229,580 09/09/2011 PAT 8626115
and is a CIP of 13/237,827 09/20/2011 PAT 8832777
and is a CIP of 13/239,321 09/21/2011 PAT 8898293
and is a CIP of 13/248,028 09/28/2011 PAT 8924469
and is a CIP of 13/247,998 09/28/2011 PAT 8725123
and is a CIP of 13/248,025 09/28/2011 PAT 8924543

and is a CIP of 13/253,013 10/04/2011 PAT 8745191
and is a CIP of 13/309,556 12/01/2011 PAT 8893009
and is a CIP of 13/309,463 12/01/2011 PAT 8793758
and is a CIP of 13/134,028 05/25/2011 PAT 8589541
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and claims benefit of 61/472,606 04/06/2011
and claims benefit of 61/550,906 10/24/2011
and claims benefit of 61/589,830 01/23/2012
and said 12/695,019 01/27/2010
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and said 12/694,455 01/27/2010
claims benefit of 61/264,120 11/24/2009
and said 13/248,028 09/28/2011
claims benefit of 61/348,022 05/25/2010
and said 13/134,028 05/25/2011
claims benefit of 61/381,159 09/09/2010
and claims benefit of 61/381,162 09/09/2010
and claims benefit of 61/384,456 09/20/2010
and claims benefit of 61/389,547 10/04/2010
and claims benefit of 61/385,020 09/21/2010
and claims benefit of 61/387,243 09/28/2010
and claims benefit of 61/387,247 09/28/2010
and claims benefit of 61/407,358 10/27/2010
and claims benefit of 61/418,507 12/01/2010
and claims benefit of 61/418,509 12/01/2010
and claims benefit of 61/420,727 12/07/2010
and claims benefit of 61/422,565 12/13/2010
and claims benefit of 61/422,572 12/13/2010
and claims benefit of 61/422,574 12/13/2010
and is a CIP of 13/134,005 05/25/2011 PAT 8635335
and is a CIP of 12/695,021 01/27/2010 PAT 8346225
which claims benefit of 61/252,151 10/15/2009
and claims benefit of 61/252,153 10/15/2009
and is a CIP of 12/380,780 03/02/2009 PAT 8839388
and said 13/134,005 05/25/2011
is a CIP of 12/380,780 03/02/2009 PAT 8839388
and said 13/134,005
is a CIP of 12/380,778 03/02/2009 PAT 8321526
and said 12/380,780
claims benefit of 61/206,354 01/28/2009
and claims benefit of 61/206,944 02/04/2009
and claims benefit of 61/207,393 02/10/2009
and claims benefit of 61/207,739 02/13/2009
and said 12/380,778 03/02/2009
claims benefit of 61/206,354 01/28/2009
and claims benefit of 61/206,944 02/04/2009
and claims benefit of 61/207,393 02/10/2009

and claims benefit of 61/207,739 02/13/2009

**Foreign Applications** for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
*Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.*

**Permission to Access Application via Priority Document Exchange:** Yes

**Permission to Access Search Results:** Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

**If Required, Foreign Filing License Granted:** 08/16/2016

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 15/227,814**

**Projected Publication Date:** 11/24/2016

**Non-Publication Request:** No

**Early Publication Request:** No
**** SMALL ENTITY ****
**Title**

Mobile Device and Method Attributing Media Services Network Usage to Requesting Application

**Preliminary Class**

370

**Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:** No

## PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application

serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

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## Title 35, United States Code, Section 184

## Title 37, Code of Federal Regulations, 5.11 & 5.15

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**NOT GRANTED**

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

## *SelectUSA*

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

**INFORMATION DISCLOSURE STATEMENT BY APPLICANT**
**( Not for submission under 37 CFR 1.99)**

| | |
|---|---|
| Application Number | 15227814 |
| Filing Date | 2016-08-03 |
| First Named Inventor | Raleigh |
| Art Unit | |
| Examiner Name | not yet assigned |
| Attorney Docket Number | RALEP046C2C1C1 |

**U.S.PATENTS** Remove

| Examiner Initial* | Cite No | Patent Number | Kind Code[1] | Issue Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|---|
| | 1 | 5577100 | | 1996-11-19 | McGREGOR et al. | |
| | 2 | 5794142 | | 1998-08-11 | VANTTILA et al. | |
| | 3 | 5892900 | | 1999-04-06 | GINTER et al. | |
| | 4 | 5903845 | | 1999-05-11 | BUHRMANN et al. | |
| | 5 | 5933778 | | 1999-08-03 | BUHRMANN et al. | |
| | 6 | 5940472 | | 1999-08-17 | NEWMAN et al. | |
| | 7 | 6047268 | | 2000-04-04 | BARTOLI et al. | |
| | 8 | 6078953 | | 2000-06-20 | VAID et al. | |

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | Application Number | 15227814 |
| | Filing Date | 2016-08-03 |
| | First Named Inventor | Raleigh |
| | Art Unit | |
| | Examiner Name | not yet assigned |
| | Attorney Docket Number | RALEP046C2C1C1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 9 | 6098878 | | 2000-08-08 | DENT et al. | |
| | 10 | 6141686 | | 2000-10-31 | JACKOWSKI et al. | |
| | 11 | 6148336 | | 2000-11-14 | THOMAS et al. | |
| | 12 | 6198915 | | 2001-03-06 | McGREGOR et al. | |
| | 13 | 6263055 | | 2001-07-17 | GARLAND et al. | |
| | 14 | 6317584 | | 2001-11-13 | ABU-AMARA et al. | |
| | 15 | 6418147 | | 2002-07-09 | WIEDEMAN, Robert A. | |
| | 16 | 6449479 | | 2002-09-10 | SANCHEZ, Eduardo | |
| | 17 | 6532235 | | 2003-03-11 | BENSON et al. | |
| | 18 | 6532579 | | 2003-03-11 | SATO et al. | |
| | 19 | 6539082 | | 2003-03-25 | LOWE et al. | |

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | Application Number | 15227814 |
| | Filing Date | 2016-08-03 |
| | First Named Inventor | Raleigh |
| | Art Unit | |
| | Examiner Name | not yet assigned |
| | Attorney Docket Number | RALEP046C2C1C1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 20 | 6563806 | | 2003-05-13 | YANO et al. | |
| | 21 | 6574321 | | 2003-06-03 | COX et al. | |
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| | First Named Inventor | Raleigh |
| | Art Unit | |
| | Examiner Name | not yet assigned |
| | Attorney Docket Number | RALEP046C2C1C1 |

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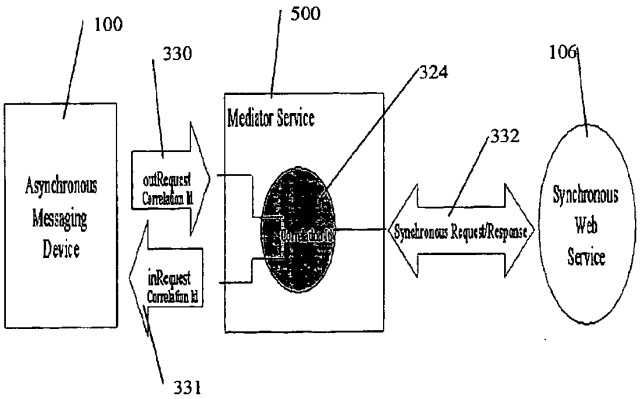
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*[Continued on next page]*

(54) Title: SYSTEM AND METHOD FOR COMMUNICATING ASYNCHRONOUSLY WITH WEB SERVICES USING MESSAGE SET DEFINITIONS




(57) Abstract: A system and method for correlating asynchronous communication messages between a mobile device and a data source over a network, the mobile device for executing an application to provide interaction with the data source based on content of the communication messages. The system and method comprising: a message correlation set configured to include a set of correlation definitions for linking an asynchronous request message of the communication messages with a corresponding asynchronous response message of the communication messages, the correlation definitions including a first correlation identifier for including in the asynchronous request message when generated and a second correlation identifier expected in the asynchronous response message when received, the first identifier different from the second identifier; a message manager for coordinating the transmission and receipt of the messages so as to associate a first data parameter of the request message with a second data parameter of the response message by matching the first and second identifiers of the messages with the correlation definitions of the message correlation set, the first and second data parameters also part of the message correlation set as data definitions.

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BNSDOCID: <WO_____2005083934A1_I_>

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# System and Method for Communicating Asynchronously with Web Services Using Message Set Definitions

## BACKGROUND

This application relates generally to wireless communication and specifically to network messaging for mobile communication devices.

There is a continually increasing number of mobile communication devices in use today, such as mobile telephones, PDAs with wireless communication capabilities, and two-way pagers. Software applications which run on these mobile communication devices increase their utility. For example, a mobile phone may include an application which retrieves the weather for a range of cities, or a PDA may include an application that allows a user to shop for groceries. These software applications take advantage of the mobility of these devices and connectivity to a wireless network in order to provide timely and useful services to users, regardless of where the users are. However, due to the restricted resources of mobile communications devices, and the complexity of delivering data wirelessly to a mobile communication device, developing software applications for mobile communications devices remains a difficult and time-consuming task.

Web Services are emerging as the de-facto mechanism to allow disjoint parties to collaborate on the Internet. Web services allow businesses and other parties to collaborate in a universal, platform and language neutral way and promise to overcome traditional barriers encountered in linking numerous and diverse information systems. Web services are still in their relative infancy, with many technology players cooperating to define the emerging standards, and corporations beginning to throw their weight behind the thrust to link disparate systems over the web using this standard approach. A common model employed in web service offerings is the traditional synchronous request-response type interaction whereby the consumer of the service passes some information and receives something in response. In this scenario the user of the device requests or **"pulls"** the content from the network. In other words, the content is



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constantly present in the network, but the user needs to issue a retrieval request to access the information (e.g. using a browser on the mobile device).

In real-life applications there is a lot of information that is available to a user but hardly accessible, as the user doesn't know when the information is posted or when there is a change in the status of the posted content. Such information ideally needs to be **"pushed"** to the user either periodically or when certain predefined events occur. Some examples of possible push situations are unrequested arrival of new e-mail, stock market information, multi-user game updates, etc. This ability to push information spontaneously implies an asynchronous messaging framework. From a practical point of view, wireless communications have higher cost than wired communications and usually are characterized by higher latency times, making a 'pull' from a wireless device inherently expensive. Slow connection times sometimes might be critical to the user's experience. Push technology can be wireless friendly. Its users can benefit in a number of ways: push technology can make useful data instantly available, can improve user perception of the wireless network; can make data delivery cost effective (since the device does not have to repeatedly poll for data); and can extend battery life.

Wireless push would involve a server that, given a user's specific one-time request to be notified with specific data on predefined conditions, would send this data to the user's device as soon as the data is available and/or the conditions have been met. The communication protocol and user/device addressing are device-specific and the server must be aware of them. Web Services have become a ubiquitous standard for access to content resources as well as communicating to back-end servers. Their number and complexity have increased considerably in recent years. However, invoking Web Service operations from a wireless device using the synchronous communication method exclusively can be expensive and impractical.

## SUMMARY OF THE INVENTION

Systems and methods disclosed herein provide a correlated asynchronous messaging environment to obviate or mitigate at least some of the above presented disadvantages.



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Wireless push would involve a server that, given a user's specific one-time request to be notified with specific data on predefined conditions, would send this data to the user's device as soon as the data is available and/or the conditions have been met. The communication protocol and user/device addressing are device-specific and the server must be aware of them. Web Services have become a ubiquitous standard for access to content resources as well as communicating to back-end servers. Their number and complexity have increased considerably in recent years. However, invoking Web Service operations from a wireless device using the synchronous communication method exclusively can be expensive and impractical. Contrary to current systems and methods there is provided a system and method for correlating asynchronous communication messages between a mobile device and a data source over a network, the mobile device for executing an application to provide interaction with the data source based on content of the communication messages. The system and method comprising: a message correlation set configured to include a set of correlation definitions for linking an asynchronous request message of the communication messages with a corresponding asynchronous response message of the communication messages, the correlation definitions including a first correlation identifier for including in the asynchronous request message when generated and a second correlation identifier expected in the asynchronous response message when received, the first identifier different from the second identifier; a message manager for coordinating the transmission and receipt of the messages so as to associate a first data parameter of the request message with a second data parameter of the response message by matching the first and second identifiers of the messages with the correlation definitions of the message correlation set, the first and second data parameters also part of the message correlation set as data definitions.

There is provided a system for correlating asynchronous communication messages between a mobile device and a data source over a network, the mobile device for executing an application to provide interaction with the data source based on content of the communication messages, the system comprising: a message correlation set configured to include a set of correlation definitions for linking an asynchronous request message of the communication messages with a corresponding asynchronous response message of the communication messages, the correlation definitions including a first correlation identifier for including in the asynchronous request message when generated and a second correlation identifier expected in



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the asynchronous response message when received, the first identifier different from the second identifier; a message manager for coordinating the transmission and receipt of the messages so as to associate a first data parameter of the request message with a second data parameter of the response message by matching the first and second identifiers of the messages with the correlation definitions of the message correlation set, the first and second data parameters also part of the message correlation set as data definitions.

There is further provided a method for correlating asynchronous communication messages between a mobile device and a data source over a network, the mobile device for executing an application to provide interaction with the data source based on content of the communication messages, the method comprising the steps of: sending an asynchronous request message of the communication messages; receiving an asynchronous response message of the communication messages; linking the asynchronous request message with the corresponding asynchronous response message by employing a message correlation set including a set of correlation definitions, the correlation definitions including a first correlation identifier for including in the asynchronous request message when generated and a second correlation identifier expected in the asynchronous response message when received, the first identifier different from the second identifier; associating a first data parameter of the request message with a second data parameter of the response message by matching the first and second identifiers of the messages with the correlation definitions of the message correlation set, the first and second data parameters also part of the message correlation set as data definitions.

There is further provided a computer program product for correlating asynchronous communication messages between a mobile device and a data source over a network, the mobile device for executing an application to provide interaction with the data source based on content of the communication messages, the computer program product comprising: a computer readable medium; a message correlation set module stored on the medium and configured to include a set of correlation definitions for linking an asynchronous request message of the communication messages with a corresponding asynchronous response message of the communication messages, the correlation definitions including a first correlation identifier for including in the asynchronous request message when generated and a second correlation identifier expected in



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the asynchronous response message when received, the first identifier different from the second identifier; a message manager module for coordinating the transmission and receipt of the messages so as to associate a first data parameter of the request message with a second data parameter of the response message by matching the first and second identifiers of the messages with the correlation definitions of the message correlation set module, the first and second data parameters also part of the message correlation set as data definitions.

## BRIEF DESCRIPTION OF THE DRAWINGS

These and other features will become more apparent of embodiments of the present invention in the following detailed description, in which reference is made to the appended drawings by way of example wherein:

Figure 1 is a block diagram of a communication system;

Figure 2 is a block diagram of a mobile communication device of Figure 1;

Figure 3 is an asynchronous messaging and data relationship example of the web service of Figure 1;

Figure 4 is an example synchronous operation of the web service of Figure 3;

Figure 5 shows a mediator service correlating asynchronous to synchronous messaging of the examples of Figures 3 and 4;

Figure 6 shows an example configuration of the mediator service and runtime of Figures 1 and 5;

Figure 7 is further embodiment the system of Figure 5; and

Figure 8 is a block diagram of a component application program of Figure 9.

## DESCRIPTION

### Network System

Referring to Figure 1, a network system 20 comprises mobile communication devices 100 for interacting with one or more web services 106 provided via a coupled wireless network 102 and the Internet 104. The devices 100 transmit and receive requests/response messages 105, respectively, when in communication with the web services 106. The devices 100 can operate as web clients of the web services 106 by using the requests/response messages 105 in the form of message header information and associated data content, for example requesting and



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receiving product pricing and availability from an on-line merchant. The web service 106 is an example of a system with which client application programs 302 (see Figure 2) on the communication devices 100 interact via the wireless network 102 and the Internet 104 in order to provide utility to users of the communication devices 100. The messages 105 sent between the communication devices 100 and the web service 106 could traverse a message-map service (not shown) which converts the messages 105 between the differing formats used by the devices 100 and the web service 106.

For satisfying the appropriate requests/response messages 105, the web service 106 could communicate with the devices 100 through various protocols (such as but not limited to HTTP and component API) for exposing relevant business logic (methods) to client application programs 302 (see Figure 2) once provisioned on the devices 100. The application programs 302 of the devices 100 can use the business logic of the web service 106 similarly to calling a method on an object (or a function). It is recognized that the client application program 302 can be downloaded/uploaded in relation to the web service 106, through the messages 105 via the network 102, 104, directly to the devices 100. It is further recognized that the devices 100 can communicate with one or more web services 106 via the networks 102, 104.

**Server Environment**

Referring to Figure 1, the web service 106 provides information messages 105 which are used by the client application programs 302 on the communication devices 100. Alternatively, or in addition, the web service 106 may receive and use the information messages 105 provided by the client application programs 302 executed on the communication devices 100, or perform tasks on behalf of client application programs 302 executed on the communication devices 100. The web service 106 can be defined as a software service, which can implement an interface expressed using Web Services Description Language (WSDL) registered in Universal Discovery Description and Integration (UDDI), for example,and can communicate through messages 105 with client devices 100 by being exposed over the Internet 104 through an appropriate protocol such as the Simple Object Access Protocol (SOAP), for example. In some implementations, SOAP is a specification that defines the XML format for the messages 105, including a well-formed XML fragment enclosed in SOAP elements. Other parts of SOAP specify how to



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represent program data as XML and how to use SOAP to do Remote Procedure Calls (RPC). These optional parts of SOAP are used to implement RPC-style applications where a SOAP request message 105 containing a callable function, and the parameters to pass to the function, is sent from the client device 100, and the service 106 returns the response message 105 with the results of the executed function. SOAP also supports document style applications where the SOAP message 105 is a wrapper around an XML document. A further optional part of SOAP defines the HTTP binding (e.g. header), whereas some SOAP implementations support MSMQ, MQ Series, SMTP, or TCP/IP transport protocols. Alternatively, the web service 106 may use other known communication protocols, message 105 formats, and the interface may be expressed in other web services 106 languages than described above. Accordingly, the services supplied by the web service 106 are utilized by the user of the devices 100 over the network 102, 104.

**Client Environment**

Referring to Figures 2 and 3, the applications 302 are software applications which can be written, for example, in eXtensible Markup Language (XML) and a subset of ECMAScript. An example application 302 is described in detail, for completeness purposes, with reference to Figure 10 in the Application Program 302 section found at the end of this Description Section. XML and ECMAScript are standards-based languages which allow software developers to develop the applications 302 in a portable and platform-independent way. The applications 302 can be transmitted over-the-air via the wireless network 102 and loaded into a memory module 210 of a device infrastructure 204. Alternatively, the applications 302 may be loaded via a serial connection, a USB connection, or a short-range wireless communication system such as IR, 802.11(x) and/or Bluetooth™ onto the device 100. Once loaded onto the mobile communication device 100, the applications 302 are executed by a framework 206 on the mobile communication device 100, which converts applications 302 into native code which is executed by the processor in the device infrastructure 204. Alternatively, the applications 302 may be executed as native code or interpreted by another software module or operating system on the mobile communication device 100, which provides the framework 206 as a native runtime environment, hereafter referred to generically by reference numeral 206.



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Referring again to Figure 3, the applications 302 are organised as multiple tier/layer 310 applications 302, such as but not limited to a messaging layer 404 and a data layer 400. It is recognised that the application 302 can contain other layers 310, such as but not limited to a presentation layer 402 and a workflow layer 406, as further explained below with reference to Figure 10. The application 302 is configured to have a set of data definitions 314 in the data layer 400, a set of asynchronous message definitions 316 in the message layer 404 and mappings 318 that specify how the message definitions 316 are related to the underlying data definitions 314. In general, it is recognised that the application definitions 314,316 (including definitions 320,322 – see Figure 10) of the respective layers 310 can be expressed in a structured definition language such as but not limited to XML.

Data Components 400 can be defined as application 302 data represented in native code or XML, or other structured definition language. Message Components 402 can be defined as messaging data represented in native code or XML, or other structured definition language. Message components 402 may define mapping relationships to Data Components 400 that specify their definition, or how underlying data is affected through transmission or reception of the messages 330,331a,331b. The Device Runtime or framework 206 can be defined as the software that hosts and evaluates the application 302. The Device Runtime 206 provides services to manage data associated to the application 302, provides capability for asynchronous incoming 331b and outgoing messages 330 generated by the application 302, and manages relationships between messages and data. Message Mapping can be defined as a relationship existing between data 400 and message 402 components that specifies partial or complete definition of the message based on a data mapping, and how messaging interactions affect the underlying data.

Generally the data definitions 314 are distinguished as having a set of sub-elements 323 (or fields), and define a key field or identifier 324 by which the mapping 318 (from the corresponding message definition 316) to the associated data element 323 may be resolved. Messages 105 derived from the message definitions 316 can define a set of fields but may not specify key fields, which is implemented through mappings 318. The messages 105 are typically short lived; are consumed and then discarded, whereas data elements 323 corresponding to the data definitions 314 are long lived and may be restored at any time from the persistent storage



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210 (see Figure 2) by providing the appropriate key field value 324 by the storage service (not shown) of the device runtime 206. The messages 105, either synchronous-based or asynchronous-based, represent interactions with entities (i.e. web-services 106) outside of the Device Runtime 206 and these messages 105 are typically not correlated by the web services 106 themselves. The messages 105 may be defined as originating (i.e. out message 105) from the device runtime 206 and targeted to the external web service 106, or may be transmitted (i.e. in message 105) to the device runtime 206.

Further, message definitions 316 may define relationships to data elements 323 called mappings 318 that determine how origination or reception of the related message 105 affects the related data element 323, as for example defined by the data definition 314 of the data layer 400. This mapping 318 relation is uniquely identified by the key field 324 mapping 318 that may be determined as follows, such as but not limited to:

the mapping 318 is made directly to the data definition 314: the message 105 takes its complete definition from the data definition 314 such that the data element key field 324 value is extracted from identical message definition 316 field element (generally referred to hereafter as message mapping 318 wherein all fields of the message 105 correspond to all fields of the data definition 314); and

the mapping 318 is from a field of the message definition 316 to a field of the data definition 314: the message 105 partially defines itself such that the data element key field 324 value is extracted from mapped message field (generally referred to hereafter as field mapping 318 wherein selected fields of the data definition 314 are mapped 318 to selected fields of the message definition 316).

As an example, referring to Figure 3, consider an asynchronous web service 106 (see Figure 1) that models a pizza parlour. This web service 106 exposes the capability to register the wireless device 100 as a PizzaClient application 302 (see Figure 2) and may aynchronously deliver the user an asynchronous response message 331, e.g. a Coupon message 326 or a Special message 328, to the wireless application 302 running on the runtime environment 206 of the device 100. The set of corresponding data elements 323 and asynchronous response messages 331 to interact with the web service 106 are depicted in Figure 3, which illustrates the



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PizzaClient data elements 323 and message field level mappings 318 to the outRegisterUser outgoing request message 330. The PizzaClient application 302 may contain none or more Coupon data elements 323 which are message mapped 318 directly to the inAddCoupon incoming message 326. Finally the Special data element 323 is message mapped 318 directly to the inAddSpecial incoming message 328. It is noted that the inAddCoupon 326 and inAddSpecial 328 are asynchronous messages 331, such that each arriving message 326,328 identifies its own key field (from mapping 318) that affects the underlying data element 323. For example, once the messages 326,328 are received by the application 302, the persistence service (e.g. data manager) of the device 100 may create a new data element or update an existing data element resident in the storage 210 (see Figure 2).

Further, referring to Figure 4, suppose that the Pizza Shop now wants to extend their web service 106 by allowing the user of the device 100 to order a pizza. The web service 106 can be enhanced to provide a synchronous message operation 332 that accepts some order criteria and returns order confirmation and delivery time. The order request is distinguished by an order id (this becomes the data key 324 preferably a unique identifier), and the order confirmation id 325 is associated with uncorrelated data from the web service 106 describing the success of the order. Correlation of the return data from the Web Service's 106 perspective is achieved by the synchronous request-response nature of the submission operation 332. However correlation of the returned data within the framework of the asynchronous messaging model (see Figure 3) of the device runtime environment 206 is not immediately apparent, due to the fact that the order confirmation data returned by the web service 106 is uncorrelated to the request by any key 324 information, which if included would tie the result to the original order data element. As depicted in Figure 4, two asynchronous message definitions 316 are used to generate corresponding messages 105 to handle the order placement (outPlaceOrder) and reception of order confirmation (orderConfirmation). The mediator 500 (see Figure 5) is used to help link the order confirmation information directly to the originating Order data element, as further described below.

Referring again to Figures 1 and 2, the client runtime environment 206 provided by the devices 100 can be configured to make the devices 100 operate as web clients of the web



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services 106. The client runtime environment 206 of the devices 100 is preferably capable of generating, hosting and executing the client application programs 302 (which are in the form of tiered/layered 310 applications – see Figure 3) on the device 100. Further, specific functions of the client runtime environment 206 can include such as but not limited to support for language, coordinating memory allocation, networking, management of data during I/O operations, coordinating graphics on an output device of the devices 100 and providing access to core object oriented classes and supporting files/libraries.

The terminal runtime environment 206 of the devices 100 preferably supports the following basic functions for the resident executable versions of the client application programs 302, such as but not limited to:

provide a communications capability to send the messages 105 to the Web Services 106 connected via the network 102, 104;

provide data input capabilities by the user on the input interface 202 (see Figure 2) of the devices 100 to supply data parts for Web Services' outgoing messages 105 (messages to the service 106);

provide data presentation or output capabilities for Web Services' response messages 105 (incoming messages) or uncorrelated notifications of the web service 106 on the output interface 202;

provide data storage services to maintain local client data in the memory module 210 (see Figure 9) of the device 100; and

provide an execution environment for a scripting language for coordinating operation of the application layers 400, 402, 404, 406 (see Figure 10) of the client application programs 302.

Therefore, the native client terminal runtime environment 206 provides an interface for the client application programs 302 and to the device 100 functionality of a processor 208 and associated operating system of a device infrastructure 204. The runtime environment 206 preferably supplies a controlled, secure and stable environment on the device 100, in which the component application programs 302 execute. The runtime environment 206 provisions the definitions of the layers 400, 402, 404, 406 to create the actual web client.



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**Communication Device**

Referring to Figures 1 and 2, the communication devices 100 are devices such as but not limited to mobile telephones, PDAs, two-way pagers and dual-mode communication devices (see Figure 9). The devices 100 include a network connection interface such as a wireless transceiver 200 coupled via connection 218 to the device infrastructure 204. The wireless transceiver 200 is connectable during operation of the devices 100 to the network 102, 104, such as to the wireless network 102 by RF links, which enable the devices 100 to communicate with each other and with external systems (such as the web service 106) via the network 102, 104. The wireless transceiver 200 also helps the device 100 to coordinate the requests/response messages 105 between the client application programs 302 and the service 106. The network 102, 104 supports the transmission of data in the requests/response messages 105 between devices 100 and external systems, which are connected to the network 102, 104. The network 102, 104 may also support voice communication for telephone calls between the communication devices 100 and devices which are external to the network 102, 104. A wireless data transmission protocol can be used by the wireless network 102, such as but not limited to DataTAC, GPRS or CDMA. The connection between the wireless network 102 and the Internet 104 includes an Internet Gateway (not shown), which provides for the messages 105 and associated data content to flow between the connected devices 100 and the web service 106.

Referring again to Figure 2, the devices 100 also have the user interface 202, coupled to the device infrastructure 204 by connection 222, to interact with a user (not shown). The user interface 202 can include one or more user input interface such as but not limited to a QWERTY keyboard, a keypad, a trackwheel, a stylus, a mouse, a microphone, and the user output interface such as an LCD screen display and/or a speaker. If the screen is touch sensitive, then the display can also be used as the user input device as controlled by the device infrastructure 204. The user interface 202 is employed by the user of the device 100 to coordinate the requests/response message messages 105 over the system20(see Figure 1) as employed by client application programs 302 executed in the runtime environment 206.

Referring again to Figure 2, operation of the communication device 100 is enabled by the device infrastructure 204. The device infrastructure 204 includes the computer processor 208



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and the associated memory module 210. The computer processor 208 manipulates the operation of the network interface 200, the user interface 202 and the runtime environment 206 of the communication device 100 by executing related instructions, which are provided by an operating system and client application programs 302 located in the memory module 210. Further, it is recognized that the device infrastructure 204 can include a computer readable storage medium 212 coupled to the processor 208 for providing instructions to the processor and/or to load/update client application programs 302 in the memory module 210. The computer readable medium 212 can include hardware and/or software such as, by way of example only, magnetic disks, magnetic tape, optically readable medium such as CD/DVD ROMS, and memory cards. In each case, the computer readable medium 212 may take the form of a small disk, floppy diskette, cassette, hard disk drive, solid state memory card, or RAM provided in the memory module 210. It should be noted that the above listed example computer readable mediums 212 can be used either alone or in combination.

**Mediator Service 500**

The desire to migrate towards an asynchronous messaging 105 paradigm in relation to the device 100 is further explained with reference to Figure 5, by example only, wherein a message set 600 (see figure 6) is used to facilitate asynchronous communication between the device 100 and the synchronous web service 106. For situations in which the web service 106 is an asynchronous web service 106, the message set 600 (see Figure 6) is also applicable, as further described below, wherein the device 100 may communicate directly with the asynchronous web service 106 preferably without the proxy function of the mediator 500. . It is recognized that the mediator service 500 could be hosted: on the device 100 as either part of the application 302 or as a separate service/program; on a third party server; and/or on the web service 106, as desired.

**Application Synchronous Message Set 600**

Referring to Figure 6, the message set 600 can be defined as a data to message set that provides for a synchronous relation of otherwise uncorrelated (asynchronous) messages 330,331. It is recognized that the message set 600 can be described in a structured definition language (e.g. markup language) such as but not limited to XML. An example of the message set is the data elements 324a,b,c and 325a,b of the data definition 314 of Figure 4. It is noted that the



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mediator service 500 can optionally proxy synchronous messaging 332 interaction with the web service 106 into the asynchronous exchange of messages 330,331 to the Device Runtime 206 of the device 100. The message Set 600 is a logical grouping of messages definitions 330,331 (see figure 4) of the message definition tier 404 and data elements 324a,b,c of the data tier 400 included for the outgoing asynchronous message 330 content and the data elements 325a,b included in the incoming asynchronous message 331 content. The data definition 314 of the data tier 400 states a correlation between otherwise unrelated asynchronous messages by defining the data 324a,b,c and 325a, as the message set 600. The message set 600 applies a restriction to the otherwise unrestricted asynchronous messaging 330;331 paradigm.

For example, the message set can be further defined as: a single data element definition 314 to which messages 330,331are correlated; one or more outgoing messages 330 that are derived from the data definition 314; and one or more incoming messages 331 that are applied to the data definition 314.

Referring to Figure 7 for example, the problem of correlating a Pizza Shop order could be addressed by defining the Message Set 600 in figure 6, where the outPlaceOrder message 330 and orderConfirmation message 31 are correlated to the Order data definition 314 and clearly define how outgoing and incoming asynchronous messages 330,331 affect the underlying data elements as defined by the definition 314. The outPlaceOrder message 330 complies to the agreement of outgoing messages in the message set 600 by linking to the key field 324a of Order definition 314, i.e. outgoing message 330 definitions may be constrained in that they provide a linkage 440 (see figure 4) to the key element 324a of the data definition 314. This may arise due to Message Mapping or Field Mapping, as described above. The orderConfirmation incoming message 331 conforms to the incoming message requirement of the message set 600 for example by not linking to any key field 324a of the Order data definition 314, rather containing an identifier field 325a that is also part of the message set 600, i.e. incoming message 331 definitions specify Field Mapping 442 directions to the Message Set 600 enclosed by the data element definition 314. Incoming message 331 definitions may be constrained in that they cannot employ Message Mapping 440, and for example no Field Mapping 442 may reference the key field element 324a of the data definition 314.



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It is further emphasized in relation to Figure 7 that the Mediator Service 500 may act as a proxy to the device runtime 206 asynchronous messaging 330,331 so as to assist the device 100 to interact asynchronously with a synchronous message 332 based web service 106. However, the Mediator Service may or may not be present between the device 100 and the web service 106 in cases where the web service is asynchronous based and has knowledge of the message set definitions 600. A further scenario is that the mediator service 500 is present between the device 100 and the web service 106 and has knowledge of the message set 600 definitions and can therefore either interact with the web service 106 in a synchronous fashion or asynchronously as dictated by the configuration of the web service 106. The Mediator Service 500, where used, is able to maintain correlation information of the message set 600 between the incoming device message 330 (i.e. in essence the outgoing request to the web service 106) and the outgoing device message 331 (in essence the response by the web service 106). It is further recognized that where used, the mediator service 500 can be part of the device 100, part of the web service 106, and/or configured as a third party proxy.

**Message Set Components**

Referring to Figure 6, in this system 20, the management of correlation of asynchronous messages 330,331 can be split between the intelligent Device Runtime 206 and the Mediator service 500 using the message set definitions 600. The larger part of this management burden can be borne by the device framework 206. The Device Runtime 206 is primarily responsible for managing the Message Set 600 and relationships, and correlating received messages 331 to prior originating messages 330. The Mediator Service 500, for example, splits the web service 106 request into the asynchronous exchange of messages 330,331 with the device 10, if needed, and associates the correlation information of the message set 600 between related messages 330,331.

Device Runtime Modules

The runtime environment 206 can have a Message Correlation Service 602 responsible for enforcing the rules of the Message Set 600, correlating outgoing asynchronous messages 330



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to incoming asynchronous messages 331 to a single mapped data instance as per the data definitions 314 of the message set 600. Subsystems of the service 602 can include a message Decoder 604 for converting Communication Service 608 message protocol (i.e. for incoming messages 331) into internal operable message format of the device 100 where needed, an Encoder 606 for converting internal message representation of the device 100 into format required to support protocol of the Communication Service 608 (i.e. for outgoing messages 330), and the Message Manager 610 for performing the correlation of messages 330,331 to a data instance as used by the application 302 and utilizes a message envelope of the messages 330,331 to carry the correlation Id 324a. The runtime environment 206 can also have a Data Persistence Manager 612 that persists and provides access to all instances of Data components 400 defined by the application 302. The Persistence Manager 612 permits resolution of a data instance by a key field data value 324a. It is recognised that the data instances mentioned are instantiated versions of the data definition 314 as utilised by the device 100 during operation of the application 302 as a result of direct or indirect interaction with the web service 106. A UI Service 614 provides interaction with the user of the device interface 202 (see Figure 2) via visualization of screen definitions 404 (of the application 302), knows when a user action corresponds to changes in underlying data, and knows when a particular user action results in interaction with the associated web service (e.g. sends the message 330). It is also recognised that the Communication Service 608 can provide an over the air (OTA) interface of the device 100.

For example, one scenario is for the Communication Service 608 to use a synchronous mechanism to transmit messages 330,331 to the Mediator Service 500 or the web service 106 directly (not shown), and can offer a synchronous listener interface for arriving messages from the mediator 500 or web service 106. As such the Communication Service 608 can provides a device facing asynchronous messaging mechanism to device applications 302, i.e. provide synchronous messaging 330,331 between the mediator 500 or web service 106 while providing asynchronous messaging internally of the device 100 with the message manager 610. a second scenario is for the communication service 608 to act as a simple messaging network 20 interface for the device 100 and therefore transfer asynchronous messages 330,331 outgoing and incoming with respect to the device 100.



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Mediator Service Modules

When utilized as a proxy between asynchronous and synchronous environments, the mediator service 500 can have a Synchronous Dispatcher module 614 for performing the messaging 332 interaction with the synchronous web service 106. The Synchronous Dispatcher 614 maintains the correlationId 324a between the arriving device message 330 and the departing device message 331. The Synchronous Dispatcher 614 is able to detect when the message 330 has arrived and is sitting at an Async Receiver 616, which receives and queues arriving device message 330 envelopes. On receipt of the message 330, the receiver 616 releases the connection (i.e. returns immediately to the device 100). As well, The Synchronous Dispatcher 615 is able to detect when the message 332 has arrived from the web service 106 and forwards the appropriate message 331 to an Async transmitter 618, which initiates the outgoing connection to the device 100, passes the outgoing message 331envelope with correlation Id 325a as received from the web service 106. Finally, an optional Decoder 620 for transforming the incoming device message 330 into an internal operable format that can be utilized by the Synchronous Dispatcher 615 for submission to the webservice 106, and an optional Encoder 622 for transforming the web service 106 result data (e.g. data element 325b) into the outgoing device message 331from an internal operable format.

**Message Set and Mediator Service Operation**

This section describes the interactions between the device runtime 206 and the web service 106 to satisfy asynchronous messaging in the context of a Pizza Shop order process example. Referring to Figure 6, the following steps can be performed such as but not limited to:

1. In response to user interaction with a screen of the user interface 202, the Screen Service 614 updates a data element associated to the screen, i.e. the device Runtime generates the Order data element based the interaction with the application 302 user;
2. The Screen Service 614 detects via application metadata of the message set 600 that a rule indicating that the message 330 is sent on update of this data item. The Screen Service 614 requests the Message Manager 610 to send the appropriate message 330, and supplies the data instance (e.g. data definition 314) required to allow message creation;



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3. The Message Manager 610 examines the Message Set 600 definitions of the application 302, and determines that the message 330 requested in 1 is part of the Message Set 600. The key field 324a of mapped data is determined from the message set 600 definition (e.g. link 440 – see figure 4) and this value is reserved as the *correlationId* 324a;
4. The Message Manager 610 passes the data instance and outgoing message metadata definition 600 to the Encoder module 604. The Encoder module 604 takes the internal metadata representation of the message 330, and the provided values, and generates the message 330 supporting the protocol of the Communication Service 608, such that the device Runtime 206 generates the outPlaceOrder message330 from the Order data definitions 314 using mapping instructions in the Message Set 600. The outPlaceOrder message can contain the *id* 324a, *user*324b and *special* 324c fields derived from the Order *orderId*, *userId* and *specialName* fields of the data definition 314 as specified in the message set 600. The Device Runtime 206 detects that the orderId 324a represents the key field of the data element representing the data definition 314 and includes a token in the outPlaceOrder message 330 envelope that distinguishes this field as the correlation id 324a;
5. The Message Manager 610 adds the *correlationId* 324a to the envelope of the encoded message 330 request. The entire envelope is passed to the Communication Service 608 for delivery to the Mediator Service 500, if used, otherwise directly to the web service 106;

6. The Communication Service 608 initiates a connection to the Mediator Service Async Receiver 616 (or directly to the web service 106) and passes the message 330. The Async Receiver 616, if used, returns immediately to the Communication Service 608. Accordingly, the Device Runtime 206 transmits the outPlaceOrder message 330 to the Mediator Service 500, if used, which detects the correlation id 324a of the message 330;

Where Mediator synchronous request handling is used

7. The Mediator Service Synchronous Dispatcher 615 detects that the message 330 has arrived from the device 100. The message 330 is picked up from the Async Receiver 616;



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8. The Synchronous Dispatcher 615 obtains the *correlationId* 324a from the message 330 envelope and passes the message 330 data to the Decoder 620 to obtain the message content;
9. The Synchronous Dispatcher 615 initiates a synchronous request 332, for example, to the web service 106 with the data obtained in step 8. The Mediator Service 500 initiates the synchronous request 332 to the web service 106 using the outPlaceOrder parameters 324a,b,c, where the field 324b can identify the user and/or device 100 and/or application 302 originating the message 330. the field 324c can be a data value sent to the web service 106 as generated by the application 302. The web service 106 processes the information 324a,b,c of the message 330 and immediately returns a result 325a,b. The web service response 332 is returned in the same cycle as the request 332;
10. The Synchronous Dispatcher 615 passes the response data to the Encoder 622 to produce the required device response message 331. The Synchronous Dispatcher 615 adds the *correlationId* 325a to the envelope of the message 331 in response to the data received from the web service 106. The Mediator Service 500 therefore obtains the result 325a,b and generates the orderConfirmation message 331. The correlation id 325a is embedded in the envelope of the orderConfirmation message 330 as well as any data 325b (e.g. an update to the data element deliverytime of the data definition 314. The Mediator Service 500 transmits the message 331asynchronously/synchonously to the Device Runtime 206; and
11. The message 331 is passed to the Async Transmitter 618 which...
12. Calls the device 100 passing the message 331. The device 100 returns to the Mediator service 500 immediately.

It is recognised that in the above given mediator example that the web service could be substituted in the mediator's 500 stead, where the web service 106 would be responsible for placing the id 325a in the message 331 as per the expected shared definitions of the message set 600. At the device 100, further steps:

Device 100 asynchronous message reception and handling



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13. The device Communication Service 608 passes the received message 331 to the Message Manager 610. The Message Manager 610 obtains the *correlationId* 325a from the envelope of the message 331;
14. The Message Manager 610 passes the message 331 to the Decoder 606 which converts the message 331 into an internal operable representation if needed;
15. The Message Manager 610 queries the Message Set 600 definitions and determines that the received message 331 belongs to a particular set as per the id 325a. The Message Manager 610 determines the Data instance to which incoming messages apply. The Device Runtime 206 receives the orderConfirmation message 330 and detects that this message is part of the Pizza Order message set 600; and
16. The Message Manager 610 resolves the data instance using the *correlationId* 325a as the id value, and updates the data instance according to mapping rules described in the Message Set 600. It extracts the correlation id 325a, resolves the underlying data element (Order) in view of field element 325b and applies the orderConfirmation mappings to this instance.

**Application Program 302**

Referring to Figure 8, a block diagram of the component application program 302 comprises the data layer 400, the presentation layer 402 and the message layer 404, which are coordinated by workflow layer 406 through communications 214 with the client runtime environment 206. The structured definition language can be used to construct the definitions 314,316,320 of the layers 400, 402, 404 as a series of metadata records, which consist of a number of pre-defined elements representing specific attributes of a resource such that each element can have one or more values. Each metadata schema typically has defined characteristics such as but not limited to; a limited number of elements, a name of each element, and a meaning for each element. Example metadata schemas include such as but not limited to Dublin Core (DC), Anglo-American Cataloging Rules (AACR2), Government Information Locator Service (GILS), Encoded Archives Description (EAD), IMS Global Learning Consortium (IMS), and Australian Government Locator Service (AGLS). Encoding syntax allows the metadata of the layers 400, 402, 404 to be processed by the device infrastructure 204 (see Figure 2), and encoding schemes include such as but not limited to XML, HTML, XHTML,



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XSML, RDF, Machine Readable Cataloging (MARC), and Multipurpose Internet Mail Extensions (MIME). The client runtime environment 206 can operate on the metadata descriptors of the layers 400, 402, 404 to provision an executable version of the application program 302. It is recognised that the layers 402 and 406 can be provided by other means for the application 302, such as but not limited to native code and other defined execution languages. The application 302 can make use of the data 400 and message 404 layers to implement mappings 318 (see Figure 3) between fields of the definitions 314,316,320 to help correlate asynchronous messaging 105 between the device 100 and the web service 106.

Referring again to Figure 8, the data layer 400 defines data entities (definitions 314) which are used by the application program 302. Examples of data entities which the data layer 400 may describe are orders, users, and financial transactions. The Data layer 400 defines what information is required to describe the data entities, and in what format the information is expressed. For example, the data layer 400 may define such as but not limited to an order which is comprised of a unique identifier for the order which is formatted as a number, a list of items which are formatted as strings, the time the order was created which has a date-time format, the status of the order which is formatted as a string, and a user who placed the order which is formatted according to the definitions 314 of the data layer 400.

Referring again to Figure 8, the message layer 404 defines the format of messages 105 used by the application program 302 to communicate with external systems such as the web service 106. For example, one of the message definitions 316 may describe such as but not limited to a message for placing an order which includes the unique identifier for the order, the status of the order, and notes associated with the order.

It is noted that the use of layers 402 and 406 may be optional for the application 302.

Referring again to Figure 8, the optional presentation layer 402 defines the appearance and behavior of the application program 302 as it displayed by the user interface 202. The presentation layer 402 can specify GUI screens and controls, and actions to be executed when the user interacts with the application 302 using the user interface 202. For example, the presentation



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definitions 320 may define screens, labels, edit boxes, buttons and menus, and actions to be taken when the user types in an edit box or pushes a button. The majority of Web Service 106 consumers use a visual presentation of Web Service 106 operation results, and therefore provide the runtime environment 206 on their devices 100 capable of displaying user interface screens.

Referring to Figures 1 and 8, it is recognized that in the above described client application program 302 definitions hosting model, the presentation layer 402 may vary depending on the client platform and environment of the device 100. For example, in some cases Web Service consumers do not require a visual presentation. The application definitions 314,316,320,322 of the application program 302 can be hosted in a Web Service registry as a bundle of platform-neutral data 400, message 404, workflow 406 layer descriptors with a set of platform-specific presentation layer 402 descriptors for various predefined client runtimes 206 (see Figure 2). When the discovery or deployment request message 105 is issued the client type should be specified as a part of this request message 105. In order not to duplicate data, message, and workflow metadata while packaging application programs 302 for different client platforms of the communication devices 100, application definitions 314,316,320,322 can be hosted on the web service 106 (for example) as a bundle of platform-neutral component definitions 314,316,322 linked with different sets of presentation definitions 320. When a user makes a discovery or download request message 105, the client runtime type of the communication devices 100 is validated and the proper bundle is constructed for delivery by the web service 106 to the device 100 over the network 102, 104. For those Web Service 106 consumers, the client application programs 302 would contain the presentation layer 402 linked with the data 400 and message 404 layers through the workflow layer 406. It is recognized that the hosting model includes message 404 and data 400 layers with the remainder of the application functionality (presentation and workflow) expressed in a manner that cooperates with these defined layers 400, 404, such as but not limited to native code and other defined components as desired.

Referring again to Figure 8, the optional workflow layer 406 of the application program 302 defines processing that occurs when an action is to be performed, such as an action specified by a presentation layer 402 as described above, or an action to be performed when messages 105



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(see Figure 1) arrive from the system 20. Presentation, workflow and message processing are defined by the workflow layer 406. The workflow layer 406 can be written as a series of instructions in a programming language or a scripting language, such as but not limited to ECMAScript, and can be compiled into native code and executed by the runtime environment 206, as described above. An example of the workflow layer 406 content may be to assign values to data, manipulate screens, or send the message 105. As with presentation layer 402, multiple workflow definitions 322 can be created to support capabilities and features that vary among devices 100. The appropriate workflow definition can be determined and sent at the time of downloading and provisioning of the application program 302.

ECMA (European Computer Manufacturers Association) Script is a standard script language, wherein scripts can be referred to as a sequence of instructions that is interpreted or carried out by another program rather than by the computer processor. Some other example of script languages are Perl, Rexx, VBScript, JavaScript, and Tcl/Tk. The scripting languages, in general, are instructional languages that are used to manipulate, customize, and automate the facilities of an existing system, such as the devices 100. In such systems, useful functionality is already available through the user interface 202 (see Figure 2), and the scripting language is a mechanism for exposing that functionality to program control. In this way, the device 100 is said to provide a host runtime environment of objects and facilities which completes the capabilities of the scripting language.

Specifically, EMCAScript is an object-oriented programming language for performing computations and manipulating computational objects within the host runtime environment. ECMAScript can be used as a Web scripting language, providing a mechanism to perform service 106 computation as part of the Web-based client-server architecture of the system20(see Figure 2). ECMAScript provides core scripting capabilities for a variety of host runtime environments, and therefore the core scripting language can be considered platform neutral for a number of particular host runtime environments. The runtime environment 206 (see Figure 2) can provide the ECMAScript host runtime environment for client-side computation of the communication devices 100, such as but not limited to; objects that represent windows, menus, pop-ups, dialog boxes, text areas, anchors, frames, history, cookies, and input/output. Further,



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the host runtime environment of the runtime environment 206 provides a means to attach scripting code to events such as but not limited to change of focus, page and image loading, unloading, error, and abort, selection, form submission, and mouse actions. In implementations using ECMA scripting, the code appears within the workflow layer 406, combines user interface elements and fixed and computed text and images, and is reactive to user interaction on the user interface 202. The web service 106 (see Figure 1) provides a different host environment for server-side computation including objects representing requests, clients, and files, and mechanisms to lock and share data. By using the client side and server side scripting together, it is possible to distribute computation between the client communication devices 100 and the service 106 while providing a customized user interface 202 for the Web-based application programs 302.

ECMAScript also defines a set of built-in operators which may not be, strictly speaking, functions or methods. ECMAScript operators include such as but not limited to various unary operations, multiplicative operators, additive operators, bitwise shift operators, relational operators, equality operators, binary bitwise operators, binary logical operators, assignment operators, and the comma operator. ECMAScript syntax resembles Java syntax, however, ECMAScript syntax is relaxed to enable it to serve as an easy-to-use scripting language for developers. For example, a variable in ECMAScript is not required to have its type declared nor are types associated with properties, and defined functions are not required to have their declarations appear textually before calls to them. It is recognized that in a class-based object-oriented programming language, in general, state is carried by instances, methods are carried by classes, and inheritance is only of structure and behavior. In ECMAScript, the state and methods are carried by objects, and structure, behavior, and state are all inherited.

Application Program 302 Example

Accordingly, referring to Figure 8, the client application programs 302 can be defined as a set of platform-neutral component definitions 314,316, namely for data 400 and message 404 layers, and the optional presentation layer 402 using XML (or any other suitable structured definition language). The optional workflow layer 406 can be defined using ECMAScript (or any other suitable platform-neutral scripting language). The client runtime environment 206 (see



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Figure 2) can generate component templates based on meta-definitions when the definitions 314,316,320,322 of the application program 302 are provisioned on the communication device 100. With a large variety of terminal runtime environments 206, the cross-platform standards such as XML or ECMAScript can be used to define application component metadata instead of pre-building the application programs 302. This delayed binding can allow the generic application definitions of the component application programs 302 to be run on a wide variety of terminal system environments 206, represented by various different communication devices 100.

The following example shows how a Web Services client application program 302 could be expressed using a structured definition language, such as but not limited to XML, and a platform neutral scripting/programming language, such as but not limited to ECMAScript, with defined components conforming with the following Document Type Definition (DTD):

```
<!ELEMENT wcApp (desc?, iconUrl?, res*, wcData*, wcMsg*, style*, wcScr*, wcFlow)>
<!ATTLIST wcApp
        name CDATA #REQUIRED
        title CDATA #IMPLIED
        vendor CDATA #IMPLIED
        version CDATA #IMPLIED
        transportKey CDATA #IMPLIED
        installNotifURL CDATA #IMPLIED
        registerURL CDATA #IMPLIED
>
<!ELEMENT desc (#PCDATA)>
<!ELEMENT iconUrl (#PCDATA)>
<!ELEMENT res (#PCDATA)>
<!ATTLIST res
        name CDATA #REQUIRED
        url CDATA #REQUIRED
        type (xml | image | sound | any) #REQUIRED
        deferred (true | false) "false"
>
```

Example Data definitions 314

```
<!ELEMENT wcData (dfield+)>
<!ATTLIST wcData
        name CDATA #REQUIRED
        persisted (true | false) "true"
>
<!ELEMENT dfield (#PCDATA)>
<!ATTLIST dfield
        name CDATA #REQUIRED
        type (String | Number | Boolean | Date | Any) "Any"
        array (true | false) "false"
```



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```
        cmp (true | false) "false"
        cmpName CDATA #IMPLIED
        key (0 | 1 | 2) "0"
>
Example Message definitions 316
<!ELEMENT wcMsg (mfield*)>
<!ATTLIST wcMsg
        name CDATA #REQUIRED
        mapping CDATA #IMPLIED
>

<!ATTLIST wcMsg
        pblock CDATA #IMPLIED
>
<!ELEMENT mfield (#PCDATA)>
<!ATTLIST mfield
        name CDATA #REQUIRED
        type (String | Number | Boolean | Date | Array | XML) #IMPLIED
        mapping CDATA #IMPLIED
>

Example Presentation definitions 320
<!ELEMENT wcScr (layout?, menu?, refresh?, event?)>
<!ATTLIST wcScr
        name CDATA #REQUIRED
        title CDATA #IMPLIED
        main (true | false) "false"
        dialog (true | false) "false"
        param CDATA #IMPLIED
>
<!ELEMENT style (font?)>
<!ATTLIST style
        name CDATA #REQUIRED
        bgColor CDATA #IMPLIED
>
<!ELEMENT font EMPTY>
<!ATTLIST font
        name CDATA #REQUIRED
        color CDATA #IMPLIED
        size CDATA #IMPLIED
        bold (true | false) "false"
        italic (true | false) "false"
        underline (true | false) "false"
>
<!ELEMENT refresh (msg+)>
<!ELEMENT msg (#PCDATA)>
<!ELEMENT layout (layout*, label*, separator*, edit*, image*, choice*, button*, textarea*)>
<!ATTLIST layout
        type (grid | flow | border | vertical) #REQUIRED
        param CDATA #IMPLIED
        placement CDATA #IMPLIED
        style CDATA #IMPLIED
>
<!ELEMENT menu (item*)>
<!ELEMENT item (action, condition?)>
<!ATTLIST item
```



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```
        name CDATA #REQUIRED
        label CDATA #REQUIRED
        shortcut CDATA #IMPLIED
>
<!ELEMENT action EMPTY>
<!ATTLIST action
        screen CDATA #IMPLIED
        pblock CDATA #IMPLIED
        param CDATA #IMPLIED
        acceptChanges (true | false) "true"
>
<!ELEMENT condition EMPTY>
<!ATTLIST condition
        pblock CDATA #REQUIRED
        param CDATA #IMPLIED
        result (true | false) "true"
>
<!ELEMENT event EMPTY>
<!ATTLIST event
        type (onInit | onClick | onChange | onFocusOut) "onInit"
        pblock CDATA #IMPLIED
        screen CDATA #IMPLIED
        param CDATA #IMPLIED
>
<!ELEMENT separator EMPTY>
<!ELEMENT label (condition?, event?)>
<!ATTLIST label
        name CDATA #REQUIRED
        value CDATA #REQUIRED
        placement CDATA #IMPLIED
        style CDATA #IMPLIED
>
<!ELEMENT edit (condition?, event?)>
<!ATTLIST edit
        name CDATA #REQUIRED
        value CDATA #IMPLIED
        mapping CDATA #IMPLIED
        type (char | number | date | pwd | phone | email) "char"
        readOnly (true | false) "false"
        placement CDATA #IMPLIED
        style CDATA #IMPLIED
>
<!ELEMENT textarea (condition?, event?)>
<!ATTLIST textarea
        name CDATA #REQUIRED
        value CDATA #IMPLIED
        mapping CDATA #IMPLIED
        readOnly (true | false) "false"
        placement CDATA #IMPLIED
        style CDATA #IMPLIED
>
<!ELEMENT image (condition?, event?)>
<!ATTLIST image
        name CDATA #REQUIRED
        resName CDATA #REQUIRED
        placement CDATA #IMPLIED
```



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```
>
<!ELEMENT choice (condition?, event?, entry*)>
<!ATTLIST choice
        name CDATA #REQUIRED
        value CDATA #IMPLIED
        mapping CDATA #IMPLIED
        type (singleList | multiList | dropdown | checkbox | radio) "singleList"
        readOnly (true | false) "false"
        placement CDATA #IMPLIED
        style CDATA #IMPLIED
>
<!ELEMENT entry (#PCDATA)>
<!ELEMENT button (condition?, event?)>
<!ATTLIST button
        name CDATA #REQUIRED
        label CDATA #REQUIRED
        image (true | false) "false"
        placement CDATA #IMPLIED
        style CDATA #IMPLIED
>
```

Example Workflow definitions 322

```
<!ELEMENT wcFlow (pblock+)>
<!ELEMENT pblock (#PCDATA)>
<!ATTLIST pblock
        id CDATA #REQUIRED
        param CDATA #IMPLIED
>
```

As given above, the XML elements define the example component application 302 including a wcApp element, a wcData element, a wcMsg element, a wcSrc element, and a wcFlow element. Referring to Figure 8, the wcApp element is a top-level element which defines the application program 302. The wcData element defines the example data layer 400, which is comprised of a group of named, typed fields. The wcMsg element defines the example message layer 404, which similarly defines a group of named, typed fields. The wcSrc element defines the example presentation layer 402. The example presentation layer 402 is a label, a separator, an image, a button, an edit field, a text area, a single-selection list, a multi-selection list, a drop-list, a checkbox, a radio button, or a screen containing a group of other presentation definitions 320.

Referring to the above example component application program 302 and Figure 8, the wcFlow element defines the example workflow layer 406. The pblock attributes of the XML elements specify a pblock element nested in the wcFlow element. Each pblock element comprises script which defines part of the workflow of the application program 302. The script is



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written in ECMAScript. In order to define the behavior of the application 302, the optional workflow layer 406 uses ECMAScript to reference and manipulate the data layer 400, the presentation layer 402, and the message layer 404. The workflow layer 406 can also reference external object types, which allow actions to be performed on the components defined in the application 302. For example, a wcMsg type allows a message defined by a message definition 316 to be evaluated to determine whether mandatory fields have been supplied, and to be sent to an external system such as the web service 106. A wcData type allows the size of collections of data entities defined by data definition 314 to be determined, and allows data entities to be deleted. A wcScr type allows a presentation definition 320 to be displayed to the user. Similarly, a special dialog external object allows a message to be displayed to the user on the user interface 202 (see Figure 2).



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WE CLAIM:

1. A system for correlating asynchronous communication messages between a mobile device and a data source over a network, the mobile device for executing an application to provide interaction with the data source based on content of the communication messages, the system comprising:

a message correlation set configured to include a set of correlation definitions for linking an asynchronous request message of the communication messages with a corresponding asynchronous response message of the communication messages, the correlation definitions including a first correlation identifier for including in the asynchronous request message when generated and a second correlation identifier expected in the asynchronous response message when received, the first identifier different from the second identifier;

a message manager for coordinating the transmission and receipt of the messages so as to associate a first data parameter of the request message with a second data parameter of the response message by matching the first and second identifiers of the messages with the correlation definitions of the message correlation set, the first and second data parameters also part of the message correlation set as data definitions.

2. The system of claim 1, wherein the first identifier is configured for insertion in the request message by the mobile device and the second identifier is configured for insertion in the response message by the data source.

3. The system of claim 1 further comprising a communication service for providing a communication interface between the message manager and the network.

4. The system of claim 3, wherein the communication manager is configured to provide communication of the messages between the communication manager and the message manager asynchronously.



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5. The system of claim 4, wherein the communication manager is configured to provide communication of the messages between the communication manager and the network asynchronously.

6. The system of claim 2 further comprising a screen service for initiating the message request based on a user data event from a user interface of the device.

7. The system of claim 6, wherein the message manager is configured for querying the message correlation set to determine if the data corresponding to the user event is defined by the message correlation set as the first data parameter.

8. The system of claim 7, wherein the message manager is configured to select the first correlation identifier of the message correlation set corresponding to the identified first data parameter as part of the message correlation set.

9. The system of claim 6 further comprising a persistence manager for resolving the persistence of the first data parameter value according to the first correlation identifier.

10. They system of claim 2, wherein the message correlation set is described in a structured definition language.

11. A method for correlating asynchronous communication messages between a mobile device and a data source over a network, the mobile device for executing an application to provide interaction with the data source based on content of the communication messages, the method comprising the steps of:

sending an asynchronous request message of the communication messages;

receiving an asynchronous response message of the communication messages;

linking the asynchronous request message with the corresponding asynchronous response message by employing a message correlation set including a set of correlation definitions, the correlation definitions including a first correlation identifier for including in the asynchronous request message when generated and a second correlation identifier expected in the



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asynchronous response message when received, the first identifier different from the second identifier;

associating a first data parameter of the request message with a second data parameter of the response message by matching the first and second identifiers of the messages with the correlation definitions of the message correlation set, the first and second data parameters also part of the message correlation set as data definitions.

12. The method of claim 11, wherein the first identifier is configured for insertion in the request message by the mobile device and the second identifier is configured for insertion in the response message by the data source.

13. The system of claim 11 further comprising the step of providing a communication interface between a message manager and the network.

14. The system of claim 13, wherein the communication interface is configured to provide communication of the messages between the communication interface and the message manager asynchronously.

15. The system of claim 14, wherein the communication interface is configured to provide communication of the messages between the communication interface and the network asynchronously.

16. The system of claim 12 further comprising the step of initiating the message request based on a user data event from a user interface of the device.

17. The system of claim 16 further comprising the step of querying the message correlation set to determine if the data corresponding to the user event is defined by the message correlation set as the first data parameter.



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18. The system of claim 17 further comprising the step of selecting the first correlation identifier of the message correlation set corresponding to the identified first data parameter as part of the message correlation set.

19. The system of claim 16 further comprising the step of resolving the persistence of the first data parameter value according to the first correlation identifier.

20. They system of claim 12, wherein the message correlation set is described in a structured definition language.

21. A computer program product for correlating asynchronous communication messages between a mobile device and a data source over a network, the mobile device for executing an application to provide interaction with the data source based on content of the communication messages, the computer program product comprising:

a computer readable medium;

a message correlation set module stored on the medium and configured to include a set of correlation definitions for linking an asynchronous request message of the communication messages with a corresponding asynchronous response message of the communication messages, the correlation definitions including a first correlation identifier for including in the asynchronous request message when generated and a second correlation identifier expected in the asynchronous response message when received, the first identifier different from the second identifier;

a message manager module for coordinating the transmission and receipt of the messages so as to associate a first data parameter of the request message with a second data parameter of the response message by matching the first and second identifiers of the messages with the correlation definitions of the message correlation set module, the first and second data parameters also part of the message correlation set as data definitions.



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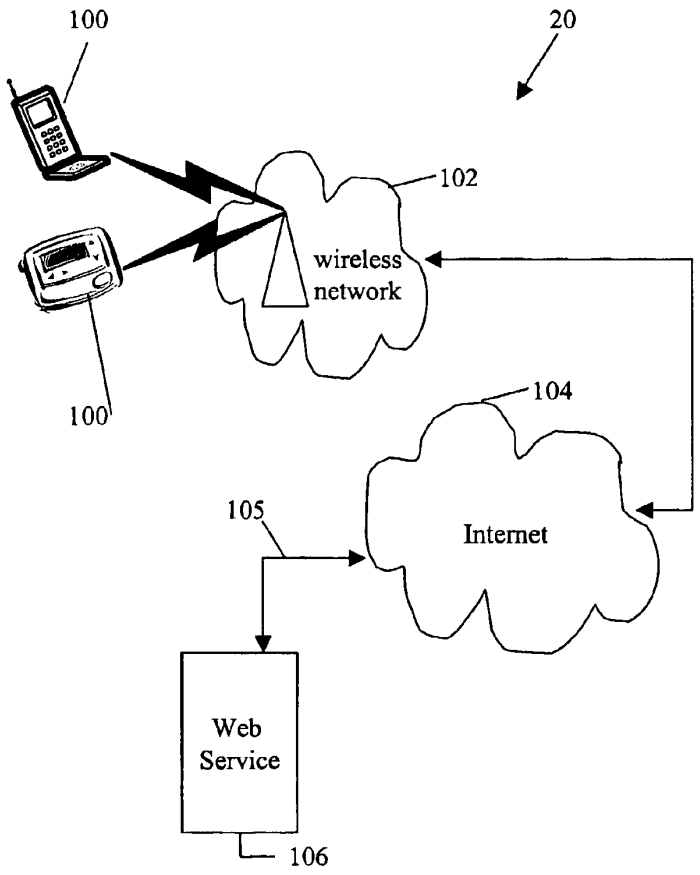



Figure 1



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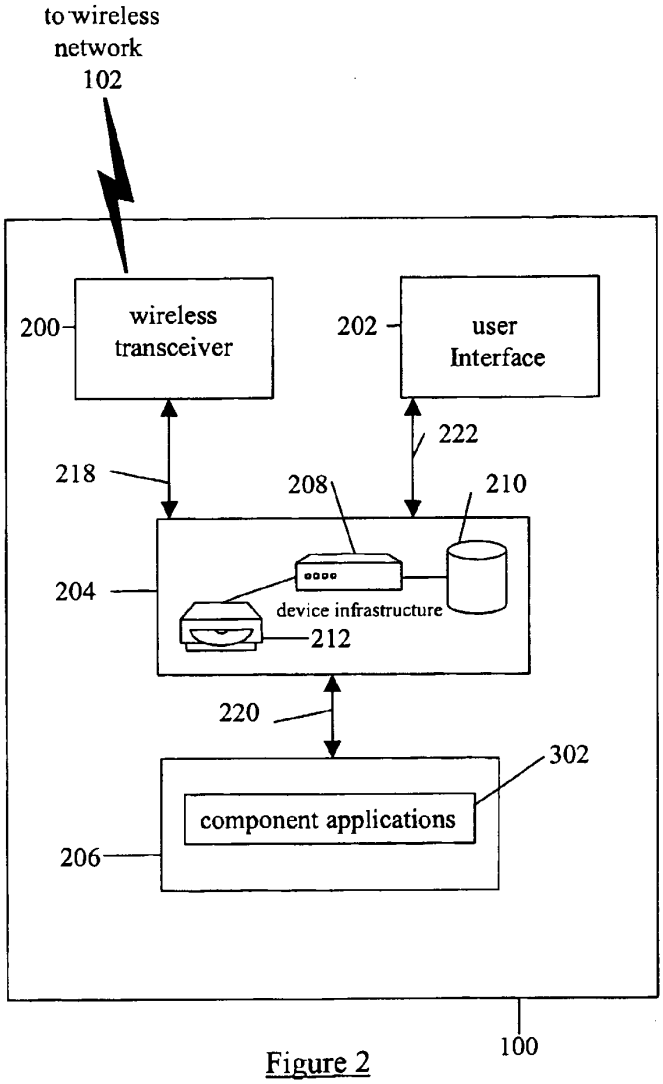



Figure 2



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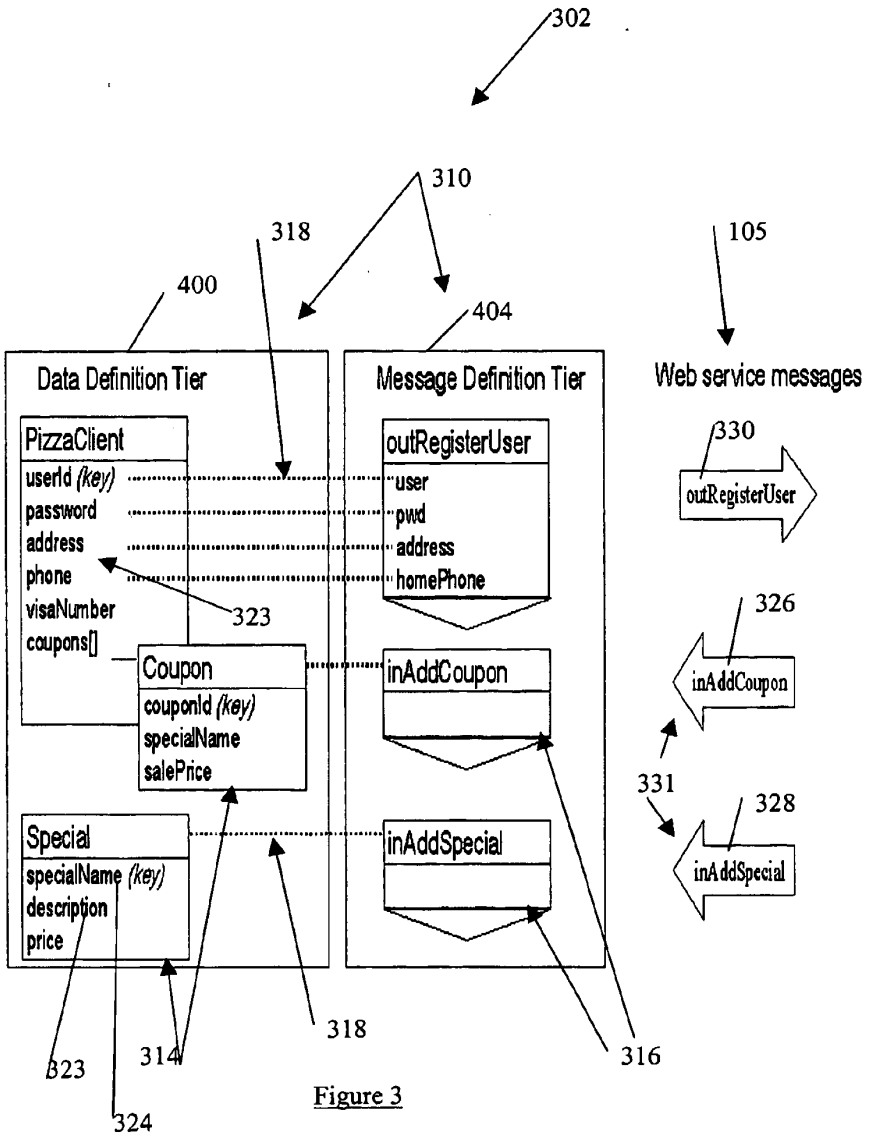



Figure 3



BNSDOCID: <WO_____2005083934A1_I_>

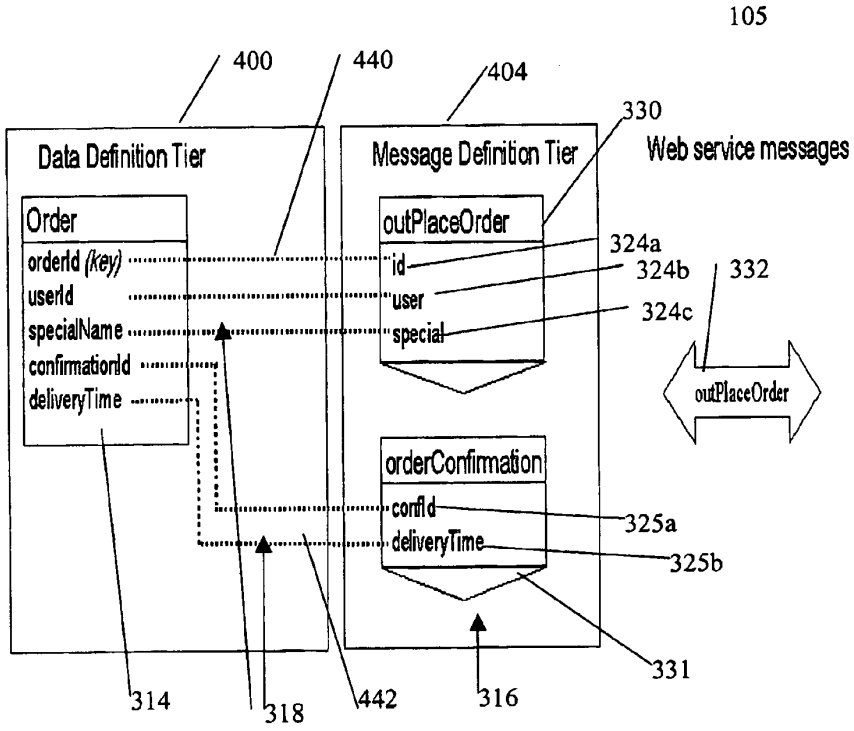



Figure 4



BNSDOCID: <WO_____2005083934A1_I_>

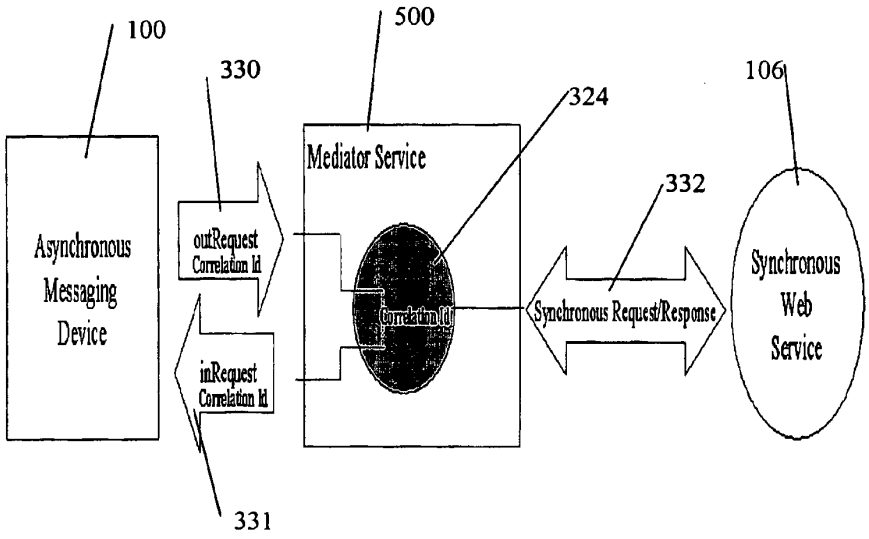



Figure 5



BNSDOCID: <WO_____2005083934A1_I_>

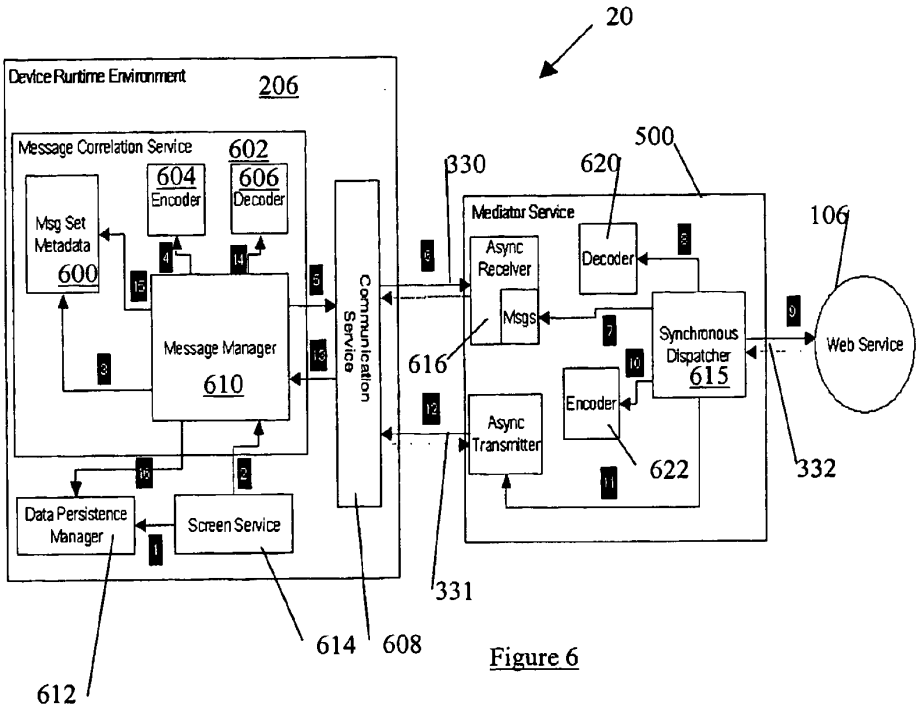



Figure 6



BNSDOCID: <WO_____2005083934A1_I_>

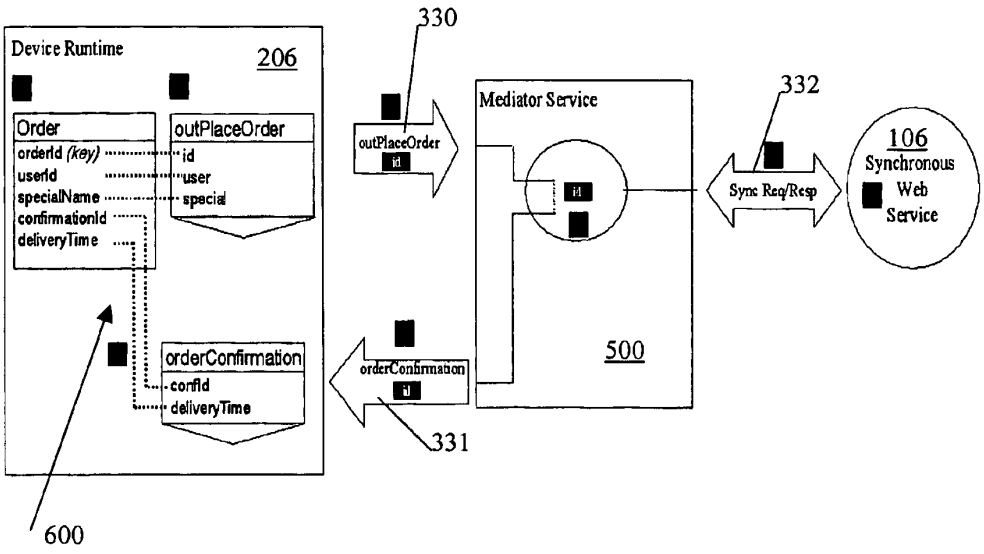



Figure 7



BNSDOCID: <WO_____2005083934A1_I_>

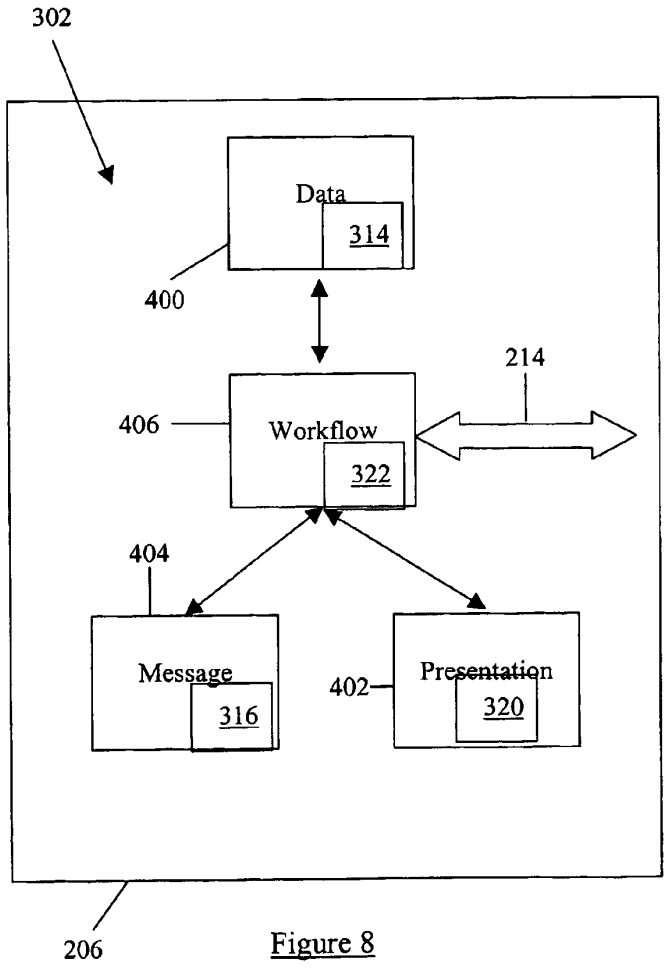



Figure 8



BNSDOCID: <WO_____2005083934A1_I_>

## INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2005/000286

A. CLASSIFICATION OF SUBJECT MATTER
IPC7 H04L 12/16, H04Q 7/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC7 H04L 12/16, H04Q 7/20

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)
Delphion, Canadian Patent Database - Search Terms used: web, service, asynchronous, mobile, device,

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | US 2002/0023127 (SABETI) 21.02.2002 | 1-21 |
| A | US 2003/0206192 (CHEN et al.) 06.11.2003 | 1-21 |
| A, P | US 2004/0255046 (RINGSETH et al.) 16.12.2004 | 1-21 |
| A | US 6,035,324 (CHANG et al.) 07.03.2000 | 1-21 |
| A, P | WO 2004/066081 (CHEENATH) 05.08.2004 | 1-21 |

[ ] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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| 08 June 2005 (08-06-2005) | 5 July 2005 (05-07-2005) |

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## INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/CA2005/000286

| Patent Document Cited in Search Report | Publication Date | Patent Family Member(s) | Publication Date |
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| US6035324 | 07-03-2000 | GB2330502 A | 21-04-1999 |
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| | | US20040143645 A1 | 22-07-2004 |



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(74) Agents: **WADSWORTH, Philip R.** et al.; 5775 Morehouse Drive, San Diego, California 92121 (US).

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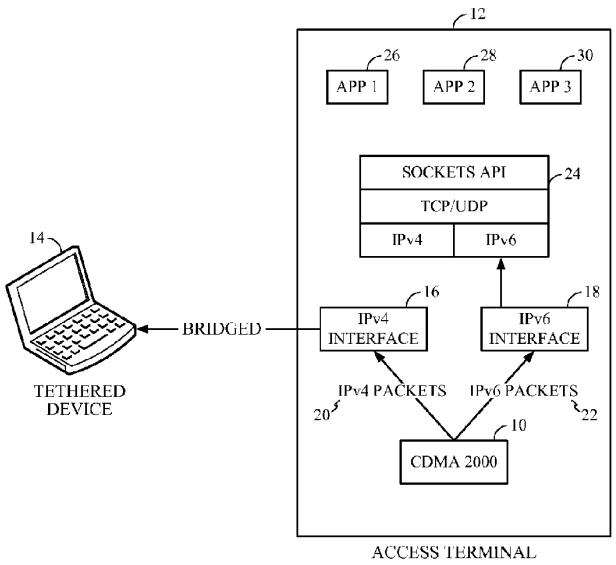
— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

**Published:**

— *without international search report and to be republished upon receipt of that report*

*[Continued on next page]*

(54) Title: CONCURRENT INTERNET PROTOCOL CONNECTIVITY TO AN ACCESS TERMINAL AND A TETHERED DEVICE




(57) Abstract: Using split interfaces for Internet Protocol version 6 (IPv6) and Internet Protocol version 4 (IPv4), and bridging the IPv4 interface, makes it possible to support a Tethered Device (TD) and an Access Terminal (AT) having concurrent IP connectivity. This configuration enables the support of IP Multimedia Subsystem (IMS) applications in the AT using IPv6 while concurrently supporting general Internet usage on a TD. It is also possible to bridge an IPv6 interface to the TD.

WO 2007/120310 A2

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

# CONCURRENT INTERNET PROTOCOL CONNECTIVITY TO AN ACCESS TERMINAL AND A TETHERED DEVICE

## Claim of Priority under 35 U.S.C. §119

[0001] The present Application for Patent claims priority to Provisional Application No. 60/742,155 entitled "Method For Supporting Concurrent IP Connectivity To An Access Terminal And Tethered Device Each Using Different IP Protocols In CDMA 2000 Networks," Filed December 1, 2005, and assigned to the assignee hereof and hereby expressly incorporated by reference herein.

## BACKGROUND

### Field

[0002] The present disclosed embodiments relates generally to cellular communications, and more specifically to concurrent Internet Protocol (IP) connectivity to an Access Terminal (AT) and a Tethered Device (TD).

### Background

[0003] It is desirable to support one Internet Protocol (IP) protocol to an Access Terminal (AT) and another to a Tethered Device (TD). An example of where this is desirable is with the launch of the new IP Multimedia Subsystem (IMS) services, which will provide a rich set of new Multimedia services in the mobile environment. One of these services will the Voice over IP (VoIP), which will replace traditional circuit switched voice, which is how voice services are supported today. In order to support these IMS services, an AT must be continuously connected to the IP Network, which is also known as "always-on." Typically in the case for Code Division Multiple Access (CDMA) 2000 networks this implies that it is not possible to support a TD as the AT is already in a data session.

[0004] There is therefore a need in the art for concurrent IP connectivity to an AT and a TD.

## SUMMARY

[0005] Using split interfaces for Internet Protocol version 6 (IPv6) and Internet Protocol version 4 (IPv4), and bridging the IPv4 interface, makes it possible to support a TD and

an AT having concurrent IP connectivity. This configuration enables the support of IMS applications in the AT using IPv6 while concurrently supporting general Internet usage on a TD. It is also possible to bridge the IPv6 interface to the TD.

## BRIEF DESCRIPTION OF THE DRAWINGS

[0006] FIG. 1 is an illustration of a concurrently connected Access Terminal and Tethered Device.

## DETAILED DESCRIPTION

[0007] The embodiments described herein make it possible to provide service concurrently to the AT and TD. Different IP protocol versions can be used by the AT and TD. In the case of IMS, it is desirable to use IP version 6 (IPv6) for the AT in order to be always on an assigned IP for as long as the AT is powered on. In order to support a wide scale deployment of these services, it would require as many IP addresses as there are ATs. In the case of IPv4 there is a dearth of addresses, so IPv6 is preferred for the AT.

[0008] For most general Internet services, such as web browsing and email, still use IP version 4 (IPv4). Thus for the TD it is desirable to have IPv4 connectivity.

[0009] The embodiments described below with reference to FIG. 1 describe how to provide IPv6 in the AT while concurrently supporting IPv4 to a TD. However, the same technique could be used to provide IPv4 to the AT and IPv6 to the TD.

[0010] IP packets arriving over an air interface 10 and based on an IP version are received by an AT 12 and are either forwarded up an AT stack 24 (for example, IPv6 packets 22) or forwarded to a TD 14 (for example, IPv4 packets 20).

[0011] There are a variety of ways this could be done:

[0012] 1. Examine the incoming packets and apply the forwarding as described in the paragraph above.

[0013] 2. Use the notion of Network Interfaces, which provide an abstraction layer, between the physical layer (in this case the CDMA2000 air interface data protocols, such as Radio Link Protocol (RLP) and Point-to-Point Protocol (PPP)) and the generic IP stack above (commonly referred to as the Transmission Control Protocol/Internet Protocol (TCP/IP) suite). This is described in more detail below.

[0014] The use of the Network Interface can provide a variety of processing options with respect to IP packets passing through them, such as filtering and routing/bridging information.

[0015] It is possible in the interface itself to identify whether or not packets should be forwarded directly to another interface without processing them further. This further processing is typically done at the IP layer, and consists of routing. Routing is the act of examining the IP addresses in the header and determining if the packet is destined for the local host, which is the device doing the routing, or another host. Typically if it is intended for another host, a determination may need to be made over which link to transmit it – if there are multiple links. If the interface is configured to directly forward the packets to another interface (or link), this is referred to as bridging the two interfaces together. This is typically used when it is known that all of the packets arriving in one interface must be transmitted over another interface, regardless of the addressing information they contain. An example of this is a Wireless LAN bridge. Any packets arriving on the Ethernet interface must be forwarded over the WLAN interface without exception.

[0016] In an AT it is desirable to have separate network interfaces for IPv4 and IPv6 as there is much information for each protocol that is independent, but needs to be duplicated, such as the state of the interface (disabled, available, configuring, etc.), IP address(es), and so forth.

[0017] Using the properties of bridging and the separation of the IPv6 and IPv4 interfaces allows an IPv4 interface 16 to be set up in bridging mode such that it forwards all IPv4 packets 20 to the TD, while leaving an IPv6 interface 18 in non-bridged mode, which results in the IPv6 packets 22 being delivered to the IP stack 24, and the payload ultimately being delivered to the IMS application. This allows IPv6 IMS applications 26, 28, and 30 on the AT 12 to work concurrently with generic IPv4 Internet applications on the TD 14.

[0018] Using this split interface/bridging solution, it is also possible to run IPv6 addresses on the TD 14 while supporting IPv4 applications on the AT 12.

[0019] When it becomes desirable to support IPv6 applications on the TD 14 as well, because the IPv6 packets are going to the IP layer 24 they could be routed to the TD as well if they are not destined for the AT 12, but rather for the TD. This would allow

both IPv4 and IPv6 applications on the TD running concurrently with IPv6 applications running on the AT.

**WHAT IS CLAIMED IS:**

## CLAIMS

1. An Access Terminal for having concurrent Internet Protocol Activity with a Tethered Device, the Access Terminal comprising:

an Internet Protocol stack;

a first Internet Protocol version interface adapted in a non-bridged mode for delivering first Internet Protocol version packets to the Internet Protocol stack; and

a second Internet Protocol version interface adapted in a bridged mode for delivering second Internet Protocol version packets to the Tethered Device.

2. The Access Terminal of claim 1 wherein the first Internet Protocol version interface is an Internet Protocol version 6.

3. The Access Terminal of claim 2 wherein the second Internet Protocol version interface is an Internet Protocol version 4.

4. The Access Terminal of claim 1 wherein the first Internet Protocol version interface is an Internet Protocol version 4.

5. The Access Terminal of claim 4 wherein the second Internet Protocol version interface is an Internet Protocol version 6.

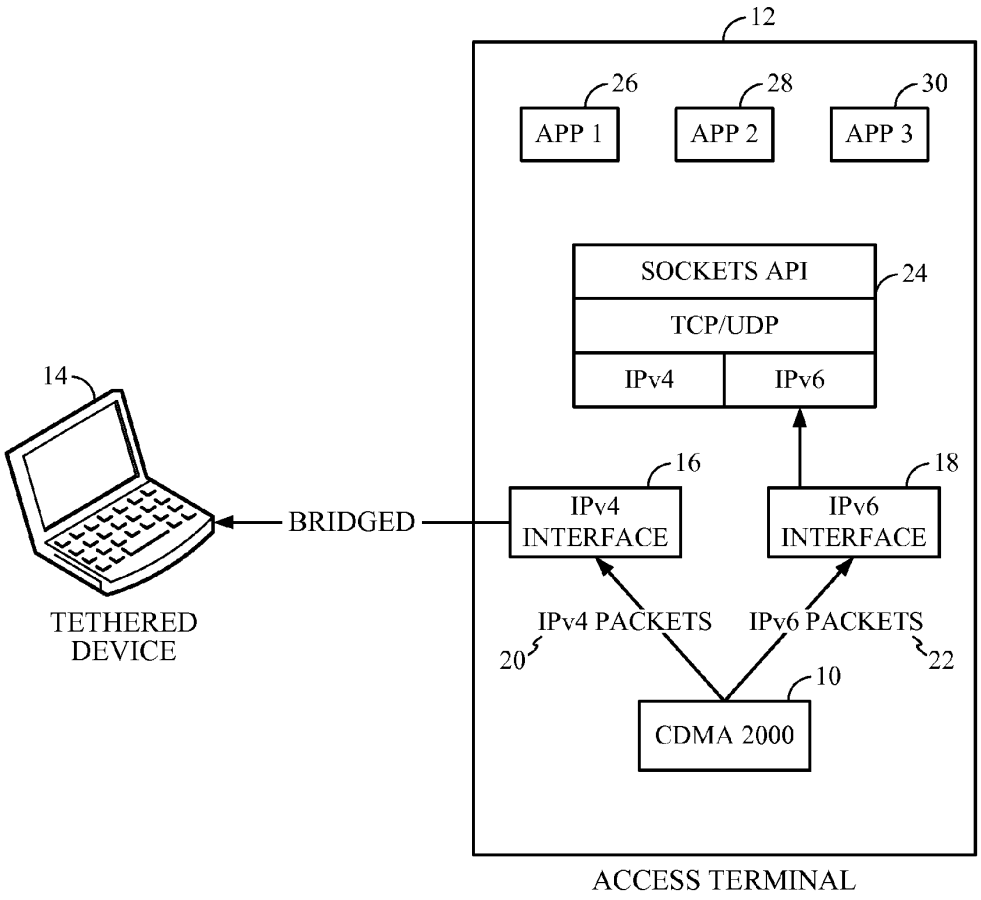

12
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APP 1
APP 2
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SOCKETS API
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INTERFACE
IPv6
INTERFACE
BRIDGED
TETHERED
DEVICE
IPv4 PACKETS
IPv6 PACKETS
20
22
10
CDMA 2000
ACCESS TERMINAL

FIG. 1

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 26633316 |
| **Application Number:** | 15227814 |
| **International Application Number:** | |
| **Confirmation Number:** | 2668 |
| **Title of Invention:** | Flow Tagging for Service Policy Implementation |
| **First Named Inventor/Applicant Name:** | Gregory G. Raleigh |
| **Customer Number:** | 106963 |
| **Filer:** | James E. Harris/Ann Taylor |
| **Filer Authorized By:** | James E. Harris |
| **Attorney Docket Number:** | RALEP046C2C1C1 |
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| **Filing Date:** | |
| **Time Stamp:** | 18:55:14 |
| **Application Type:** | Utility under 35 USC 111(a) |

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## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Assignee showing of ownership per 37 CFR 3.73 | P046C2C1C1_Statement.pdf | 117989<br>296e1d25cd60c48c6a541db2129af07bbdab8714 | no | 3 |

**Warnings:**

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| 2 | Transmittal Letter | P046C2C1C1_IDSTransLtr.pdf | 60014<br>2a1eba510b795c59c97c44e86f06e90b402c1043 | no | 2 |
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| 5 | Information Disclosure Statement (IDS) Form (SB08) | IDS3.pdf | 619935<br>d5c051812a3303e2c45742517c7964f6d7b07a8b | no | 27 |
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| 6 | Information Disclosure Statement (IDS) Form (SB08) | IDS4.pdf | 618987<br>39bbd4bc592c71ef7fad7173d4161f5abe790f29 | no | 31 |
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| **Information:** | | | | | |
| 8 | Foreign Reference | 2082.pdf | 7497094<br>1cab9a3e1917138dd03e255717030799796eafc5 | no | 45 |
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| 9 | Foreign Reference | 2083.pdf | 782462<br>2ce1ee70705ca2f54e4571f31517ddc96b1c19c4 | no | 8 |
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# STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Raleigh

Application No./Patent No.: 15/227,814 Filed/Issue Date: August 3, 2016

Titled: Mobile Device and Method Attributing Media Services Network Usage to Requesting Application

Headwater Partners I LLC, a limited liability company

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

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[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

| | |
|---|---|
| /James E. Harris/ | 2016-08-12 |
| Signature | Date |
| James E. Harris | 40013 |
| Printed or Typed Name | Title or Registration Number |

[Page 2 of 2]

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| | | | |
|---|---|---|---|
| In re Application of: | Raleigh | Examiner: | not yet assigned |
| Serial No.: | 15/227,814 | Art Unit: | |
| Filed: | August 3, 2016 | Conf. No.: | 2668 |
| Title: | Mobile Device and Method Attributing Media Services Network Usage to Requesting Application | | |

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## INFORMATION DISCLOSURE STATEMENT

The references cited on attached form PTO/SB/08A are being called to the attention of the Examiner. Copies of the references are not enclosed.

In accordance with 37 CFR §1.98(d), copies of the references can be found in related U.S. Patent Application No. 14/339,110 filed July 23, 2014, Patent Application No. 14/338,807 filed July 23, 2014, Patent Application No. 14/098,527 filed December 5, 2013, or in Patent Application No. 13/374,959 filed January 24, 2012, of which the instant application is from the same direct family. Any foreign or non-patent references not submitted in those family applications are transmitted herewith.

It is respectfully requested that the cited references be expressly considered during the prosecution of this application, and the references be made of record therein and appear among the "references cited" on any patent to issue therefrom.

As provided for by 37 CFR § 1.97(g) and (h), no inference should be made that the information and references cited are prior art merely because they are in this statement and no representation is being made that a search has been conducted or that this statement encompasses all the possible relevant information.

Applicant believes that no fee is required for submission of this statement, but if for any reason an insufficient fee has been paid, please charge the insufficiency to Deposit Account No. **50-5876**.

Respectfully submitted,

Date: August 12, 2016

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|---|---|---|
| | Application Number | 15227814 |
| | Filing Date | 2016-08-03 |
| | First Named Inventor | Raleigh |
| | Art Unit | |
| | Examiner Name | not yet assigned |
| | Attorney Docket Number | RALEP046C2C1C1 |

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| | Application Number | 15227814 |
| | Filing Date | 2016-08-03 |
| | First Named Inventor | Raleigh |
| | Art Unit | |
| | Examiner Name | not yet assigned |
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| | Application Number | 15227814 |
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| | First Named Inventor | Raleigh |
| | Art Unit | |
| | Examiner Name | not yet assigned |
| | Attorney Docket Number | RALEP046C2C1C1 |

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Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

**OR**

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See attached certification statement.

Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ None

**SIGNATURE**

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

| Signature | /James E. Harris/ | Date (YYYY-MM-DD) | 2016-08-12 |
|---|---|---|---|
| Name/Print | James E. Harris | Registration Number | 40013 |

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The information provided by you in this form will be subject to the following routine uses:

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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | | | |
|---|---|---|---|
| In re Application of: | Raleigh | Examiner: | not yet assigned |
| Serial No.: | 15/227,814 | Art Unit: | |
| Filed: | August 3, 2016 | Conf. No.: | 2668 |
| Title: | Flow Tagging for Service Policy Implementation | | |

Mail Stop Amendment
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Alexandria, VA 22313-1450

**PRELIMINARY AMENDMENT**

Prior to examination on the merits, please amend the above-identified application as follows:

**Amendments to the Specification** begin on page 2.

**Amendments to the Claims** begin on page 3.

**Remarks** begin on page 7.

AMENDMENTS TO THE SPECIFICATION

Please replace the Application Title with the following:

Mobile Device and Method Attributing Media Services Network Usage to Requesting Application

Please replace the Abstract with the following:

A wireless end-user device has a wireless modem, a network stack configurable to receive and transmit data via the modem and a wireless network, and two Application Programming Interfaces (APIs) available to device applications. The first API allows applications to open and use data flows via the network stack. The second API allows applications to make data transfer requests for media objects associated with network resource identifiers. The second API prompts a media service manager to manage network data transfers for the media object via the network stack. A service classification agent associates wireless network data usage for the media object network data transfers with the device application making the request.

AMENDMENTS TO THE CLAIMS

Please amend the claims as follows:

1. (Canceled).

2. (New) A wireless end-user device, comprising:

a wireless modem configurable to connect to a wireless network;

a network stack configurable to receive and transmit data via the wireless modem and the wireless network;

a first network stack Application Programming Interface (API), containing at least one first call to allow device applications to open and use data flows via the network stack, the wireless modem, and the at least one wireless network;

a second API containing at least one second call to allow device applications to make a data transfer request for a media object associated with a network resource identifier supplied by the device application;

a media service manager prompted by the second call, to manage network data transfers for the media object by interfacing with the network stack to retrieve the media object associated with the network resource identifier via the wireless modem and the wireless network; and

a service classification agent to associate wireless network data usage for the media object network data transfers with the device application that requests the data transfer for the media object.

3. (New) The wireless end-user device of claim 2, the service classification agent to also associate wireless network data usage for a data flow opened via the first API with the device application opening that data flow.

4. (New) The wireless end-user device of claim 2, wherein to associate data usage for the media object network data transfers with the device application that makes the data transfer request for the media object comprises to identify at least one of an application name, an application identifier, or a process identifier for the application that makes the data transfer request.

5. (New) The wireless end-user device of claim 4, wherein the data transfer request comprises a network resource identifier that identifies a source of the data to be transferred, a

proxy to the source of the data to be transferred, or the media object to be transferred, in particular, wherein the network resource identifier comprises one or more of an Internet Protocol address, a Uniform Resource Locator, a remote file name/address, a stream name, and an object name.

6. (New) The wireless end-user device of claim 5, wherein to associate data usage for the media object network data transfers with the application that makes the data transfer request for the media object further comprises to store an entry comprising the at least one of the application name, the application identifier, or the process identifier for each of the device applications that makes a data transfer request, each stored entry further comprising information about the corresponding network resource identifier for the data transfer request.

7. (New) The wireless end-user device of claim 6, wherein the service classification agent includes a requesting application storing function within the media services manager.

8. (New) The wireless end-user device of claim 7, wherein the media service manager is a first media service manager and the requesting application storing function is a first requesting application storing function, the device further comprising a second media service manager of a different type than the first media service manager, the service classification agent including a second requesting application storing function within the second media service manager.

9. (New) The wireless end-user device of claim 8, further comprising a usage and classification reconciliation agent and a usage and classification database, the usage and classification reconciliation agent to receive application association information stored by the first and second requesting application storing functions, and to maintain the usage and classification database based in part on the received application association information.

10. (New) The wireless end-user device of claim 5, wherein to manage network data transfers for the media object by interfacing with the at least one network stack comprises to map the data transfer request and network resource identifier to one or more data flow connections communicated through the device networking stack.

11. (New) The wireless end-user device of claim 2, further comprising a media player and a user interface, wherein the media object comprises media data that is, as a result of the media service manager management of network data transfers for the media object, received by the device and played by the media player through the user interface.

12. (New) The wireless end-user device of claim 11, the media service function to receive, from the application launching the data transfer request, a network resource indicator that identifies the media object,

return to the application a media object handle descriptor,

call a proxy service to perform one or more network data transfers comprising the media object,

accept, from the application, commands associated with the media object handle descriptor, and

control playback of the media data by the media player based on the commands.

13. (New) The wireless end-user device of claim 2, wherein the service classification agent comprises:

a requesting application storage agent to, for each device application that makes a data transfer request using the second API, store application identification information and network resource identification information;

a network data flow storage agent to, for each network data flow associated with the media service manager, identify network data flow identification information; and

an association agent to match the network data flow identification information for a network data flow with application identification information for the network data transfer associated with the network data flow.

14. (New) The wireless end-user device of claim 2, further comprising:

a local database to store data usage, including data usage for network data transfers managed by the media service manager on behalf of a device application, the stored data usage classified by device application;

a user interface; and

a user interface display agent to display the data usage classified by application to a user.

15. (New) The wireless end-user device of claim 2, the service classification agent to further associate one or more traffic flows, comprising the media object network data transfers, with the device application that makes the data transfer request, the device further comprising an enforcement agent to, based on the association between the one or more traffic flows and the device application, enforce an application-based usage control on network data usage by one or more of the device applications.

16. (New) A method of operating a wireless end-user device when connected via a wireless modem to a wireless network, the method comprising:

operating a first network stack Application Programming Interface (API), containing at least one first call that allows device applications to open and use data flows via a network stack coupled to the wireless modem;

operating a second API containing at least one second call that allows device applications to make a data transfer request for a media object associated with a network resource identifier supplied by the device application;

operating a media service manager prompted by the second call, the media service manager managing network data transfers for the media object by interfacing with the network stack to retrieve the media object associated with the network resource identifier via the wireless modem and the wireless network; and

associating wireless network data usage for the media object network data transfers with the device application that requests the data transfer for the media object.

## REMARKS

Applicant respectfully requests entry of the amendments provided herein. This preliminary amendment is presented before any office action. Claim 1 has been canceled, and new claims 2-16 have been added. No new matter has been added. If the Examiner has any questions or needs any additional information, the Examiner is invited to contact the undersigned.

The Commissioner is authorized to charge any fee deficiency or credit any overpayment to Deposit Account 50-5876.

Respectfully submitted,

Date: August 4, 2016 By: /James E. Harris/

James E. Harris
Reg. No. 40013
Patent Counsel
Headwater Partners I LLC
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Tyler, TX 75703
(903) 201-6212

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| **EFS ID:** | 26549060 |
| **Application Number:** | 15227814 |
| **International Application Number:** | |
| **Confirmation Number:** | 2668 |
| **Title of Invention:** | Flow Tagging for Service Policy Implementation |
| **First Named Inventor/Applicant Name:** | Gregory G. Raleigh |
| **Customer Number:** | 106963 |
| **Filer:** | James E. Harris/Ann Taylor |
| **Filer Authorized By:** | James E. Harris |
| **Attorney Docket Number:** | RALEP046C2C1C1 |
| **Receipt Date:** | 04-AUG-2016 |
| **Filing Date:** | |
| **Time Stamp:** | 14:52:10 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

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## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
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| | Multipart Description/PDF files in .zip description | | |
|---|---|---|---|
| | **Document Description** | **Start** | **End** |
| | Preliminary Amendment | 1 | 1 |
| | Specification | 2 | 2 |
| | Claims | 3 | 6 |
| | Applicant Arguments/Remarks Made in an Amendment | 7 | 7 |
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I hereby appoint:

■ Practitioners associated with Customer Number: 106963

**OR**

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

| Name | Registration Number | Name | Registration Number |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignments documents attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:

■ The address associated with Customer Number: 106963

**OR**

| | | | | |
|---|---|---|---|---|
| ☐ | Firm or Individual Name | | | |
| | Address | | | |
| | City | | State | Zip |
| | Country | | | |
| | Telephone | | Email | |

Assignee Name and Address: Headwater Partners I LLC
1011 Pruitt Place
Tyler, TX 75703 (USA)

**A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be Filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of The practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.**

**SIGNATURE of Assignee of Record**

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

| | | | |
|---|---|---|---|
| Signature | | Date | March 10, 2016 |
| Name | David R. Johnson | Telephone | 650-517-2782 |
| Title | Chief Executive Officer | | |

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

## Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

| Electronic Patent Application Fee Transmittal | |
|---|---|
| **Application Number:** | |
| **Filing Date:** | |
| **Title of Invention:** | FLOW TAGGING FOR SERVICE POLICY IMPLEMENTATION |
| **First Named Inventor/Applicant Name:** | Gregory G. Raleigh |
| **Filer:** | James E. Harris/Ann Taylor |
| **Attorney Docket Number:** | RALEP046C2C1C1 |
| Filed as Small Entity | |

**Filing Fees for Track I Prioritized Examination - Nonprovisional Application under 35 USC 111(a)**

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| Utility filing Fee (Electronic filing) | 4011 | 1 | 70 | 70 |
| Utility Search Fee | 2111 | 1 | 300 | 300 |
| Utility Examination Fee | 2311 | 1 | 360 | 360 |
| Request for Prioritized Examination | 2817 | 1 | 2000 | 2000 |
| **Pages:** | | | | |
| Utility Appl Size fee per 50 sheets >100 | 2081 | 1 | 200 | 200 |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| Publ. Fee- Early, Voluntary, or Normal | 1504 | 1 | 0 | 0 |
| PROCESSING FEE, EXCEPT PROV. APPLS. | 2830 | 1 | 70 | 70 |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| **Extension-of-Time:** | | | | |
| **Miscellaneous:** | | | | |
| | | **Total in USD ($)** | | **3000** |

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 26540899 |
| **Application Number:** | 15227814 |
| **International Application Number:** | |
| **Confirmation Number:** | 2668 |
| **Title of Invention:** | FLOW TAGGING FOR SERVICE POLICY IMPLEMENTATION |
| **First Named Inventor/Applicant Name:** | Gregory G. Raleigh |
| **Customer Number:** | 106963 |
| **Filer:** | James E. Harris/Ann Taylor |
| **Filer Authorized By:** | James E. Harris |
| **Attorney Docket Number:** | RALEP046C2C1C1 |
| **Receipt Date:** | 03-AUG-2016 |
| **Filing Date:** | |
| **Time Stamp:** | 18:52:46 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | Deposit Account |
| Payment was successfully received in RAM | $3000 |
| RAM confirmation Number | 5114 |
| Deposit Account | 505876 |
| Authorized User | TAYLOR, ANN |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:<br>Charge any Additional Fees required under 37 CFR 1.16 (National application filing, search, and examination fees)<br>Charge any Additional Fees required under 37 CFR 1.17 (Patent application and reexamination processing fees) | |

Charge any Additional Fees required under 37 CFR 1.19 (Document supply fees)

Charge any Additional Fees required under 37 CFR 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 CFR 1.21 (Miscellaneous fees and charges)

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | TrackOne Request | P046C2C1C1_TrackOneRequest.pdf | 172307<br>a8bc1792bb17281a1147384a0199bd2e9ea37cf6 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Application Data Sheet | P046C2C1C1_ADS.pdf | 1825156<br>8cc00e4c45a65442192a891cb52150d166c3fd58 | no | 15 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | | P046C2C1C1_Application.pdf | 1079992<br>b362af37985d933e75ca811331348aee8987eb97 | yes | 154 |

**Multipart Description/PDF files in .zip description**

| Document Description | Start | End |
|---|---|---|
| Specification | 1 | 152 |
| Claims | 153 | 153 |
| Abstract | 154 | 154 |

| | | | | | |
|---|---|---|---|---|---|
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 4 | Oath or Declaration filed | P046C2C1C1_DeclRaleigh.pdf | 105478<br>bc8971fadbaa81f20c9d3c039a057b1147c018a4 | no | 1 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 5 | Oath or Declaration filed | P046C2C1C1_DeclLavine.pdf | 279316<br>7a3cdbc4dc233e537e0d24e16145ebf8d30f481a | no | 2 |

| | | | | | |
|---|---|---|---|---|---|
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 6 | Oath or Declaration filed | P046C2C1C1_DeclGreen.pdf | 106219<br>4ef5841b439d9de5e2388ae6df059e86afd14860 | no | 1 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 7 | Oath or Declaration filed | P046C2C1C1_DeclNguyen.pdf | 150906<br>1f9b573a86eb6bc1624571f80c58c2c8d4170321 | no | 1 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 8 | Drawings-only black and white line drawings | P046C2C1C1_Drawings.pdf | 1631356<br>b359396a07c6a0a51394516ecc5a0bef42d6bcf5 | no | 40 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 9 | Power of Attorney | POA_2016.pdf | 387200<br>8a625d81e60f9ef081dd94ae772be639675df15d | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 10 | Fee Worksheet (SB06) | fee-info.pdf | 41936<br>7f9d0007a9d227a7c2f90a2ecaefd790b429f00c | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | | **Total Files Size (in bytes):** | 5779866 | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

**Doc Code: TRACK1.REQ**
**Document Description: TrackOne Request**

PTO/AIA/424 (04-14)

## CERTIFICATION AND REQUEST FOR PRIORITIZED EXAMINATION UNDER 37 CFR 1.102(e) (Page 1 of 1)

| | | | |
|---|---|---|---|
| First Named Inventor: | Raleigh | Nonprovisional Application Number (if known): | RALEP046C2C1C1 |
| Title of Invention: | Flow Tagging for Service Policy Implementation | | |

**APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS PRIORITIZED EXAMINATION FOR THE ABOVE-IDENTIFIED APPLICATION.**

1. The processing fee set forth in 37 CFR 1.17(i)(1) and the prioritized examination fee set forth in 37 CFR 1.17(c) have been filed with the request. The publication fee requirement is met because that fee, set forth in 37 CFR 1.18(d), is currently $0. The basic filing fee, search fee, and examination fee are filed with the request or have been already been paid. I understand that any required excess claims fees or application size fee must be paid for the application.

2. I understand that the application may not contain, or be amended to contain, more than four independent claims, more than thirty total claims, or any multiple dependent claims, and that any request for an extension of time will cause an outstanding Track I request to be dismissed.

3. The applicable box is checked below:

**I. ☑ Original Application (Track One) - Prioritized Examination under § 1.102(e)(1)**

i. (a) The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a). This certification and request is being filed with the utility application via EFS-Web.

---OR---

(b) The application is an original nonprovisional plant application filed under 35 U.S.C. 111(a). This certification and request is being filed with the plant application in paper.

ii. An executed inventor's oath or declaration under 37 CFR 1.63 or 37 CFR 1.64 for each inventor, **or** the application data sheet meeting the conditions specified in 37 CFR 1.53(f)(3)(i) is filed with the application.

**II. ☐ Request for Continued Examination - Prioritized Examination under § 1.102(e)(2)**

i. A request for continued examination has been filed with, or prior to, this form.
ii. If the application is a utility application, this certification and request is being filed via EFS-Web.
iii. The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a), or is a national stage entry under 35 U.S.C. 371.
iv. This certification and request is being filed prior to the mailing of a first Office action responsive to the request for continued examination.
v. No prior request for continued examination has been granted prioritized examination status under 37 CFR 1.102(e)(2).

| | |
|---|---|
| Signature /James E. Harris/ | Date 2016-08-03 |
| Name (Print/Typed) James E. Harris | Practitioner Registration Number 40013 |

***Note:*** *This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required.**

☐ *Total of _____ forms are submitted.

# Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

PTO/AIA/14 (11-15)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | RALEP046C2C1C1 |
|---|---|---|
| | Application Number | |
| Title of Invention | Flow Tagging for Service Policy Implementation | |

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

## Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

## Inventor Information:

**Inventor 1** Remove

**Legal Name**

| Prefix | Given Name | Middle Name | Family Name | Suffix |
|---|---|---|---|---|
| | Gregory | G. | Raleigh | |

**Residence Information (Select One)** ● US Residency Non US Residency Active US Military Service

| City | Woodside | State/Province | CA | Country of Residence | US |
|---|---|---|---|---|---|

**Mailing Address of Inventor:**

| Address 1 | 1011 Pruitt Place | | |
|---|---|---|---|
| Address 2 | | | |
| City | Tyler | State/Province | TX |
| Postal Code | 75703 | Country | US |

**Inventor 2** Remove

**Legal Name**

| Prefix | Given Name | Middle Name | Family Name | Suffix |
|---|---|---|---|---|
| | Jeffrey | | Green | |

**Residence Information (Select One)** ◉ US Residency Non US Residency Active US Military Service

| City | Sunnyvale | State/Province | CA | Country of Residence | US |
|---|---|---|---|---|---|

**Mailing Address of Inventor:**

| Address 1 | 1011 Pruitt Place | | |
|---|---|---|---|
| Address 2 | | | |
| City | Tyler | State/Province | TX |
| Postal Code | 75703 | Country | US |

**Inventor 3** Remove

**Legal Name**

| Prefix | Given Name | Middle Name | Family Name | Suffix |
|---|---|---|---|---|
| | James | | Lavine | |

**Residence Information (Select One)** ◉ US Residency Non US Residency Active US Military Service

PTO/AIA/14 (11-15)
Approved for use through 04/30/2017. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | RALEP046C2C1C1 |
|---|---|---|
| | Application Number | |
| Title of Invention | Flow Tagging for Service Policy Implementation | |

| City | Corte Madera | State/Province | CA | Country of Residence | US |
|---|---|---|---|---|---|

**Mailing Address of Inventor:**

| Address 1 | 1011 Pruitt Place | | |
|---|---|---|---|
| Address 2 | | | |
| City | Tyler | State/Province | TX |
| Postal Code | 75703 | Country | US |

Inventor 4 Remove

**Legal Name**

| Prefix | Given Name | Middle Name | Family Name | Suffix |
|---|---|---|---|---|
| | Vien-Phuong | | Nguyen | |

**Residence Information (Select One)** ◉ US Residency ○ Non US Residency ○ Active US Military Service

| City | Newark | State/Province | CA | Country of Residence | US |
|---|---|---|---|---|---|

**Mailing Address of Inventor:**

| Address 1 | 1011 Pruitt Place | | |
|---|---|---|---|
| Address 2 | | | |
| City | Tyler | State/Province | TX |
| Postal Code | 75703 | Country | US |

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

## Correspondence Information:

**Enter either Customer Number or complete the Correspondence Information section below.**
**For further information see 37 CFR 1.33(a).**

☐ **An Address is being provided for the correspondence Information of this application.**

| Customer Number | 106963 | | |
|---|---|---|---|
| Email Address | patent@headwaterllc.com | Add Email | Remove Email |

## Application Information:

| Title of the Invention | Flow Tagging for Service Policy Implementation | | |
|---|---|---|---|
| Attorney Docket Number | RALEP046C2C1C1 | Small Entity Status Claimed | ☒ |
| Application Type | Nonprovisional | | |
| Subject Matter | Utility | | |
| Total Number of Drawing Sheets (if any) | 40 | Suggested Figure for Publication (if any) | |

PTO/AIA/14 (11-15)
Approved for use through 04/30/2017. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | RALEP046C2C1C1 |
|---|---|---|
| | Application Number | |
| Title of Invention | Flow Tagging for Service Policy Implementation | |

## Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

| Application number of the previously filed application | Filing date (YYYY-MM-DD) | Intellectual Property Authority or Country |
|---|---|---|
| | | |

## Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

## Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

| Please Select One: | ● Customer Number | US Patent Practitioner | ○ Limited Recognition (37 CFR 11.9) |
|---|---|---|---|
| Customer Number | 106963 | | |

## Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the "Application Number" field blank.

| Prior Application Status | Pending | | Remove |
|---|---|---|---|
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| thisapplication | Continuation of | 14339110 | 2014-07-23 |

PTO/AIA/14 (11-15)
Approved for use through 04/30/2017. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

| **Application Data Sheet 37 CFR 1.76** | Attorney Docket Number | RALEP046C2C1C1 |
|---|---|---|
| | Application Number | |
| Title of Invention | Flow Tagging for Service Policy Implementation | |

| Prior Application Status | Patented | | | | Remove |
|---|---|---|---|---|---|
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 14339110 | Continuation of | 14338807 | 2014-07-23 | 9094311 | 2015-07-28 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 14338807 | Continuation of | 14098527 | 2013-12-05 | 9270559 | 2016-02-23 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 14098527 | Continuation of | 13374959 | 2012-01-24 | 8606911 | 2013-12-10 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 12695019 | 2010-01-27 | 8275830 | 2012-09-25 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 12695020 | 2010-01-27 | 8406748 | 2013-03-26 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 12694445 | 2010-01-27 | 8391834 | 2013-03-05 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 12694451 | 2010-01-27 | 8548428 | 2013-10-01 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 12694455 | 2010-01-27 | 8402111 | 2013-03-19 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 12695980 | 2010-01-28 | 8340634 | 2012-12-25 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 13229580 | 2011-09-09 | 8626115 | 2014-01-07 |

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| **Application Data Sheet 37 CFR 1.76** | Attorney Docket Number | RALEP046C2C1C1 |
|---|---|---|
| | Application Number | |
| Title of Invention | Flow Tagging for Service Policy Implementation | |

| Prior Application Status | Patented | | | | Remove |
|---|---|---|---|---|---|
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 13237827 | 2011-09-20 | 8832777 | 2014-09-09 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 13239321 | 2011-09-21 | 8898293 | 2014-11-25 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 13248028 | 2011-09-28 | 8924469 | 2014-12-30 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 13247998 | 2011-09-28 | 8725123 | 2014-05-13 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 13248025 | 2011-09-28 | 8924543 | 2014-12-30 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 13253013 | 2011-10-04 | 8745191 | 2014-06-03 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 13309556 | 2011-12-01 | 8893009 | 2014-11-18 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 13309463 | 2011-12-01 | 8793758 | 2014-07-29 |
| Prior Application Status | Patented | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13374959 | Continuation in part of | 13134028 | 2011-05-25 | 8589541 | 2013-11-19 |
| Prior Application Status | Expired | | | | Remove |

| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
|---|---|---|---|
| 13374959 | Claims benefit of provisional | 61435564 | 2011-01-24 |

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| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | RALEP046C2C1C1 |
|---|---|---|
| | Application Number | |
| Title of Invention | Flow Tagging for Service Policy Implementation | |

| Prior Application Status | Expired | | Remove |
|---|---|---|---|
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13374959 | Claims benefit of provisional | 61472606 | 2011-04-06 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13374959 | Claims benefit of provisional | 61550906 | 2011-10-24 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13374959 | Claims benefit of provisional | 61589830 | 2012-01-23 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 12695019 | Claims benefit of provisional | 61264126 | 2009-11-24 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 12695019 | Claims benefit of provisional | 61270353 | 2009-07-06 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 12695020 | Claims benefit of provisional | 61275208 | 2009-08-25 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 12695020 | Claims benefit of provisional | 61237753 | 2009-08-28 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 12694455 | Claims benefit of provisional | 61264120 | 2009-11-24 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61348022 | 2010-05-25 |

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| **Application Data Sheet 37 CFR 1.76** | Attorney Docket Number | RALEP046C2C1C1 |
|---|---|---|
| | Application Number | |
| Title of Invention | Flow Tagging for Service Policy Implementation | |

| Prior Application Status | Expired | | Remove |
|---|---|---|---|
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61381159 | 2010-09-09 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61381162 | 2010-09-09 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61384456 | 2010-09-20 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61389547 | 2010-10-04 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61385020 | 2010-09-21 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61387243 | 2010-09-28 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61387247 | 2010-09-28 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61407358 | 2010-10-27 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61418507 | 2010-12-01 |

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| **Application Data Sheet 37 CFR 1.76** | Attorney Docket Number | RALEP046C2C1C1 |
|---|---|---|
| | Application Number | |
| Title of Invention | Flow Tagging for Service Policy Implementation | |

| Prior Application Status | Expired | | Remove |
|---|---|---|---|
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61418509 | 2010-12-01 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61420727 | 2010-12-07 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61422565 | 2010-12-13 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61422572 | 2010-12-13 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 13134028 | Claims benefit of provisional | 61422574 | 2010-12-13 |
| Prior Application Status | Patented | | Remove |

| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
|---|---|---|---|---|---|
| 13134028 | Continuation in part of | 13134005 | 2011-05-25 | 8635335 | 2014-01-21 |
| Prior Application Status | Patented | | | | Remove |

| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
|---|---|---|---|---|---|
| 13134028 | Continuation in part of | 12695021 | 2010-01-27 | 8346225 | 2013-01-01 |
| Prior Application Status | Expired | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | | | Filing or 371(c) Date (YYYY-MM-DD) |
| 12695021 | Claims benefit of provisional | 61252151 | | | 2009-10-15 |
| Prior Application Status | Expired | | | | Remove |
| Application Number | Continuity Type | Prior Application Number | | | Filing or 371(c) Date (YYYY-MM-DD) |
| 12695021 | Claims benefit of provisional | 61252153 | | | 2009-10-15 |

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| **Application Data Sheet 37 CFR 1.76** | Attorney Docket Number | RALEP046C2C1C1 |
|---|---|---|
| | Application Number | |
| Title of Invention | Flow Tagging for Service Policy Implementation | |

| Prior Application Status | Patented | | | Remove | |
|---|---|---|---|---|---|
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 12695021 | Continuation in part of | 12380780 | 2009-03-02 | 8839388 | 2014-09-16 |
| Prior Application Status | Patented | | | Remove | |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13134005 | Continuation in part of | 12380780 | 2009-03-02 | 8839388 | 2014-09-16 |
| Prior Application Status | Patented | | | Remove | |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 13134005 | Continuation in part of | 12380778 | 2009-03-02 | 8321526 | 2012-11-27 |
| Prior Application Status | Expired | | | Remove | |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) | | |
| 12380780 | Claims benefit of provisional | 61206354 | 2009-01-28 | | |
| Prior Application Status | Expired | | | Remove | |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) | | |
| 12380780 | Claims benefit of provisional | 61206944 | 2009-02-04 | | |
| Prior Application Status | Expired | | | Remove | |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) | | |
| 12380780 | Claims benefit of provisional | 61207393 | 2009-02-10 | | |
| Prior Application Status | Expired | | | Remove | |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) | | |
| 12380780 | Claims benefit of provisional | 61207739 | 2009-02-13 | | |
| Prior Application Status | Expired | | | Remove | |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) | | |
| 12380778 | Claims benefit of provisional | 61206354 | 2009-01-28 | | |
| Prior Application Status | Expired | | | Remove | |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) | | |
| 12380778 | Claims benefit of provisional | 61206944 | 2009-02-04 | | |

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| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | RALEP046C2C1C1 |
|---|---|---|
| | Application Number | |
| Title of Invention | Flow Tagging for Service Policy Implementation | |

| Prior Application Status | Expired | | Remove |
|---|---|---|---|
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 12380778 | Claims benefit of provisional | 61207393 | 2009-02-10 |
| Prior Application Status | Expired | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 12380778 | Claims benefit of provisional | 61207739 | 2009-02-13 |
| Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. | | | Add |

## Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)[i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

| | | | Remove |
|---|---|---|---|
| Application Number | Country[i] | Filing Date (YYYY-MM-DD) | Access Code[i] (if applicable) |
| | | | |
| Additional Foreign Priority Data may be generated within this form by selecting the **Add** button. | | | Add |

## Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

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| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | RALEP046C2C1C1 |
|---|---|---|
| | Application Number | |
| Title of Invention | Flow Tagging for Service Policy Implementation | |

## Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

**NOTE**: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

**1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)**

**A. Priority Document Exchange (PDX)** - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

**B. Search Results from U.S. Application to EPO** - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

**2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)**

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

**NOTE:** Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

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| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | RALEP046C2C1C1 |
|---|---|---|
| | Application Number | |
| Title of Invention | Flow Tagging for Service Policy Implementation | |

## Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

**Applicant 1** Remove

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

| ● Assignee | Legal Representative under 35 U.S.C. 117 | Joint Inventor |
|---|---|---|
| Person to whom the inventor is obligated to assign. | Person who shows sufficient proprietary interest | |

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☒

| Organization Name | Headwater Partners I LLC |
|---|---|

**Mailing Address Information For Applicant:**

| | | | |
|---|---|---|---|
| **Address 1** | 1011 Pruitt Place | | |
| Address 2 | | | |
| **City** | Tyler | **State/Province** | TX |
| **Country** | US | Postal Code | 75703 |
| Phone Number | 903-201-6212 | Fax Number | |
| Email Address | patent@headwaterllc.com | | |

Additional Applicant Data may be generated within this form by selecting the Add button. Add

## Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

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| **Application Data Sheet 37 CFR 1.76** | Attorney Docket Number | RALEP046C2C1C1 |
|---|---|---|
| | Application Number | |
| Title of Invention | Flow Tagging for Service Policy Implementation | |

**Assignee 1**

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

Remove

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

| Prefix | **Given Name** | Middle Name | **Family Name** | Suffix |
|---|---|---|---|---|
| | | | | |

**Mailing Address Information For Assignee including Non-Applicant Assignee:**

| | | | |
|---|---|---|---|
| **Address 1** | | | |
| Address 2 | | | |
| **City** | | **State/Province** | |
| **Country** i | | Postal Code | |
| Phone Number | | Fax Number | |
| Email Address | | | |

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button. Add

## Signature:

Remove

**NOTE:** This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

| **Signature** | /James E. Harris/ | | | Date (YYYY-MM-DD) | 2016-08-03 |
|---|---|---|---|---|---|
| First Name | James E. | Last Name | Harris | Registration Number | 40013 |

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# FLOW TAGGING FOR SERVICE POLICY IMPLEMENTATION

## BACKGROUND

**[0001]** With the advent of mass market digital communications, applications and content distribution, many access networks such as wireless networks, cable networks and Digital Subscriber Line (DSL) networks are pressed for user capacity, with, for example Evolution-Data Optimized (EVDO), High Speed Packet Access (HSPA), Long Term Evolution (LTE), Worldwide Interoperability for Microwave Access (WiMax), DOCSIS, DSL, and Wireless Fidelity (Wi-Fi) becoming user capacity constrained. In the wireless case, although network capacity will increase with new higher capacity wireless radio access technologies, such as Multiple-Input Multiple-Output (MIMO), and with more frequency spectrum and cell splitting being deployed in the future, these capacity gains are likely to be less than what is required to meet growing digital networking demand.

**[0002]** Similarly, although wire line access networks, such as cable and DSL, can have higher average capacity per user compared to wireless, wire line user service consumption habits are trending toward very high bandwidth applications and content that can quickly consume the available capacity and degrade overall network service experience. Because some components of service provider costs go up with increasing bandwidth, this trend will also negatively impact service provider profits. In addition, it is becoming increasingly important to associate device access network services usage (e.g., network data services usage, voice services usage, etc.) to the applications (e.g., application, widget, service, process, embedded object, or any combination of these, etc.) that are using the services.

**[0003]** The foregoing example of trends and issues is intended to be illustrative and not exclusive. Other limitations of the art will become apparent to those of skill in the relevant art upon a reading of the specification and a study of the drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0004]** FIG. 1 illustrates a functional diagram of a network architecture for providing quality of service (QoS) for device assisted services (DAS) and/or for providing DAS for protecting network capacity in accordance with some embodiments.

**[0005]** FIG. 2 illustrates another functional diagram of another network architecture for providing quality of service (QoS) for device assisted services (DAS) and/or for providing DAS for protecting network capacity in accordance with some embodiments.

**[0006]** FIG. 3 illustrates a functional diagram of an architecture including a device based service processor and a service controller for providing quality of service (QoS) for device assisted services (DAS) and/or for providing DAS for protecting network capacity in accordance with some embodiments.

**[0007]** FIGS. 4A through 4C illustrate a functional diagram for providing quality of service (QoS) for device assisted services (DAS) in accordance with some embodiments.

**[0008]** FIG. 5 illustrates a functional diagram for generating a QoS activity map for quality of service (QoS) for device assisted services (DAS) in accordance with some embodiments.

**[0009]** FIG. 6 illustrates a functional diagram for quality of service (QoS) for device assisted services (DAS) for an end to end coordinated QoS service channel control in accordance with some embodiments.

**[0010]** FIG. 7 illustrates a flow diagram for quality of service (QoS) for device assisted services (DAS) in accordance with some embodiments.

**[0011]** FIGS. 8A through 8C each illustrate another flow diagram for quality of service (QoS) for device assisted services (DAS) in accordance with some embodiments.

**[0012]** FIG. 9 illustrates another flow diagram for quality of service (QoS) for device assisted services (DAS) in accordance with some embodiments.

**[0013]** FIG. 10 illustrates another flow diagram for quality of service (QoS) for device assisted services (DAS) in accordance with some embodiments.

**[0014]** FIG. 11 illustrates another flow diagram for quality of service (QoS) for device assisted services (DAS) in accordance with some embodiments.

**[0015]** FIG. 12 illustrates a device stack for providing various service usage measurement techniques in accordance with some embodiments.

**[0016]** FIG. 13 illustrates another device stack for providing various service usage measurement techniques in accordance with some embodiments.

**[0017]** FIG. 14 illustrates a flow diagram for device assisted services (DAS) for protecting network capacity in accordance with some embodiments.

**[0018]** FIG. 15 illustrates another flow diagram for device assisted services (DAS) for protecting network capacity in accordance with some embodiments.

**[0019]** FIG. 16 illustrates another flow diagram for device assisted services (DAS) for protecting network capacity in accordance with some embodiments.

**[0020]** FIG. 17 illustrates another flow diagram for device assisted services (DAS) for protecting network capacity in accordance with some embodiments.

**[0021]** FIG. 18 illustrates another flow diagram for device assisted services (DAS) for protecting network capacity in accordance with some embodiments.

**[0022]** FIG. 19 illustrates another flow diagram for device assisted services (DAS) for protecting network capacity in accordance with some embodiments.

**[0023]** FIG. 20 illustrates another flow diagram for device assisted services (DAS) for protecting network capacity in accordance with some embodiments.

**[0024]** FIG. 21 illustrates another flow diagram for device assisted services (DAS) for protecting network capacity in accordance with some embodiments.

**[0025]** FIG. 22 illustrates another flow diagram for device assisted services (DAS) for protecting network capacity in accordance with some embodiments.

**[0026]** FIG. 23 illustrates a network capacity controlled services priority level chart for device assisted services (DAS) for protecting network capacity in accordance with some embodiments.

**[0027]** FIG. 24 depicts a diagram of a network capacity protection system utilizing device-assisted services (DAS).

**[0028]** FIG. 25 depicts a diagram an example of a differential access control notification system.

**[0029]** FIG. 26 depicts an example of a computer system on which techniques described in this paper can be implemented.

**[0030]** FIG. 27 depicts a diagram of an example of a system for application-specific differential network access control.

**[0031]** FIG. 28 depicts an example of a system for flow tracking.

**[0032]** FIG. 29 depicts a flowchart of an example of a method of flow tracking.

**[0033]** FIG. 30 depicts an example of a system with a tagged traffic flow.

**[0034]** FIGS. 31A and 31B depict a flowchart of an example of a method of virtual tagging.

**[0035]** FIG. 32 depicts an example of a system for classification mapping using virtual tagging.

**[0036]** FIG. 33 depicts an example of a media service classification system.

**[0037]** FIG. 34 depicts a conceptual diagram of a proxy encapsulated frame.

**[0038]** FIG. 35 depicts an example of a system for proxy client counting.

**[0039]** FIG. 36 depicts an example of a system for classifying traffic and enforcing a service policy based upon the classification.

**[0040]** FIG. 37 depicts a flowchart of an example of a method for flow tagging and enforcing service policies associated with an identified initiator of the flow.

## DETAILED DESCRIPTION

**[0041]** The invention can be implemented in numerous ways, including as a process; an apparatus; a system; a composition of matter; a computer program product embodied on a computer readable storage medium; and/or a processor, such as a processor configured to execute instructions stored on and/or provided by a memory coupled to the processor. In this specification, these implementations, or any other form that the invention may take, may be referred to as techniques. In general, the order of the steps of disclosed processes may be altered within the scope of the invention. Unless stated otherwise, a

component such as a processor or a memory described as being configured to perform a task may be implemented as a general component that is temporarily configured to perform the task at a given time or a specific component that is manufactured to perform the task. As used herein, the term 'processor' refers to one or more devices, circuits, and/or processing cores configured to process data, such as computer program instructions.

**[0042]** A detailed description of one or more embodiments of the invention is provided below along with accompanying figures that illustrate the principles of the invention. The invention is described in connection with such embodiments, but the invention is not limited to any embodiment. The scope of the invention is limited only by the claims and the invention encompasses numerous alternatives, modifications and equivalents. Numerous specific details are set forth in the following description in order to provide a thorough understanding of the invention. These details are provided for the purpose of example and the invention may be practiced according to the claims without some or all of these specific details. For the purpose of clarity, technical material that is known in the technical fields related to the invention has not been described in detail so that the invention is not unnecessarily obscured.

**[0043]** As the network capacity gains are less than what is required to meet growing digital networking demand, a network capacity crunch is developing due to increasing network congestion on various wireless networks, such as mobile networks. The increasing popularity of various smart phone devices, net book devices, tablet computing devices, and various other wireless mobile computing devices, which are becoming increasingly popular on 3G, 4G, and other advanced wireless networks, is contributing to the network capacity crunch. Some network carriers have indicated that a relatively small number of users on such devices demand a disproportionately significant amount of their network capacity. For example, AT&T has recently indicated that about 3 percent of its smart phone device users (e.g., Apple iPhone® users) are generating approximately 40 percent of the operator's data traffic.

**[0044]** For example, in wireless networks, managing the wireless access connection capacity and network access connection resources is important to maintain network performance as network resources/capacity demand increases. Many network performance measures can be advantageously maintained or improved as network loading increases if capacity management and/or network resource management is employed. For example, these performance measures include network availability; the ability to deliver connections to all devices, users and/or applications seeking connections and enabled for service on the network; network access attempt success rate; the transmission speed experienced by one or more devices, users or applications; the average transmission speed experienced by all devices, users and/or applications; network bit error rate or packet error rate; the time delay from network access request

to delivered access connection; the one-way delay or round-trip delay for a transmission; the delay timing jitter for a transmission; the time variation in transmission speed for one or more connections; the ability of the network to deliver various requested/needed levels of Quality of Service (QoS) to devices, users or applications that require differentiated connection QoS classes; the ability of the network to maintain efficiency (e.g., aggregated service throughput measured across all devices, users, and/or applications); the ability of the network to share or distribute a performance measure (e.g., the performance measures listed above) uniformly or fairly across multiple devices, users, and/or applications that all have the same service quality class or the same service plan performance parameters.

**[0045]** For example, if there is a limited amount of shared bandwidth for a set of user devices (e.g., a set of devices on a wireless network, such as a given base station or base station controller or femto cell or pico cell; or a set of devices on a cable modem networks, etc.), and if multiple and/or all devices allow all applications to indiscriminately access or attempt to access network resources or transmit/receive traffic, then the network can generally become overloaded. As a result, a subset of users/devices or in some cases most or all users/devices obtain poor network performance. As another example, if one or more devices forming a subset of devices on the network allow multiple and/or all applications to indiscriminately access or attempt to access network resources or transmit/receive traffic, then the network can become overloaded. As a result, a subset of users/devices or in some cases most or all users/devices obtain poor network performance.

**[0046]** Traditionally, mobile devices typically have specialized designs that are optimized to preserve network capacity and protect network resources from being over taxed. For example, wireless devices that browse the Internet often use specialized protocols such as WAP and data traffic compression or low resolution techniques rather than standard HTTP protocols and traffic used in wired Internet devices.

**[0047]** However, the wireless devices that implement specialized methods for accessing the Internet and/or other networks often implement complex specifications provided by one or more wireless carriers that own the networks that the device is designed to connect to. Such complex specifications often require time consuming design, testing, and certification processes. These processes in part have the effect of narrowing the base of device suppliers to those qualified and willing to perform the specialized design work required, slowing time to market for new devices, increasing the expense to develop new devices and reducing the types of applications that are supported.

**[0048]** Device OEMs have recently created wireless devices that are designed more like standard Internet devices and not fully optimized to preserve network capacity and resources. Many wireless

service customers desire this type of device, and the OEMs generally want to reduce the complexity and time to market to deliver such devices. In addition, new market needs and new government requirements sometimes require that carriers offer a more open process for bringing new devices onto their network, in which the process does not require all of the specialized design and certification described above. These and various other factors are driving a growing need and trend for less complex and time consuming wireless device design and certification processes.

**[0049]** This trend has led many carriers to begin selling devices that are designed more as standard Internet service devices that connect to the Internet and other data networks through carrier wireless networks. As the cellular network is opened up to more and more new devices, applications and markets, there is a growing demand to allow general purpose Internet devices and applications to gain access to wireless networks without necessarily going through specialized design and certification process requirements to make the devices and applications efficient and authorized for access to such wireless networks.

**[0050]** However, general purpose Internet devices are not as frugal or sparing with wireless network access bandwidth. Moreover, with the advent of always on wide area network connections to the Internet has led to popular Internet services and applications that typically assume very inexpensive access and generally heed no attention to, for example, network busy state. As more general purpose Internet devices are provided for us on various wireless networks (e.g., mobile wireless networks), a high frequency of inefficient wireless network accesses continue to rise, which can reduce network capacity sometimes to levels that hinder access to service for that device (e.g., user, device, software demand) and/or other devices on that wireless network and/or that wireless network segment. As discussed above, judicious use of wireless network bandwidth, capacity, and resources generally results in better service for all users, but at present, device manufacturers and wireless network providers (e.g., wireless network carriers or carriers) have not provided or implemented more intelligent bandwidth usage techniques. These factors generally result in less carrier control of device design, which poses a threat to longer term network capacity and performance preservation as the volume of devices with less optimized wireless designs continues to grow.

**[0051]** There are many network performance and user performance factors that are impacted by the efficiency of the network, including, for example, overall network congestion; the access network performance experienced by one or more groups of users, devices, applications, network service sources, communication protocols, and/or operating system functions; and/or the performance experienced by a given user, device, application, network service source, communication protocol, and/or operating system

function. Under a relatively low capacity demand of a wireless network, network performance as experienced by a group of devices, applications, network service sources, communication protocols, operating system functions, and/or users or by a single device, application, network service source, communication protocol, operating system function, and/or user can degrade somewhat proportionally (e.g., aggregate traffic delivered by the network may be roughly proportional to the peak available network traffic) with incremental increases in network access and/or traffic demand from one or more groups of users, devices, applications, network service sources, communication protocols and/or operating system functions. However, as network resources/network capacity demand increases (e.g., more wireless network data traffic is demanded in aggregate; more devices are serviced by the network; more users are serviced by the network; more applications are serviced by the network; more network service sources are serviced by the network; more operating system functions are serviced by the network; and/or more differentiated QoS sessions are serviced by the network), network availability/performance can decrease and/or the network may not adequately service one or more users, devices, applications, network service sources, communication protocols, and/or operating system functions, or may not service one or more groups of users, devices, applications, network service sources, communication protocols, and/or operating system functions.

**[0052]** There are many examples of how increasing network capacity demand can decrease network performance, including for example, to a decrease in average bandwidth offered per device (e.g., one or more users on a device, application, network service source, communication protocol, and/or operating system function executed/implemented on the device); an increase in traffic delivery latency; an increase in traffic delivery latency jitter; insufficient guaranteed or differentiated bandwidth for one or more differentiated QoS and/or dynamic QoS services (e.g., as described herein) to one or more devices, users, applications, network service sources, communication protocols, and/or operating system functions; increased latency for bandwidth reservation services; increased latency for QoS reservation services; performance problems with one or more communication protocols; unacceptable delays in user experience, and/or various other or similar consequences and device or user impacts resulting from reduced network availability and/or reduced network capacity. Examples of network communication protocols that can have degraded performance with excessive network loading or degraded network performance include, for example, Internet protocol (IP), HTML protocols, voice communication protocols including VOIP protocols, real-time video communication protocols, streaming media protocols (e.g., audio, video, etc), gaming protocols, VPN protocols, file download protocols, background service protocols, software update protocols, and/or various other network communication protocols. Thus, is it important to preserve/protect network capacity.

**[0053]** It is also important to control the number of transactions demanded from a given network resource (e.g., edge network segment, base station, base station controller, MAC resources, pico cell, femto cell, etc.) in a given period of time so that demand does not overcome the transaction servicing ability of that network resource. For example, network resources that should not be subjected to excess transaction demand can include base station or base station controller resources, media access control (MAC) resources, traffic transport resources, AAA resources, security or authentication resources, home agent (HA) resources, DNS resources, resources that play a part in network discovery, gateway or router resources, data session reservation or establishment resources (e.g., network resources required to manage, set up, conduct, and/or close service sessions, PPP sessions, communication flows, communication streams, QoS flows, radio access bearer reservation resources , tunnels, VPNs, APNs, special service routing, etc.), bandwidth reservation resources, QoS reservation or coordination resources, QoS transport resources, service charging resources, traffic analysis resources, network security resources, and/or various other or similar network resources. In some networks, the network performance degradation due to a given measure of incremental increase in network resource/capacity demand can become relatively large as various network resources become increasingly taxed due to either limited transaction processing capability or limited traffic bandwidth for one or more of the network resources that participate in establishing, servicing, conducting, maintaining, and/or closing the necessary network service connections and/or information exchanges required to conduct a service activity. For example, if the equipment required to establish a PPP session can only handle a certain number of new PPP session openings and/or closings per given period of time, and if device behavior is such that PPP sessions are often opened and/or closed, then the rate of PPP session transactions (e.g., openings and/or closings) can exceed the transaction capacity of the PPP session management resources. This is sometimes referred to as "flooding" or "overloading" a network resource with excess demand or excess connections, and, in such cases, the network resource may begin falling behind in servicing transaction demand in a well controlled manner (e.g., the network resource may continue processing transactions at or near a maximum rate for that network resource), or in some cases, the resource may fall behind transaction demand in a less well controlled manner (e.g., the network resource may become overwhelmed such that its processing rate not only falls below aggregate transaction demand, but the transaction rate processing capability decreases under overload as well). In the PPP session establishment resource example, once the rate of requested transactions exceeds the resource maximum transaction rate, then unmet device demand can grow to a point where one or more devices experiences delays in connecting to and/or communicating (e.g., sending/receiving data) with the network.

**[0054]** As another example, in any type of random access bandwidth reservation protocol, MAC protocol, or bandwidth delivery protocol, in a network without proper management and/or control of traffic access reservations and/or transmissions, as the network demand increases there may be more collisions between reservation requests, traffic transmissions, application demands, network service source demands, communication protocol demands, and/or operating system function demands causing a decreasing network efficiency that can degrade user, device, application and/or network service performance so that performance falls below acceptable levels. As another example, in systems in which there is a QoS service session reservation system, uncontrolled and/or unmanaged QoS reservation requests and/or reservation grants can lead to a situation where the QoS reservation resources and/or QoS service delivery resources are over taxed to the point where QoS service performance falls below desired levels. As another example, in networks that require some form of minimum resource allocation for transmissions, reservations, or network resource transactions, the network can become inefficient if one or more devices, applications, network service sources, operating system functions, and/or communication protocols have a relatively high rate of network resource access attempts, network accesses or data transmissions for small transmission payloads (e.g., minimum MAC reservation factors, minimum security overhead factors, minimum QoS reservation factors, minimum time responses for establishing a base station connection, minimum time responses for establishing or closing/being released from a session, etc). Even if the data packet comprising the access event is small, the network resources required to complete the access event are often busy servicing the access event for much longer periods of time than are required for the actual data transmission.

**[0055]** Another example of device service activity behavior that can have an impact on network performance is the way the device, device subsystem, and/or modem subsystem power cycling or transitions from one power save state to another. For example, establishing a basic connection from a device to a wireless base station consumes base station resources for a period of time and in some cases can also consume other network resources such as AAA, HLR, HA, gateway, billing, and/or charging gateway resources. If a device terminates the connection to the base station when the modem subsystem (e.g., or some other portion of the device) goes from active connection state to a power save state, then each time the device enters power save state and then exits power save state network resources are consumed, sometimes for time periods measured on the order of seconds or in extreme cases even minutes. If such a device has an aggressive power save algorithm that enters power save state after a short idle period, then the device behavior can consume a proportionally large amount of resources such that the network ability to support multiple devices is diminished, or such that the network cannot support very many similar devices on the network. Another similar example is the establishment of network

sessions once the base station connection is established (e.g., establishing a PPP session between the device and a home agent (HA) or other gateway), in which network resources required to open and/or close the network session are ignorantly consumed if a device exhibits aggressive power save state cycling or frequently terminates the data session for other reasons.

**[0056]** Another example of device service activity behavior that can impact network performance is applications that maintain persistent network communication that generates a relatively high frequency of network data packets. Some applications have persistent signaling that falls into this category. Specific examples include frequent device signaling sequences to update widgets on a desktop; synchronize user data such as calendars, contacts, email, and/or other information/content; check or update email or RSS feeds; access social networking websites or tools; online text, voice or video chat tools; update real-time information; and conduct other repetitive actions. Additional application behavior that can significantly tie up network resources and capacity include, for example, conference meeting services, video streaming, content update, software update, and/or other or similar application behavior. For example, even when the user is not directly interacting with or benefiting from this type of application, the application can be running in the background and continuing to consume potentially significant network resources.

**[0057]** For example, the types of service activities and/or device behavior that can reduce network capacity and/or network resource availability include software updates for OS and applications, frequent OS and application background network accesses and signaling, frequent network discovery and/or signaling (e.g., EtherType messages, ARP messages, and/or other messaging related to network access), cloud synchronization services, RSS feeds and/or other background information feeds, application (e.g., web browser) or device behavior reporting, background email downloads, content subscription service updates and downloads (e.g., music/video downloads, news feeds, etc.), text/voice/video chat clients, virus updates, peer to peer networking applications, inefficient network access sequences during frequent power cycling or power save state cycling, large downloads or other high bandwidth accesses, and/or greedy application programs that continually and/or frequently access the network with small transmissions or requests for information. Various other examples will now be apparent to one of ordinary skill in the art.

**[0058]** Thus, not only can network capacity, network performance, and/or network resource availability be degraded by high device transmission bandwidth demand, but other types of persistent or frequent traffic resulting from network resource requests, network data accesses or other network interaction can also degrade network capacity, network performance, and/or network resource whether or

not the aggregate bandwidth demand as measured by the total data throughput is high or not. Thus, techniques are needed to preserve network capacity by, for example, differentially controlling these types of network service usage activities in various ways depending on the type of service activity requesting network access and/or requesting transactions with network resources.

**[0059]** Smart phone and similar devices are exacerbating the problem by making frequent queries of the wireless network as such devices move among cell sites to while in transit, for example, push email, access social networking tools, and/or conduct other repetitive actions. While data traffic is also growing, signaling traffic is outpacing actual mobile data traffic by 30 percent to 50 percent by some estimates. For example, a Yahoo IM user may send a message but then wait a couple of seconds between messages. To preserve battery life, the smart phone typically moves into an idle mode. When the user pushes another message seconds later, the device has to set up a signaling path again, and even when the signaling resource is released by the smart phone, the network typically does not react fast enough to allow for the next station to use resources until several seconds and sometimes minutes. As a result, the base station controller in this example is spending a lot of its resources trying to process the signaling so it cannot perform other tasks, such as allocate additional resources for data network usage, and such inefficiencies exacerbates the data network capacity crunch and dropped calls on such wireless networks.

**[0060]** One approach used by smart phone vendors to address this problem and save battery life on their devices is to implement a fast dormancy feature, which allows the mobile device to quickly make a query to the radio network controller to release the connection so that it can return to the idle state faster. In other words, the device is relaying the fact that the phone is going dormant saving device resources (e.g., signaling channel) rather than network resources. However, the fast dormancy feature can exacerbate this problem by prematurely requesting a network release only to follow on with a request to connect back to the network or by a request to re-establish a connection with the network.

**[0061]** Network carriers have typically attempted to manage network capacity using various purely central/core network based approaches. For example, some carriers have indicated a robust capacity planning process and sufficient investment is needed to alleviate this growing capacity crunch. Purely centralized network solutions with no assistance from a device based software agent (or service processor) can have several limitations. For example, for some device applications, OS functions or other service usage activities, if the activity is blocked somewhere in the network behind the base station after over the air (OTA) spectrum bandwidth is consumed to open or begin to open a communication socket, then there can still be an appreciable amount of network capacity or resources consumed even though the data transfer is not allowed to complete. In addition, if the service usage activity is aggressive in re-

attempting to establish the network connection to transfer the data, and the network continues to allow the OTA portion of the connection establishment but blocks the connection somewhere in the network, then a large amount of capacity can be consumed by many devices exhibiting such behavior even though no useful service is being allowed. Accordingly, some embodiments for protecting network capacity include controlling network service usage activities at the source of the demand – the device. Furthermore, in some embodiments, service usage is controlled in a manner that delays, prevents, or reduces the frequency of service usage activity re-try attempts to connect to the network.

**[0062]** In some cases, an additional drawback of purely centralized network solutions to protect network capacity arises when service usage activities are controlled, blocked, throttled, and/or delayed by central network equipment with no mechanisms or support to link to a device user interface (UI) to inform the user what is happening and why it is happening. This can lead to a frustrating user experience and reduced carrier customer satisfaction. Accordingly, in some embodiments, a device based UI is provided to provide the user with real time or near real time information regarding why a service usage activity is being controlled, blocked, throttled, and/or otherwise controlled in order to protect network capacity. In some embodiments, a UI is provided that also informs the user when there are options to set, control, override, or modify service usage controls for the purpose of protecting network capacity. In some embodiments, such user preference inputs also correspond to a change in service usage billing. In some embodiments, such changes in service usage billing due to capacity sparing service control changes by the user are communicated to the user via a UI notification sequence. In some embodiments, techniques for protecting network capacity employ user warnings when a service usage activity classified for differential user notification policies is likely to cause the user to go over service plan caps (e.g., total data byte count usage caps).

**[0063]** What is needed is intelligent network monitoring to provide real-time traffic monitoring network service usage (e.g., at the packet level/layer, network stack application interface level/layer, and/or application level/layer) of the wireless network (e.g., radio access networks and/or core networks) and to effectively manage the network service usage for protecting network capacity (e.g., while still maintaining an acceptable user experience). Using Device Assisted Services (DAS) techniques, and in some cases, network assisted/based techniques, to provide for network service usage monitoring of devices, network carriers/operators would be provided greater insight into what devices, which users and what applications, and when and where network congestion problems occur, enabling operators to intelligently add additional resources to certain areas when necessary (e.g., offloading data traffic onto femto cells or WiFi hotspots and adding more network resources), to differentially control network

service usage, and/or to differentially charge for network service usage based on, for example, a network busy state, for protecting network capacity.

**[0064]** Intelligent network monitoring of the wireless network to effectively manage network service usage for protecting network capacity can include providing Device Assisted Services (DAS) for protecting network capacity in accordance with various embodiments described herein. For example, intelligent network monitoring of the wireless network to effectively manage network service usage for protecting network capacity can include differentially controlling over the air software updates and/or performing software updates via wired connections only. As another example, intelligent network monitoring of the wireless network to effectively manage network service usage for protecting network capacity can include differentially controlling various applications that demand significant network resources or network capacity. As another example, intelligent network monitoring of the wireless network to effectively manage network service usage for protecting network capacity can include managing network access connection requests resulting from repeated power down modes in the modem, which can cause resource intensive re-connection and/or re-authentication processes. As another example, intelligent network monitoring of the wireless network to effectively manage network service usage for protecting network capacity can include techniques for keeping PPP sessions alive to avoid the need to consume network resources to re-establish PPP sessions (e.g., unless the application behavior analysis predicts that a mean access time is long enough for the PPP session to be dropped off and yet not causing overall network resource limitations).

**[0065]** Unlike traditional QoS techniques, which are used to establish a single end or end to end guaranteed service level(s) on a network, techniques disclosed herein for protecting network capacity facilitate implementation of services on a network to facilitate differential control of certain services to protect network capacity (e.g., to reduce network congestion, network capacity demand, network resource demand; and/or to increase network availability). As also disclosed herein, techniques disclosed herein for protecting network capacity facilitate implementation of services on a network to facilitate differential control of certain services to protect network capacity can also facilitate QoS implementations by maintaining needed levels of network capacity/availability to facilitate delivery of certain QoS levels/classes. For example, techniques disclosed herein for protecting network capacity can aggregate across multiple services and/or devices to facilitate differential control of certain services to protect network capacity. As another example, techniques disclosed herein for protecting network capacity can be used to provide for dynamic QoS classifications (e.g., dynamically assigning/classifying and reassigning/reclassifying (based on various criteria, events, and/or measures) network service usage

activities to various QoS levels/classes, such as described herein) to facilitate differential control of certain services to protect network capacity.

**[0066]** Accordingly, Device Assisted Services (DAS) for protecting network capacity is provided. In some embodiments, DAS for protecting network capacity provides for protection of network capacity (e.g., network congestion and/or network access/resource demand and/or network availability on an edge element of the network, such as on the Radio Access Network (RAN) of a wireless network, and/or from a device to a base station/base station controller), such as by controlling network service activity usage activities of a device in wireless communication with the network to reduce demands on the network. For example, controlling network service usage activities can include classifying and/or controlling network access requests (e.g., IP address requests), network access reservation requests (e.g., a QoS reservation/sequence), network capacity/resources usage (e.g., bandwidth usage), and/or any other network service usage activities. In some embodiments, applications, OS functions, and/or other network service usage activities that request IP addresses from network address server resources are classified and/or controlled so that the IP address requests are withheld, delayed, time windowed, reduced in frequency, aggregated or otherwise controlled. In some embodiments, such "IP address request control policies"" for one or more applications, OS functions, and/or other network service usage activities are set, updated, and/or modified before communicating it over a network connection to a network element (e.g., a service controller or another network element/function). In some embodiments, network service usage activities are generated/requested by applications, operating system (OS) functions, and/or other software/functions executed on a device in communication with the network. In some embodiments, it is desirable to apply a service usage control policy for the network service usage activities to protect network capacity (e.g., reduce network capacity demand). For example, some applications and/or OS functions have limited capabilities to defer certain traffic types based on fixed settings in the application, and such applications and/or OS functions typically cannot optimize network service usage activities based on a current network busy state (e.g., based on changing levels of network capacity and/or network performance available to the device). In some embodiments, the network busy state (e.g., or conversely the network availability state) is a characterization of the congestion (e.g., or conversely available capacity) of the network for one or more device connections. For example, the network busy state can provide a measure of how busy or congested the network or a network segment (e.g., network edge element) is for one or more device connections. As another example, network availability state can provide a measure of what network connection resources are available to one or more device connections. Thus, network busy state and network availability state can be viewed as converse ways of providing

similar information, and as described herein with respect to various embodiments, these terms can be used interchangeably.

**[0067]** In some embodiments, techniques are provided for assigning a priority to a network service usage activity and controlling traffic associated with the network services usage activity based on the assigned priority. In some embodiments, techniques are provided for a implementing a differentiated and dynamic background services classification, for example, as a function of network availability state and/or network busy state.

**[0068]** In some embodiments, a service usage control policy is used for assisting in network access control of network service usage activities (e.g., deferring some or all of the network capacity demand from these source activities). In some embodiments, some or all of the network capacity demand is satisfied at a point where the network resources or capacity are more available or less busy. In some embodiments, techniques are provided for classifying network service activities associated with one or more applications or OS functions to a background service class and differentially controlling the background service class traffic. In some embodiments, techniques are provided for classifying one or more network service activities associated with an application or OS function to a background service class, while other network service activities associated with that application or OS function are classified to other service classes (e.g., or to different background service class priority levels).

**[0069]** In some embodiments, techniques are provided for determining a network busy state (e.g., for a network edge element connection to a device, such as for a RAN for the device's current wireless network access and/or to the current base station/base station controller in wireless communication with the device). In some embodiments, techniques are provided for implementing a service usage control policy to differentially control network services traffic based on a network busy state for an activity, a group of activities, or for a service class.

**[0070]** In some embodiments, DAS for protecting network capacity includes monitoring a network service usage activity of the communications device in network communication; classifying the network service usage activity for differential network access control for protecting network capacity; and associating the network service usage activity with a network service usage control policy based on a classification of the network service usage activity to facilitate differential network access control for protecting network capacity.

**[0071]** In some embodiments, a network service usage activity is any activity by the device that includes wireless network communication. In some embodiments, an application, an operating system

(OS), and/or other device function generates a network service usage activity. In some embodiments, an application, an operating system (OS), and/or other device function generates one or more network service usage activities. Examples of a network service usage activity include the following: a voice connection (e.g., coded voice connection or voice over IP (VOIP) connection), a device application or widget connection, a device OS function connection, an email text connection, an email download connection, a file download connection, a streaming media connection, a location service connection, a map services connection, a software update (e.g., application, operating system, and/or antimalware software update) or firmware update connection, a device backup connection, an RSS feed connection, a website connection, a connection to a server, a web browser connection, an Internet connection for a device based service activity, establishing a sync service account, a user data synchronization service, a device data synchronization service, a network connection flow or stream, a socket connection, a TCP connection, a destination/port assigned connection, an IP connection, a UDP connection, an HTTP or HTTPS connection, a TLS connection, an SSL connection, a VPN connection, a general network services connection (e.g., establishing a PPP session, authenticating to the network, obtaining an IP address, DNS service), and various other types of connections via wireless network communication as will be apparent to one of ordinary skill in the art.

**[0072]** In some embodiments, a network service usage activity is classified, associated with, and/or assigned to a background class (e.g., a background service or QoS class) to facilitate differential network service usage control to protect network capacity. In some embodiments, differential network service usage control includes one or more of the following: monitoring network service usage activity; accounting for network service usage activity; reporting network service usage activity; generating a user notification for a network service usage activity; requesting a user preference for control of network service usage activity; accepting a user preference for network service usage activity; implementation of a network service usage activity policy (e.g., block/allow; traffic control techniques, such as throttle, delay, priority queue, time window, suspend, quarantine, kill, remove, and other well known traffic control techniques); implementing UI intercept procedures; generating a network busy state notification; generating a background class notification; generating a user notification for differential network service usage control of a network service usage activity; and various other techniques as described herein.

**[0073]** In some embodiments, a network availability state includes a state or measure of availability/capacity of a segment of a network (e.g., a last edge element of a wireless network). In some embodiments, a network busy state includes a state or measure of the network usage level or network congestion of a segment of a network (e.g., a last edge element of a wireless network). In some embodiments, network availability state and network busy state are inverse measures. As used herein

with respect to certain embodiments, network availability state and network busy state can be used interchangeably based on, for example, a design choice (e.g., designing to assign background policies based on a network busy state or a network availability state yields similar results, but they are different ways to characterize the network performance and/or capacity and/or congestion). In some embodiments, network availability state and network busy state are dynamic measures as such states change based on network usage activities (e.g., based on a time of day, availability/capacity level, congestion level, and/or performance level). In some embodiments, differential network service usage control of a network service usage activity is based on a network busy state or network availability state.

**[0074]** In some embodiments, certain network service usage activities are classified as background services. In some embodiments, lower priority and/or less critical (and/or based on various other criteria/measures) network service usage activities are classified as background services based on a network busy state and differentially controlled based on a network busy state to protect network capacity. In some embodiments, differential network service usage control policies are based on a time of day, a network busy state, background services and/or QoS class changes based on a time of day and/or a network busy state, a random back-off for access for certain network service usage activities, a deterministic schedule for certain network service usage activities, a time windowing in which network service usage control policies for one or more service activities or background/QoS classes changes based on time of day, network busy state, a service plan, and various other criteria, measures, and/or techniques as described herein.

**[0075]** In some embodiments, a network capacity controlled service or network capacity controlled services class includes one or more network services (e.g., background download services and/or various other types or categories of services as described herein) selected for differential network service usage control for protecting network capacity. In some embodiments, a network capacity controlled services classification includes one or more network services associated with a network capacity controlled service/class priority setting for differential network service usage control for protecting network capacity. In some embodiments, a network capacity controlled service or network capacity controlled services class includes one or more network services associated with a QoS class for differential network service usage control for protecting network capacity. In some embodiments, a network capacity controlled service or network capacity controlled services class includes one or more network services associated with a dynamic QoS class for differential network service usage control for protecting network capacity.

**[0076]** For example, differentially controlling network service usage activities based on network capacity controlled services or dynamic QoS or QoS classifications can protect network capacity by, for example, improving network performance, increasing network availability, reducing network resources demand, and/or reducing network capacity demand (e.g., based on an individual device, aggregate devices connected to an edge element, and/or aggregate devices connected to many edge elements). In some embodiments, differentially controlling network service usage activities based on network capacity controlled services or dynamic QoS or QoS classifications can protect network capacity while maintaining proper device operation. In some embodiments, differentially controlling network service usage activities based on network capacity controlled services or dynamic QoS or QoS classifications can protect network capacity while maintaining an acceptable user experience (e.g., proper and/or expected device operation, proper and/or software/application/OS/function operation, avoiding (whenever possible) significant adverse impact on device functions, and/or user notifications to keep the user informed of various differential control implemented on the device).

**[0077]** In some embodiments, dynamic QoS classifications include QoS classifications that can be dynamically modified (e.g., reclassified, reprioritized, upgraded, and/or downgraded) based on various criteria, measures, settings, and/or user input as described herein (e.g., based on a time of day and/or day of week, based on a network busy state, based on a user preference, and/or based on a service plan). In some embodiments, the various techniques described herein related to DAS for providing network capacity and/or QoS for DAS are applied to dynamic QoS related techniques.

**[0078]** As wireless networks, such as mobile networks, evolve towards higher bandwidth services, which can include or require, for example, various levels of Quality of Service (QoS) (e.g., conversational, interactive data, streaming data, and/or various (end-to-end) real-time services that may benefit from QoS), demands will increase for converged network services to facilitate such services for end-to-end services between networks (e.g., to allow for control and/or support for such services, for example, QoS support, across network boundaries, such as between wireless networks (such as various service provider networks) and IP networks (such as the Internet), and/or other networks). While various efforts have attempted to address such QoS needs, such as policy management frameworks for facilitating QoS end-to end solutions, there exists a need to facilitate various QoS requirements using Device Assisted Services (DAS).

**[0079]** Accordingly, Quality of Service (QoS) for Device Assisted Services (DAS) is provided. In some embodiments, QoS for DAS is provided.

**[0080]** To establish a QoS channel, differentiated services are typically available, in which one class/level of service has a higher priority than another to provide for differentiated services on a network, such as a wireless network. For example, in a wireless network, various network elements/functions can be provisioned and controlled to establish a single end or end to end QoS channel. In some embodiments, a centralized QoS policy coordination and decision function using DAS techniques to assist in coordinating the QoS channel setup and control among the various elements of a wireless network is provided.

**[0081]** In some embodiments, QoS channel refers to the logical communication channel connected to a device that provides a desired level of QoS service level. For example, the QoS channel can be created with one or more QoS links, in which each link represents a QoS enabled connection that spans a portion of the total end to end network communication path from a near end device to a far end device. For example, the far end device can be on the same network or on a different network, potentially with different access technology and/or a different access network carrier. In some embodiments, the QoS channel includes one or more QoS links in which each link in the channel is QoS enabled, or one or more of the links in the channel is QoS enabled and others are not. As an example, a QoS channel can include the following links: a first device traffic path link, a first device to access network equipment element link (e.g., 2G/3G/4G wireless base station, WiFi access point, cable network head end, DSLAM, fiber aggregation node, satellite aggregation node, or other network access point/node), a first carrier core network, a long haul IPX network, a second carrier core network, a second device to access network equipment element link, and a second device traffic path link as similarly described herein with respect to various embodiments.

**[0082]** In some embodiments, each of the links described above have the ability to provide QoS services for that segment of an overall QoS channel. In some embodiments, the device traffic path link and/or the device to access network equipment element link are QoS enabled, but the carrier core network and/or IPX network links are not QoS enabled. In some embodiments, the core network and/or IPX network have sufficient over-provisioning of bandwidth that QoS is not limited by these network elements and, for example, can be limited by the device traffic link and/or the device to access network equipment element link do not have sufficient excess bandwidth making it desirable to QoS enable these QoS channel links. A common example is a 2G/3G/4G wireless network in which a device traffic path link and the device to access network element link (e.g., Radio Access Bearer (RAB)) are QoS enabled while the carrier core network and IPX network links are not (e.g., are provided at a best effort service level or other service levels).

**[0083]** In some embodiments, a QoS session refers to the QoS enabled traffic for a given device that flows over a QoS channel or QoS link. This QoS traffic supports a QoS service activity. In some embodiments, a QoS service activity includes a device service usage that is requested, configured, or preferably serviced with a given level of QoS. In some embodiments, a device QoS activity is a combination of one or more of the following: application, destination, source, socket (e.g., IP address, protocol, and/or port), socket address (e.g., port number), URL or other similar service identifier, service provider, network type, traffic type, content type, network protocol, session type, QoS identifier, time of day, network capacity (e.g., network busy state), user service plan authorization or standing, roaming/home network status, and/or other criteria/measures as similarly described herein. For example, QoS service activities that are supported by QoS sessions can include VOIP traffic, streaming video traffic, differentiated access bandwidth during busy network periods, real-time interactive traffic, such as network connected multimedia meetings (e.g., shared presentations, picture, video, voice, and/or other such applications/services), best effort interactive, such as Internet browsing, time sensitive services, such as email message body delivery, near real-time interactive services, such as SMS or push to talk, background download services, such as email downloads and other file transfers (e.g., FTP), and/or truly background download services, such as software updates (e.g., OS or application software updates and/or antimalware updates including content/signature updates).

**[0084]** In some embodiments, various QoS levels or classes are supported. For example a conversation class can provide for real-time traffic, which is typically very delay sensitive but can tolerate bit errors and packet losses. The conversational class is typically used for Voice Over IP (VOIP) and video telephony, in which users of such services benefit from the short delay features of the conversational class. A streaming class is similar to the conversational class except that the streaming class typically can tolerate more delay than the conversational class. The streaming class is generally used for when one end of the connection is a user (e.g., human user) and the other end is a machine/computer (e.g., for streaming content applications, such as streaming of video, such as movies or other video content). An interactive class is generally intended for traffic that allows delay variation while requiring reasonably low response time (e.g., web browsing or other applications in which the channel can be unused for long periods of time but when a user makes a request for a new page/data, the response time should be reasonably low). A background class is generally used for lowest priority service usages (e.g., typically used for e-mail with and without downloads/attachments, application software updates, OS software updates, and/or other similar applications/functions). In some embodiments, various QoS classes or services are applicable to the conversational class. In some embodiments, various QoS classes or services are also applicable to the streaming class. In some embodiments, various QoS

classes or services are also applicable to the interactive class but typically not applicable to the background class. As will now be apparent to one of ordinary skill in the art, various other classes can be provided with lower or higher granularity based on service usage/channel requirements and/or network architectures.

**[0085]** In some embodiments, a QoS link or a QoS channel supports one QoS session. In some embodiments, a QoS link or a QoS channel supports multiple QoS sessions. In some embodiments, QoS link provisioning is provided to setup the QoS traffic level for a given QoS session or group of QoS sessions.

**[0086]** In some embodiments, a QoS channel is a single ended QoS channel or an end to end QoS channel. For example, if a QoS channel is end to end, then the QoS channel provisioning is accomplished in a coordinated manner for each QoS enabled link in the QoS channel. If a QoS channel is single ended, then the network elements and/or device participate in provisioning as much of one end of the QoS channel as possible, leaving provisioning of the QoS for the other end of the channel as the responsibility of the device and/or network elements that handle the traffic at the other end of the QoS channel. In some embodiments, a single ended QoS channel includes another single ended QoS channel at the other end. In some embodiments, only one end has single ended QoS channel enablement while the other end of the channel is a best effort service level, which, for example, can be used where one end of the QoS channel has tighter constraints on traffic capacity or quality than the other end (e.g., a VOIP call with one end that is QoS enabled on a 3G wireless network that has relatively tight bandwidth compared to a lightly loaded cable modem network device on the other end which may not need to be QoS enabled in order to achieve adequate voice quality).

**[0087]** In some embodiments, a QoS request (e.g., a QoS channel request or QoS service request) is a request for a QoS provisioning event to enable a QoS channel for one or more QoS service activities. In some embodiments, QoS availability assessment includes determining whether one or more of the links in a possible QoS channel are available (e.g., based on network capacity and transmission quality) to provision the necessary level of QoS for a requested QoS channel. In some embodiments, a QoS request is initiated by a device, a user, an application, and/or a network element/function as similarly described herein.

**[0088]** In some embodiments, a service plan refers to the collection of access service capabilities, QoS capabilities, and/or network capacity controlled services that are associated with a communications device. In some embodiments, the access service capabilities, QoS capabilities, and/or network capacity

controlled services are determined by the collection of access service control policies for the device. In some embodiments, these service control policies are implemented in the network equipment. In some embodiments, these access service control policies are implemented both in the device and in the network equipment. In some embodiments, these access service control policies are implemented in the device. In some embodiments, there are different levels of service control capabilities (e.g., policies) based on different levels of service plan payments or device standing or user standing. In some embodiments, there are different levels of service control policies based on network type, time of day, network busy status, and/or other criteria/measures as similarly described herein with respect to various embodiments. In some embodiments, the access control and QoS control policies are based on the type of service activity being sought. In some embodiments, the QoS level and access level available for a given service activity for a given device or user is determined by the policies associated with the service plan. In some embodiments, a QoS authorization assessment is performed to determine whether a device or user has sufficient service plan standing to allow the requested level of QoS.

**[0089]** In some embodiments, before a QoS channel or link is provisioned (or before a QoS request is responded to or filled), a QoS availability assessment is performed to determine whether sufficient communication channel resources are available to provision the necessary level of QoS for the QoS channel or link. In some embodiments, this QoS availability assessment is determined by assessing the available QoS capacity for one or more necessary QoS links in the channel. For example, the available QoS link capacity can be assessed for one or more of a device traffic path, a device to access network equipment element link, a core network link, and/or an IPX network link. If the QoS assessment shows that the necessary channel capacity and quality is available for the desired QoS level for one or more desired QoS service activities, then a QoS channel request or QoS service request can be granted. In some embodiments, a QoS link or QoS channel reservation process is provided to reserve QoS capacity and quality in advance of link or channel provisioning to ensure that the available QoS resources are not assigned between the time of QoS availability assessment and QoS channel provisioning.

**[0090]** In some embodiments, the QoS availability assessment is performed after QoS authorization assessment. This prevents the unnecessary exercising of network elements when the device or user does not have sufficient service plan standing to receive the desired level of QoS even if it is available. This can be an important screening function performed on the device in the service processor, or by a centralized network function such as the service controller (e.g., or interchangeably, the home agent; Home Location Register (HLR); Authentication, Authorization, and Accounting (AAA) server/gateway/function; base station; one of the gateways, policy and charging rules function (PCRF), or

other network element/function). In some embodiments, QoS availability is assessed without conducting a QoS authorization assessment or before receiving the response to a QoS authorization assessment.

**[0091]** In some embodiments, a QoS channel is provisioned to create the QoS channel to support a QoS session (e.g., a QoS service activity). In some embodiments, QoS channel provision includes assigning, routing, and/or otherwise causing the QoS session traffic to flow over one or more QoS links in the assigned QoS channel.

**[0092]** In some embodiments, device assisted service traffic control and QoS apply readily and directly to the problems of managing a QoS device link for QoS channel provisioning. Accordingly, in some embodiments, a service provider is provided to assist in provisioning the device portion of the QoS channel. In some embodiments, the service processor provisions the device link portion of the QoS channel by placing a higher priority on higher QoS level traffic. In some embodiments, this QoS priority is implemented in a number of ways, including routing the higher priority QoS traffic into first priority in the downstream and/or upstream traffic queues. Upstream traffic queuing is performed directly in some embodiments by transmitting guaranteed bit rate traffic first at higher available throttling rates, differentiated QoS traffic second with a controlled throttling rate, best effort traffic third with possibly lower controlled throttled rates, and/or background traffic fourth when/if bandwidth not needed by the higher levels of QoS traffic and at lower controlled throttling rates. For example, downstream traffic can be handled by queuing traffic and delaying or preventing TCP acknowledgements to be returned for the lower levels of QoS priority, while immediately passing the traffic and TCP acknowledgements for higher levels of QoS priority. The device link portion of the QoS channel is thus provisioned by assigning policies for the queuing priority, delay, throttle rate, and TCP acknowledgement return rate for device traffic in accordance with the bandwidth that is available at any point in time for the device. In some embodiments, various device service processor traffic control capabilities regulate or partially regulate QoS in accordance with a set of network policy instructions, including, in some embodiments, a service plan policy set.

**[0093]** In some embodiments the device service processor establishes multiple QoS channels through the device traffic path with each QoS channel having traffic control policies as described herein, with each QoS channel policy set creating a different class of QoS. In some embodiments, employing this multiple QoS channel approach, QoS for a given service activity is provided by routing the traffic for that QoS activity to the appropriate QoS channel with the appropriate QoS policy settings. The routing to the appropriate QoS channel can be provided using various techniques. For example, the routing can be provided by applying a common service traffic control policy set to traffic associated with all QoS service

activities that require or request the QoS provided by the common service traffic control policy set. The application of the service traffic control policy set can be accomplished in a number of ways utilizing the embodiments described for the policy implementation agent and the policy control agent described herein. In such embodiments, the problem of assigning a QoS channel to a number of QoS service activities is reduced to applying a pre-determined set of service traffic control policies to each of the QoS service activities, with each pre-determined set of service traffic control policies representing a different QoS class. The device can then manage the overall QoS for all traffic based on the available traffic capacity and quality, the total aggregate traffic demand for each QoS traffic class and the policy rules that determine how each traffic class is provided with differential bit rate and traffic quality as compared to the other traffic classes for a given level of available traffic capacity and quality.

**[0094]** Based on the aggregate demand for each traffic QoS class, and the traffic capacity and quality level available to the device, the service processor can adjust the total available bit rate or percentage of available traffic capacity for each QoS class. For example, in some embodiments, the aggregate demand for the real-time interactive traffic control class (e.g. services, such as VOIP, emergency communication services or high performance real-time competitive gaming) can be determined, and the QoS routing function on the device (e.g., a QoS router agent/function) can first allocate enough constant bit rate traffic capacity from the available traffic capacity to satisfy these services, with each QoS service activity that requires this QoS class being assigned to this QoS channel. As more QoS service activities require this traffic class, the capacity allocated to the QoS channel out of the available device capacity is increased, and when fewer QoS service activities require this traffic class the capacity for this QoS channel is released. In the event that the device does not have any more available capacity with a guaranteed bit rate QoS level, then additional QoS service activities that desire, require or request this QoS level will not be provided this QoS level, and instead will either be provided with a lower QoS level or will not be allowed to connect to the access network. In some embodiments, there can be a hierarchy among the possible QoS service activities so that if there is no more capacity available at a given service QoS level, then the available capacity for that QoS class is provided to the service activities requiring that QoS from highest priority to lowest, until the available QoS class capacity is consumed, and then one or more QoS service activities that are too low on the priority list to obtain service with that QoS class are either bumped to a lower QoS class or are denied access. In some embodiments, once the required capacity to satisfy the real-time constant rate traffic needs is satisfied, the remaining capacity available to the device is then divided among the other QoS channel classes in accordance with a priority policy, with the priority policy being based on the relative priority of each service class, the relative priority of each QoS service activity, or a combination of the relative priority of each QoS service class and each QoS service activity. For

example, these relative priority policies can vary from device to device based on service plan selection, device type, user standing, user group, device location, device network connection, type of network, time of day, network busy state, and/or other criteria/measures.

**[0095]** In some embodiments, a QoS link is established between the device and an access network equipment element. For example, such equipment element embodiments can include a 2G/3G/4G wireless base station, a wireless access point, a cable network head end, a DSL network DSLAM, a fiber network device traffic aggregator, a satellite network device traffic aggregator, a frame relay aggregation node, an ATM aggregation node, and/or other network equipment. In some embodiments, a logical communication channel is created between the device and the network equipment element, with the logical communication channel supporting a given level of QoS or QoS class traffic policy set. For example, the logical channel can include a RAB formed between a 2G/3G/4G base station and a wireless end point device. The RAB can be formed by controlling the media access control (MAC) parameters of the base station radio channel so that a given level of QoS class policies can be implemented. For example, the RAB can support constant bit rate, low latency communication traffic for guaranteed bit rate real-time traffic, or a differentiated high priority access channel for streaming traffic, or a best effort random access channel for best effort traffic, or an available unused capacity traffic for background traffic. The QoS channel link created in this manner can be dedicated to a single device, or shared with a subset of devices, or available to all devices. The QoS channel link created in this manner can be used by the device to support a single QoS activity as described herein, or a group of QoS activities as described herein. It will now be apparent to one of ordinary skill in the art that similar settings for cable head end and cable modem MAC can yield similar QoS classes for QoS links for the cable modem case and that similar techniques can be applied for a wireless access point or a satellite system MAC to achieve similar QoS classes for QoS links. It will also now be apparent to one of ordinary skill in the art that by creating multiple logical channels in the device link, and/or adjusting the available access network capacity and quality for each logical device communication channel in the DSLAM or fiber aggregator, similar QoS class QoS links can be established for the DSL and fiber distribution network cases.

**[0096]** In some embodiments the device service processor serves to route QoS service activities to the appropriate logical communication channel established for the desired QoS class supported by a QoS link between the device and the access network equipment element. In some embodiments, the device service processor elements (e.g., the policy implementation agent and/or the policy control agent) can be used in some embodiments to assign the same QoS traffic control policies to one or more QoS service activities that require the same QoS level. In a similar manner, in some embodiments, the device service processor elements can be used to assign or route service activity traffic for a given QoS class to the correct logical

communication channel between the device and the access network element (e.g., a 2G/3G/4G base station) that supports the traffic control policies for the desired QoS class. For example, a QoS service link that supports guaranteed bit rate and latency can be established with one or more RABs from a base station to the device, and a second QoS service link can be established that supports differentiated preferred access for streaming content using one or more differentiated access RABs, and a third best effort RAB can be used to support best effort traffic. Each of the required RABs is first requested and then provisioned as described herein based on the aggregate required capacity and quality for one or more QoS service activities that require or desire the specific QoS service class associated with the RAB logical channel policy parameters. Once the set of logical QoS channels is thus established, the service processor (e.g., QoS router agent/function) routes the traffic associated with each QoS service activity to the appropriate RAB. In some embodiments, the service processor can detect increases or decreases in aggregate QoS class demand for each QoS class as QoS activities are initiated or terminated for that QoS class, and the service processor can communicate the required increases or decreases in the RAB assignments required to support that logical QoS channel.

**[0097]** In some embodiments, the access QoS link is established by direct communication from the device in which the device requests the QoS channel or link from the access network equipment element, or the device requests the QoS channel or link from an intermediate networking device, such as a service controller (e.g., or a readily substituted device with similar features, such as a home agent, an HLR, a mobile switching center, a base station, an access gateway, a AAA system, PCRF, or a billing system). In some embodiments, the device service processor bases the QoS channel or link request on an association the device performs to match a QoS service activity with a desired or required QoS class or QoS traffic control policy set. For example, this association of QoS class or QoS traffic control policy set with QoS service activity can be determined by a predefined policy mapping that is stored on the device and used by the service processor. In some embodiments, this policy mapping store is populated and/or updated by a service controller (e.g., or similar function as described herein). In some embodiments, the mapping is determined by a service controller (e.g., or similar function as described herein) based on a report from the device of the QoS service activity that needs the QoS channel or link.

**[0098]** In some embodiments, the required or desired QoS level for one or more QoS service activities is determined by a set of QoS service traffic control policies that are pre-assigned to various QoS service activities. For example, a given application can be pre-assigned a QoS class. As another example, a web service destination such as a VOIP service site can be assigned a QoS class. As another example, a given application can have one QoS assignment level for general Internet traffic but have a QoS assignment for real-time gaming traffic. As another example, a real-time broadcasting website can have a best effort

QoS level assigned to programming information and general browsing and have a differentiated streaming QoS level for broadcast traffic content. In some embodiments, detection of QoS need or QoS assignment request for a given activity can be assigned by a device service processor according to a pre-defined QoS policy rules table (e.g., QoS activity table), or can be determined by a service controller based on information reported by the device, or can be requested by an application through a QoS application interface (e.g., QoS API), or can be determined by the nature of incoming traffic.

**[0099]** In embodiments, in which both end points in the QoS channel participate in establishing an end to end QoS channel, the required QoS level is determined and/or communicated by the originating end point. In some embodiments, the required QoS level is determined and/or communicated by the receiving end point. In some embodiments the QoS level is determined and/or communicated by the originating end point service controller (e.g., or the access network element (such as a base station), the HLR, home agent, mobile switching center, AAA, gateway, or other network element/function). In some embodiments, the QoS level is determined and/or communicated by the receiving end point service controller (e.g., or alternatively the access network element (such as a base station), the HLR, home agent, mobile switching center, AAA, gateway, or other network element/function). In some embodiments, the receiving end point service controller (e.g., or the access network element (such as a base station), the HLR, home agent, mobile switching center, AAA, gateway or other network function) and the originating end point service controller (e.g., or other similar function) communicate with one another to coordinate establishment of the QoS channel between the end points.

**[00100]** In some embodiments, the near end or originating end device service processor contacts the far end or terminating device service processor to initiate a QoS channel. In some embodiments, the initiation of the QoS channel from the near end or originating device is performed automatically by the far end device when its service processor detects that a given level of QoS is needed for the communication between the two devices. In some embodiments, the near end or originating device service processor detects the need for a QoS channel to the far end or terminating device and contacts a central network resources, such as the service controller (e.g., or other equipment element with similar function for this purpose), and the service controller provisions the far end of the QoS channel, either by communicating directly with the far end device or by communicating with the far end device's service controller (e.g., or other equipment element with similar function for this purpose). In some embodiments, in which the far end device service controller is contacted to assist in provisioning the QoS channel, there is a look up function to determine the address of the far end service controller based on a look up index formed from some aspect of the far end device credentials (e.g., phone number, SIM ID, MEID, IMSI, IP address, user name, and/or other device credentials).

**[00101]** In some embodiments, the mapping of QoS service activity to the desired level of QoS class or QoS traffic control policies is determined by providing a QoS API in the device service processor that applications use to request a QoS class or QoS channel connection. In some embodiments, an API is provided so that application developers can create application software that uses the standard interface commands to request and set up QoS channels. In some embodiments, the API does one or more of the following: accepts QoS requests from an application, formats the QoS channel request into a protocol appropriate for transmission to network equipment responsible for assessing QoS channel availability (e.g., including possibly the device traffic control system), coordinates with other network elements (e.g., including possibly the device traffic control system) to reserve a QoS channel, coordinates with other network elements (e.g., including possibly the device traffic control system) to provision a QoS channel, informs the application that the desired QoS channel can be created or not, and/or coordinates with other network elements (e.g., including possibly the device traffic control system) to connect the application with the desired QoS channel class. In some embodiments, the QoS API accepts the application QoS request and communicates and possibly coordinates with one or more QoS network equipment elements, such as a base station, cable head end or access point. In some embodiments, the QoS API accepts the QoS request from the application and communicate and possibly coordinates with an intermediate network element, such as a service processor (e.g., or other similar function as described herein). In some embodiments the QoS API assesses the QoS service plan standing for the device or user before sending QoS channel requests to other network elements, and only initiates the QoS request sequence if required service plan authorization is in place. In this manner, the potentially complex process of establishing a QoS channel with all the specific equipment communication protocols that typically need to be supported to assess QoS channel availability and provision the QoS channel are simplified into a limited set of API commands that are easy for an application development community to learn about and use for QoS differentiated services and applications.

**[00102]** In some embodiments, local traffic control on the device service processor is combined with traffic control in the link between the device and the access network equipment element. In this manner, both the device traffic control path QoS link and the device to access network element QoS link can be coordinated for best device QoS performance results given the available capacity and quality of the access network traffic for the device. In some embodiments, the policies for how the device manages local traffic control, establishes access network element logical channels (e.g., RABs) and routes traffic to and from the access network element logical channels is all determined by predefined policy rules loaded onto the device by the service controller (or other equivalent network element). In some embodiments, these policies are determined in the service controller itself.

**[00103]** In some embodiments, a QoS user interface (e.g., QoS UI) is presented to the device user. In some embodiments, the QoS UI notifies the user what level of QoS services the device is authorized to receive based on the service plan selection. In some embodiments, the QoS UI notifies the user what level of QoS services are available on the present network the device is connected to at the present time. In some embodiments, the QoS UI notifies the user when a level of QoS service that is higher than that authorized by the user service plan is required or desirable for a given service activity that the device has initiated. In some embodiments, the QoS UI provides the user with a set of one or more upgrade options to upgrade the service plan to include a higher level of QoS for one or more service activities. In some embodiments, the QoS UI provides the user with an opportunity to specify what level of QoS the user would like to employ for one or more service usage activities. In some embodiments, the QoS UI allows the user to specify a service plan setting that provides differentiated QoS during times when the network is busy. In some embodiments, the QoS UI allows the user to purchase one or more grades of service QoS with either a post-pay for a pre-defined service period and one or more pre-defined service usage limits by QoS class, a pre-pay for one or more pre-defined service usage limits by QoS class, or another payment system for differentiated QoS services. In some embodiments, the QoS UI provides the user with an opportunity to QoS enable or pay for QoS services for a connection that is initiated by an incoming connection to the device.

**[00104]** In some embodiments, QoS for DAS techniques include verifying that the device is properly implementing the QoS traffic control policies, for example, in accordance with a service plan. This ensures that errors, hacking, user device software settings manipulations, or other malware events do not result in inappropriate levels of QoS for a given device or group of devices. Accordingly, in some embodiments, the traffic control and QoS verification techniques described herein are employed to verify that the proper level of QoS is applied for a given service usage activity in accordance with a QoS priority policy. For example, verification of QoS channel request policy rules behavior can be implemented in a variety of ways including, as an example, monitoring device QoS channel requests and comparing the level of QoS requested with the level of QoS the device is authorized to receive in the service plan in effect for the device. Verification of proper QoS channel usage behavior by a device can be implemented in a variety of ways including, for example, monitoring network based reports of QoS service usage and comparing the network based reports against the service policy rules that should be in effect given the device service plan. Verification of proper device traffic control to implement a QoS service policy that is in effect can be accomplished in a variety of ways by verifying that the appropriate traffic control policy rules are being properly implemented as described herein. In some embodiments, DAS for protecting network capacity techniques include various verification techniques (e.g., verifying

monitoring, traffic controlling, reporting, and/or other functions implemented or performed by the device), as described herein.

**[00105]** In some embodiments, the QoS router prioritizes traffic on the device. In some embodiments, the QoS router connects the QoS enabled session to the RAB that has the proper QoS level. In some embodiments, one session is routed to the RAB. In some embodiments, more than one session can be routed to an RAB. In some embodiments, multiple RABs providing multiple QoS levels are created to the device, and the QoS router routes each service activity to the RAB dictated by the QoS policy rules in effect on the device.

**[00106]** In some embodiments, the network collects service usage charges for different QoS classes. In some embodiments, there is differentiated service charging for the different classes of QoS service usage. As an example, since guaranteed bit rate traffic consumes network resources whether the traffic capacity is used or not, there can be a time element involved in the charging calculations. As a more detailed example, guaranteed bit rate services can be charged by the total bandwidth provisioned to the device at a given time multiplied by the amount of time that that bandwidth is made available. In some embodiments, differentiated access traffic that has higher QoS than best effort traffic but is not guaranteed bit rate can be charged at a higher rate than best effort traffic but lower than guaranteed bit rate. In some embodiments, such traffic can be charged based on the time the QoS channel is made available and the total amount of data transmitted over the channel, or can only be based on the total amount of data transmitted over the channel. Best effort traffic is charged in some embodiments based only on the total amount of data used, with the data charges being less than differentiated streaming access services. Background data services in some embodiments are charged at the lowest rate, possibly with only certain times of the day or periods of low network traffic demand being available for such services, and with the service being based on total data transmitted. In some embodiments, all QoS service levels can be charged based on a fixed price for a fixed charging period, possibly with a service usage cap with additional charges if the service cap is exceeded. In such fixed price scenario embodiments, the price charged is again higher for higher levels of QoS. In some embodiments, the network collects service usage charges for different network capacity controlled service classes. In some embodiments, there is differentiated service charging for the different classes of network capacity controlled service usage, as described herein.

**[00107]** In some embodiments, the network equipment (e.g., access network element, gateways, AAA, service usage storage systems, home agent, HLR, mobile data center, and/or billing systems) record and report service usage for one or more of the QoS service classes used by the device. In some

embodiments, the device service processor records and reports service usage for one or more of the QoS service classes used by the device and reports the QoS service class usage to the service controller (e.g., or another substitute network element). In some embodiments, in which the device is recording reporting usage for one or more QoS service classes, it is important to verify the device service usage reports to ensure that the device usage reports are not distorted, tampered with, and/or otherwise in error. In some embodiments, verifying service usage reports against service usage that should be occurring given the service control policies in place on the device, service processor agent functional operation verification, test service usage events, agent query response sequences, device service processor software protection techniques, device service processor software environment checks, and several other techniques are provides as described herein. For example, using one or more of these verification techniques can provide a verifiable device assisted QoS service usage charging system. As another example, using one or more of these verification techniques can provide a verifiable network capacity controlled service usage charging system. In some embodiments, the network equipment (e.g., access network element, gateways, AAA, service usage storage systems, home agent, HLR, mobile data center, and/or billing systems) record and report service usage for one or more of the network capacity controlled service classes used by the device, as described herein.

**[00108]** In some embodiments, device assisted traffic control is provided for managing network congestion as follows. For example, when a given base station or group of base stations experience traffic demand that is high relative to the available capacity and/or service quality that can be provided, and such a condition is determined (e.g., detected or reported) based on a network busy state assessment as described below and further herein, then a service controller (e.g., or another network function) can issue, send, and/or implement traffic control throttling policies to/for the devices in accordance with a measure of the excess traffic demand the one or more base stations is experiencing. For example, the device service processors connected to an overly busy base station can be instructed to reduce the traffic control priority for one or more classes of QoS traffic, reducing the queuing priority, throttling rate, delay and/or access allowance for some or all of one or more classes of traffic. As another example, the device service processors connected to an overly busy base station can be instructed to reduce the traffic control priority for one or more classes of network capacity controlled services traffic, reducing the queuing priority, throttling rate, delay and/or access allowance for some or all of one or more classes of such traffic. As another example, one or more classes of network capacity controlled services traffic, such as background download processes, which can include, for example, software updates can be turned off completely or throttled back significantly. As another example, best effort traffic such as Internet browsing can be throttled or reduced for a group of devices connected to base stations experiencing

excess traffic demand. As another example, a policy can be implemented on the devices connected to busy base stations in which the device is allowed to browse or conduct other best effort service activities at a relatively high throttling rate for a period of time, but if the device uses more than a certain amount of service (e.g., total data downloaded and/or uploaded) in a certain period of time then the device may be traffic controlled according to an adaptive throttling policy as described herein. In some embodiments, higher QoS level traffic cannot be throttled in such circumstances, such as VOIP traffic where real-time guaranteed bit rate is important to meet user service needs or expectations, while lower priority traffic such as interactive browsing and/or background download are throttled and/or blocked. In some embodiments, the QoS availability assessment processes described herein are adjusted so that higher QoS channels are not provided and provisioned in times or locations in which a given base station or group of base stations experience excess demand or demand above a given threshold.

**[00109]** In some embodiments, users or devices that have service plans with higher QoS levels, or service plans with higher priority during busy network periods have different traffic control policies (e.g., for QoS services and/or network capacity controlled services) applied to them that result in a higher level of traffic performance and/or a higher level of QoS service availability. For example, emergency service workers can be given higher traffic control access policies that result in differentiated services during peak busy times on the network or a portion of the network. In some embodiments, users can obtain a premium service plan for differentiated access during peak busy time periods or may use higher levels of QoS service settings and/or service plans to achieve differentiated service during peak busy periods. As another example, services that demand high levels of QoS classes, such as real-time voice services, instant messaging, push to talk, differentiated video streaming, and/or interactive gaming, are not traffic controlled to the same extent that other lower priority services or lower class service plans are traffic controlled during peak busy times. For example, this type of service differentiation can also be applied based on device type, user group, user standing, user reward zone points, and/or other criteria/measures as similarly described herein.

**[00110]** In some embodiments, the decision to control (e.g., reduce, increase, and/or otherwise control in some manner) the access traffic control settings as described above is made by the device service processor based on the device's assessment of the network capacity, which can be determined using various techniques as described herein. In some embodiments, the decision to control the access traffic control settings as described above is made by a service controller (e.g., or other interchangeable network equipment element or elements as described herein) connected to the device that provides instructions to the device to adjust the access policy settings. For example, the service controller can obtain the network capacity information from access equipment elements, from device reports of traffic capacity and/or

quality as described herein, or from reports on traffic capacity and/or quality obtained from dedicated devices used for the purpose of assessing network capacity. In some embodiments, the decision to control the access traffic control settings as described above is based on the time of day, the day of week, or both to accommodate cyclical patterns in network capacity and traffic demand.

**[00111]** In some embodiments, a service controller (e.g., or another network equipment element or elements, as described herein) assesses network busy state and then controls device traffic demand by reducing the offered capacity for one or more service classes (e.g., for QoS services and/or network capacity controlled services) supported by the access network equipment elements, such as a wireless base station. In such embodiments, the service controller (e.g., or similar function) gathers the network capacity information with one of the techniques described herein and instructs one or more of the access network equipment elements to reduce the offered capacity for one or more levels of QoS classes and/or network capacity controlled service classes, to one or more of the devices connected to the access network equipment elements. For example, the determination of which devices to throttle back can be made based on an equal throttling of all devices of a given service plan status, or based on the device traffic usage patterns in the recent past as described herein, or based on a combination of service plan status and recent traffic usage patterns.

**[00112]** In some embodiments, the device is enabled with ambient services that have differentiated QoS services and/or network capacity controlled services as part of the ambient service offering. For example, ambient QoS techniques can be provided using the pre-assigned QoS policies for a given service activity set within the ambient service, or using an ambient service application that requests QoS through the QoS API. Other embodiments for providing QoS differentiated service activities within ambient service offerings will now be apparent to one of ordinary skill in the art. As another example, ambient network capacity controlled service techniques can be provided using the pre-assigned network capacity controlled policies for a given service activity set within the ambient service, monitoring and dynamically assigned techniques, and/or using an ambient service application that uses API or emulated API techniques, and/or other techniques as described herein.

**[00113]** In some embodiments, a QoS service control policy is adapted as a function of the type of network the device is connected to. For example, the QoS traffic control policies and/or the QoS service charging policies can be different when the device is connected to a wireless network (e.g., a 3G/4G network where there is in general less available QoS enabled traffic capacity) than when the device is connected to a wired network (e.g., a cable or DSL network where there is in general a higher level of QoS capacity available). In such embodiments, the device service processor and the service controller

can coordinate to adapt the QoS service control policies and/or the QoS service charging policies to be different depending on which network the device is connected to. Similarly, the device QoS service control policy and/or QoS service charging policy can also be adapted based on whether the device is connected to a home wireless network or a roaming wireless network. In some embodiments, a network capacity controlled service control policy and/or a network capacity controlled charging policy is adapted as a function of the type of network the device is connected to, as similarly described herein.

**[00114]** In some embodiments, various of the QoS related techniques and/or network capacity controlled services techniques described herein are performed on the device using DAS techniques and/or on the service controller in secure communication with a verified service processor executed on the device using DAS techniques. In some embodiments, various of the QoS related techniques and/or network capacity controlled services techniques described herein are performed by/in coordination/communication with one or more intermediate network elements/functions for assisting in various techniques (e.g., functions) for QoS techniques and/or network capacity controlled services techniques as described herein.

**[00115]** FIG. 1 illustrates a functional diagram of a network architecture for providing quality of service (QoS) for device assisted services (DAS) and/or for providing DAS for protecting network capacity in accordance with some embodiments. In some embodiments, QoS for DAS techniques described herein are implemented using the network architecture shown in FIG. 1. In some embodiments, DAS for protecting network capacity techniques described herein are implemented using the network architecture shown in FIG. 1.

**[00116]** As shown, FIG. 1 includes a 4G/3G/2G wireless network operated by, for example, a central provider. As shown, various wireless devices 100 are in communication with base stations 125 for wireless network communication with the wireless network (e.g., via a firewall 124), and other devices 100 are in communication with Wi-Fi Access Points (APs) or Mesh 702 for wireless communication to Wi-Fi Access CPE 704 in communication with central provider access network 109. In some embodiments, one or more of the devices 100 are in communication with other network element(s)/equipment that provides an access point, such as a cable network head end, a DSL network DSLAM, a fiber network aggregation node, and/or a satellite network aggregation node. In some embodiments, each of the wireless devices 100 includes a service processor 115 (as shown) (e.g., executed on a processor of the wireless device 100), and each service processor connects through a secure control plane link to a service controller 122 (e.g., using encrypted communications).

**[00117]** In some embodiments, service usage information includes network based service usage information (e.g., network based service usage measures or charging data records (CDRs), which can, for example, be generated by service usage measurement apparatus in the network equipment), which is obtained from one or more network elements (e.g., BTS/BSCs 125, RAN Gateways (not shown), Transport Gateways (not shown), Mobile Wireless Center/HLRs 132, AAA 121, Service Usage History/CDR Aggregation, Mediation, Feed 118, or other network equipment). In some embodiments, service usage information includes micro-CDRs. In some embodiments, micro-CDRs are used for CDR mediation or reconciliation that provides for service usage accounting on any device activity that is desired. In some embodiments, each device activity that is desired to be associated with a billing event is assigned a micro-CDR transaction code, and the service processor 115 is programmed to account for that activity associated with that transaction code. In some embodiments, the service processor 115 periodically reports (e.g., during each heartbeat or based on any other periodic, push, and/or pull communication technique(s)) micro-CDR usage measures to, for example, the service controller 122 or some other network element. In some embodiments, the service controller 122 reformats the heartbeat micro-CDR usage information into a valid CDR format (e.g., a CDR format that is used and can be processed by an SGSN or GGSN or other network elements/equipment used/authorized for generating or processing CDRs) and then transmits it to a network element/function for CDR mediation (e.g., CDR Storage, Aggregation, Mediation, Feed 118).

**[00118]** In some embodiments, CDR mediation is used to account for the micro-CDR service usage information by depositing it into an appropriate service usage account and deducting it from the user device bulk service usage account. For example, this technique provides for a flexible service usage billing solution that uses pre-existing solutions, infrastructures, and/or techniques for CDR mediation and billing. For example, the billing system (e.g., billing system 123 or billing interface 127) processes the mediated CDR feed from CDR mediation, applies the appropriate account billing codes to the aggregated micro-CDR information that was generated by the device, and then generates billing events in a manner that does not require changes to the existing billing systems (e.g., using new transaction codes to label the new device assisted billing capabilities). In some embodiments, network provisioning system 160 provisions various network elements/functions for authorization in the network, such as to authorize certain network elements/functions (e.g., CDR storage, aggregation, mediation, feed 118 or other network elements/functions) for providing micro-CDRs, reformatted micro-CDRs, and/or aggregated or reconciled CDRs.

**[00119]** As shown in FIG. 1, a CDR storage, aggregation, mediation, feed 118 is provided. In some embodiments, the CDR storage, aggregation, mediation, feed 118 receives, stores, aggregates and

mediates micro-CDRs received from mobile devices 100. In some embodiments, the CDR storage, aggregation, mediation, feed 118 also provides a settlement platform using the mediated micro-CDRs, as described herein. In some embodiments, another network element provides the settlement platform using aggregated and/or mediated micro-CDRs (e.g., central billing interface 127 and/or another network element/function).

**[00120]** In some embodiments, various techniques for partitioning of device groups are used for partitioning the mobile devices 100 (e.g., allocating a subset of mobile devices 100 for a distributor, an OEM, a MVNO, and/or another partner or entity). As shown in FIG. 1, a MVNO core network 210 includes a MVNO CDR storage, aggregation, mediation, feed 118, a MVNO billing interface 122, and a MVNO billing system 123 (and other network elements as shown in FIG. 1). In some embodiments, the MVNO CDR storage, aggregation, mediation, feed 118 receives, stores, aggregates and mediates micro-CDRs received from mobile devices 100 (e.g., MVNO group partitioned devices).

**[00121]** Those of ordinary skill in the art will appreciate that various other network architectures can be used for providing device group partitions and a settlement platform, and FIG. 1 is illustrative of just one such example network architecture for which device group partitions and settlement platform techniques described herein can be provided.

**[00122]** In some embodiments, CDR storage, aggregation, mediation, feed 118 (e.g., service usage 118, including a billing aggregation data store and rules engine) is a functional descriptor for, in some embodiments, a device/network level service usage information collection, aggregation, mediation, and reporting function located in one or more of the networking equipment apparatus/systems attached to one or more of the sub-networks shown in FIG. 1 (e.g., central provider access network 109 and/or central provider core network 110), which is in communication with the service controller 122 and a central billing interface 127. As shown in FIG. 1, service usage 118 provides a function in communication with the central provider core network 110. In some embodiments, the CDR storage, aggregation, mediation, feed 118 function is located elsewhere in the network or partially located in elsewhere or integrated with/as part of other network elements. In some embodiments, CDR storage, aggregation, mediation, feed 118 functionality is located or partially located in the AAA server 121 and/or the mobile wireless center/Home Location Register(HLR) 132 (as shown, in communication with a DNS/DHCP server 126). In some embodiments, service usage 118 functionality is located or partially located in the base station, base station controller and/or base station aggregator, collectively referred to as base station 125 in FIG. 1. In some embodiments, CDR storage, aggregation, mediation, feed 118 functionality is located or partially located in a networking component in the central provider access network 109, a networking

component in the core network 110, the central billing system 123, the central billing interface 127, and/or in another network component or function. This discussion on the possible locations for the network based and device based service usage information collection, aggregation, mediation, and reporting function (e.g., CDR storage, aggregation, mediation, feed 118) can be easily generalized as described herein and as shown in the other figures and embodiments described herein by one of ordinary skill in the art. Also, as shown in FIG. 1, the service controller 122 is in communication with the central billing interface 127 (e.g., sometimes referred to as the external billing management interface or billing communication interface), which is in communication with the central billing system 123. As shown in FIG. 1, an order management 180 and subscriber management 182 are also in communication with the central provider core network 110 for facilitating order and subscriber management of services for the devices 100 in accordance with some embodiments.

**[00123]** In some embodiments, a service processor download 170 is provided, which provides for periodical downloads/updates of service processors (e.g., service processor 115). In some embodiments, verification techniques include periodically updating, replacing, and/or updating an obfuscated version of the service processor, or performing any of these techniques in response to an indication of a potential compromise or tampering of any service processor functionality (e.g., QoS functionality and/or network capacity controlled services functionality) executed on or implemented on the device 100.

**[00124]** In some embodiments, the CDR storage, aggregation, mediation, feed 118 (and/or other network elements or combinations of network elements) provides a device/network level service usage information collection, aggregation, mediation, and reporting function. In some embodiments, the CDR storage, aggregation, mediation, feed 118 (and/or other network elements or combinations of network elements) collects device generated/assisted service usage information (e.g., micro-CDRs) for one or more devices on the wireless network (e.g., devices 100); and provides the device generated service usage information in a syntax and a communication protocol that can be used by the wireless network to augment or replace network generated usage information for the one or more devices on the wireless network. In some embodiments, the syntax is a charging data record (CDR), and the communication protocol is selected from one or more of the following: 3GPP, 3GPP2, or other communication protocols. In some embodiments, as described herein, the CDR storage, aggregation, mediation, feed 118 collects/receives micro-CDRs for one or more devices on the wireless network (e.g., devices 100). In some embodiments, the CDR storage, aggregation, mediation, feed 118 (e.g., or other network elements and/or various combinations of network elements) includes a service usage data store (e.g., a billing aggregator) and a rules engine for aggregating the collected device generated service usage information. In some embodiments, the network device is a CDR feed aggregator, and the CDR storage, aggregation,

mediation, feed 118 (and/or other network elements or combinations of network elements) also aggregates (network based) CDRs and/or micro-CDRs for the one or more devices on the wireless network; applies a set of rules to the aggregated CDRs and/or micro-CDRs using a rules engine (e.g., bill by account, transactional billing, revenue sharing model, and/or any other billing or other rules for service usage information collection, aggregation, mediation, and reporting), and communicates a new set of CDRs for the one or more devices on the wireless network to a billing interface or a billing system (e.g., providing a CDR with a billing offset by account/service). In some embodiments, a revenue sharing platform is provided using various techniques described herein. In some embodiments, QoS usage accounting/charging and/or network capacity controlled services usage accounting/charging is provided using various techniques described herein.

**[00125]** In some embodiments, the CDR storage, aggregation, mediation, feed 118 (and/or other network elements or combinations of network elements) communicates a new set of CDRs (e.g., aggregated and mediated CDRs and/or micro-CDRs that are then translated into standard CDRs for a given wireless network) for the one or more devices on the wireless network to a billing interface (e.g., central billing interface 127) or a billing system (e.g., central billing system 123). In some embodiments, the CDR storage, aggregation, mediation, feed 118 (and/or other network elements or combinations of network elements) communicates with a service controller (e.g., service controller 122) to collect the device generated service usage information (e.g., micro-CDRs) for the one or more devices on the wireless network. In some embodiments, the CDR storage, aggregation, mediation, feed 118 (and/or other network elements or combinations of network elements) communicates with a service controller, in which the service controller is in communication with a billing interface or a billing system. In some embodiments, the CDR storage, aggregation, mediation, feed 118 (and/or other network elements or combinations of network elements) communicates the device generated service usage information to a billing interface or a billing system. In some embodiments, the CDR storage, aggregation, mediation, feed 118 (and/or other network elements or combinations of network elements) communicates with a transport gateway and/or a Radio Access Network (RAN) gateway to collect the network generated/based service usage information for the one or more devices on the wireless network. In some embodiments, the service controller 122 communicates the device assisted service usage information (e.g., micro-CDRs) to the CDR storage, aggregation, mediation, feed 118 (e.g., or other network elements and/or various combinations of network elements).

**[00126]** In some embodiments, the CDR storage, aggregation, mediation, feed 118 (e.g., or other network elements and/or various combinations of network elements) performs rules for performing a bill by account aggregation and mediation function. In some embodiments, the CDR storage, aggregation,

mediation, feed 118 (and/or other network elements or combinations of network elements) performs rules for performing a service billing function, as described herein, and/or for performing a service/transactional revenue sharing function, as described herein. In some embodiments, the service controller 122 in communication with the CDR storage, aggregation, mediation, feed 118 (and/or other network elements or combinations of network elements) performs a rules engine for aggregating and mediating the device assisted service usage information (e.g., micro-CDRs). In some embodiments, a rules engine device in communication with the CDR storage, aggregation, mediation, feed 118 (e.g., or other network elements and/or various combinations of network elements) performs a rules engine for aggregating and mediating the device assisted service usage information (e.g., QOS service usage information and/or network capacity controlled services usage information).

**[00127]** In some embodiments, the rules engine is included in (e.g., integrated with/part of) the CDR storage, aggregation, mediation, feed 118. In some embodiments, the rules engine and associated functions, as described herein, is a separate function/device. In some embodiments, the service controller 122 performs some or all of these rules engine based functions, as described herein, and communicates with the central billing interface 127. In some embodiments, the service controller 122 performs some or all of these rules engine based functions, as described herein, and communicates with the central billing system 123.

**[00128]** In some embodiments, a settlement platform service is provided. For example, micro-CDRs can be aggregated and mediated to associate service usage for one or more services used by a communications device (e.g., a user of the communications device). A rules engine or another function can determine a revenue share allocation for the service usage for a particular service to determine the settlement for such service usage for the revenue sharing allocation/model and to distribute accounting and settlement information to one or more of carriers, distribution partners, MVNOs, wholesale partners, and/or other partners or entities. In some embodiments, the service is a transactional service.

**[00129]** In some embodiments, duplicate CDRs are sent from the network equipment to the billing system 123 that is used for generating service billing. In some embodiments, duplicate CDRs are filtered to send only those CDRs/records for devices controlled by the service controller and/or service processor (e.g., managed devices). For example, this approach can provide for the same level of reporting, lower level of reporting, and/or higher level of reporting as compared to the reporting required by the central billing system 123.

**[00130]** In some embodiments, a bill-by-account billing offset is provided. For example, bill-by-account billing offset information can be informed to the central billing system 123 by providing a CDR aggregator feed that aggregates the device assisted service usage data feed to provide a new set of CDRs for the managed devices to the central billing interface 127 and/or the central billing system 123. In some embodiments, transaction billing is provided using similar techniques. For example, transaction billing log information can be provided to the central billing interface 127 and/or the central billing system 123.

**[00131]** In some embodiments, the rules engine (e.g., performed by the service usage 118 or another network element, as described herein) provides a bill-by-account billing offset. For example, device assisted service usage information (e.g., micro-CDRs) includes a transaction type field or transaction code (e.g., indicating a type of service for the associated service usage information). For example, the rules engine can apply a rule or a set of rules based on the identified service associated with the device generated service usage information to determine a bill-by-account billing offset (e.g., a new CDR can be generated to provide the determined bill-by-account billing offset). In some examples, the determined bill-by-account billing offset can be provided as a credit to the user's service usage account (e.g., a new CDR can be generated with a negative offset for the user's service usage account, such as for network chatter service usage, or transactional service usage, or for any other purposes based on one or more rules performed by the rules engine).

**[00132]** As another example, for a transactional service, a first new CDR can be generated with a negative offset for the user's service usage account for that transactional service related usage, and a second new CDR can be generated with a positive service usage value to charge that same service usage to the transactional service provider (e.g., Amazon, eBay, or another transactional service provider). In some embodiments, the service controller 122 generates these two new CDRs, and the service usage 118 stores, aggregates, and communicates these two new CDRs to the central billing interface 127. In some embodiments, the service controller 122 generates these two new CDRs, and the service usage 118 stores, aggregates, and communicates these two new CDRs to the central billing interface 127, in which the central billing interface 127 applies rules (e.g., performs the rules engine for determining the bill-by-account billing offset).

**[00133]** In some embodiments, the service controller 122 sends the device generated CDRs to the rules engine (e.g., a service usage data store and rules engine, such as CDR storage, aggregation, mediation, feed 118), and the rules engine applies one or more rules, such as those described herein and/or any other billing/service usage related rules as would be apparent to one of ordinary skill in the art. In some embodiments, the service controller 122 generates CDRs similar to other network elements, and the rules

(e.g., bill-by-account) are performed in the central billing interface 127. For example, for the service controller 122 to generate CDRs similar to other network elements, in some embodiments, the service controller 122 is provisioned on the wireless network (e.g., by network provision system 160) and behaves substantially similar to other CDR generators on the network).

**[00134]** In some embodiments, the service controller 122 is provisioned as a new type of networking function that is recognized as a valid, authorized, and secure source for CDRs by the other necessary elements in the network (e.g., CDR storage, aggregation, mediation, feed 118). In some embodiments, if the necessary network apparatus only recognize CDRs from certain types of networking equipment (e.g. a RAN gateway or transport gateway), then the service controller 122 provides authentication credentials to the other networking equipment that indicate that it is one of the approved types of equipment for providing CDRs. In some embodiments, the link between the service controller 122 and the necessary CDR aggregation and mediation equipment is secured, authenticated, encrypted, and/or signed.

**[00135]** In some embodiments, the CDR storage, aggregation, mediation, feed 118 discards the network based service usage information (e.g., network based CDRs) received from one or more network elements. In these embodiments, the service controller 122 provides the device assisted service usage information (e.g., device based CDRs or micro-CDRs) to the CDR storage, aggregation, mediation, feed 118 (e.g., the CDR storage, aggregation, mediation, feed 118 can just provide a store, aggregate, and communication function(s), as it is not required to mediate network based CDRs and device assisted CDRs), and the device based service usage information is provided to the central billing interface 127 or the central billing system 123.

**[00136]** In some embodiments, the device based CDRs (e.g., micro-CDRs) and/or new CDRs generated based on execution of a rules engine as described herein are provided only for devices that are managed and/or based on device group, service plan, or any other criteria, categorization, and/or grouping, such as based on ambient service or ambient service provider or transactional service or transactional service provider.

**[00137]** In some embodiments, QoS for DAS includes a service processor (e.g., any device assisted element/function) that facilitates coordination for and/or provisions wireless access/radio access bearers (e.g., RABs). In some embodiments, the service processor determines whether a request for QoS is authorized (e.g., according to QoS service level, user standing, available local network capacity (e.g., as reported by other device(s) and/or network)). In some embodiments, device QoS capacity demand reports provide and/or augment network capacity demand reports.

**[00138]** In some embodiments, QoS for DAS includes a service controller (e.g., any network device based service control element/function) that facilitates coordination for and/or provisions wireless access/radio access bearers (e.g., RABs) on a device (e.g., a communications device, such as a mobile wireless communications device and/or an intermediate networking device), on network, and/or on device plus network. In some embodiments, the service controller provides device QoS capacity demand reports to other network equipment/elements/functions, and then also provisions the RAB channel based on various criteria and determinations.

**[00139]** In some embodiments, QoS for DAS provides for device assisted monitoring, information, and/or functionality to facilitate QoS without and/or to assist network based monitoring, information, and/or functionality (e.g., Deep Packet Inspection (DPI) and/or provides such monitoring, information, and/or functionality that may not be available via network based monitoring, information, and/or functionality (e.g., encrypted activities on the device may not be accessible by DPI or other network based techniques). For example, QoS for DAS can assist in the QoS setup to facilitate the QoS setup and provide such information that may not otherwise be available using network based only techniques. For example, device assisted activity and/or service monitoring techniques can assist in classifying the QoS for the monitored activity and/or service using, for example, a QoS activity map (e.g., as described herein or other similar techniques). For example, using such device assisted techniques eliminates and/or minimizes DPI or other network based techniques that can give rise to privacy concerns/issues, network neutrality concerns/issues, and/or otherwise may not be able to provide similar or equivalent granular service/activity monitoring, as discussed above, and/or also off loads such processing from the network (e.g., network elements/devices/functionality) to the communications devices (e.g., at least for such communications devices that can perform such functions, based on their processing and/or memory capabilities, as would be apparent to one of ordinary skill in the art). In some embodiments, QoS for DAS includes the service provider for providing an initial authorization/clearance for a QoS request (e.g., using various techniques described herein), and the service controller determines if the QoS request should be authorized (e.g., based on various QoS authorization/clearance/approval criteria (e.g., QoS activity maps and/or QoS request rule) and/or network capacity, as described herein). In some embodiments, QoS for DAS includes the service provider for providing a QoS request including a QoS class to the service controller, and the service controller determines if the QoS request should be authorized, as described herein. In some embodiments, DAS for protecting network capacity provides for device assisted monitoring, information, and/or functionality to facilitate protecting network capacity without and/or to assist network based monitoring, information, and/or functionality (e.g., Deep Packet Inspection (DPI) and/or provides such monitoring, information, and/or functionality that may not be

available via network based monitoring, information, and/or functionality (e.g., encrypted activities on the device may not be accessible by DPI or other network based techniques). In some embodiments, DAS for protecting network capacity provides for device assisted monitoring, information, and/or functionality to facilitate protecting network capacity without solely relying upon DPI and/or without any use or any significant use of DPI wireless network, which conserves network resources and network capacity by controlling device network access behavior at the device instead of deep in the core network at a DPI gateway (e.g., DPI based techniques consume over the air wireless network capacity even if chatty device behavior is blocked at a DPI gateway, in contrast, DAS for protecting network capacity techniques that do not use DPI based techniques for controlling device service usage can, for example, providing a device based usage notification and service selection UI that does not consume over the air wireless network capacity).

**[00140]** In some embodiments, QoS for DAS and/or DAS for protecting network capacity includes providing or facilitating reports for base station (BTS) for network capacity (e.g., sector, channel, busy state information or network capacity usage/availability, and/or network capacity expected demand) based on, for example, one or more of the following: monitored application usage on the communications device, monitored user activity on the communications device, location of the communications, other available networks, and/or other monitored or determined activity, service usage measure, and/or metric. In some embodiments, at or after execution of an application that is determined to require network service usage (e.g., may require increased wireless network bandwidth, such as based on a service usage activity map), QoS for DAS sends information to the network (e.g., a network controller or other network device element/function) that capacity demand is forthcoming for the communications device (e.g., potentially initiating a provisioning of a QoS radio access bearer (RAB) or other type of RAB).

**[00141]** In some embodiments, network capacity (e.g., busy state information) is collected from one or more communications devices in communication with a wireless network (e.g., network capacity/usage information measured from each respective communications device's perspective is determined and stored by the service processor on each respective communications device) and reported to the service controller, and the service controller (e.g., or another network element/function) uses this information to determine what resources are available for allocation to various levels of QoS (e.g., to respond to/facilitate various QoS requests) and/or to workload balance across multiple base stations and/or networks (e.g., wired networks, cellular, Wi-Fi, and/or other wireless networks).

**[00142]** In some embodiments, the service processor executed on the communications device sends a QoS request (e.g., a wireless network bearer channel reservation request or Radio Access Bearer (RAB)

request) to the service controller. The service controller verifies the request using various verification techniques as described herein. In some embodiments, the service controller facilitates coordination of various device QoS requests with one or more base stations (BTSs) in communication with the communications device to provide for the requested QoS reservation to facilitate the new QoS session. In some embodiments, the service controller provides a QoS routing function by, for example, providing various QoS routing instructions to a device service processor (e.g., aggregating, prioritizing, queuing, authorizing, allocating reservations/RABs, denying, re-routing (such as to other BTSs and/or other networks) and/or otherwise managing QoS requests), in which the BTS may or may not be QoS aware. For example, QoS priority can be based on activity (e.g., service usage and/or application), service level, user standing, network capacity, time of day, and/or QoS priority can be purchased on a transaction basis, a session basis, a pre-pay basis or a plan basis. As another example, QoS priority can also vary by device type, user within a group, group, application type, content type, or any other criteria or measure and/or any combination thereof. In some embodiments, the service controller also facilitates coordination of various device QoS requests with other network elements/functions for QoS implementation and management to provide for an end to end QoS solution.

**[00143]** In some embodiments, QoS can be symmetric for two mobile devices or asymmetric. In some embodiments, QoS resource availability can be from communications devices, BTS(s), other network functions (e.g., service control, service controller and/or any other network elements/functions) or any combination thereof. In some embodiments, the service controller provides QoS demand information to another network element/function. In some embodiments, the service controller provides the central aggregator and policy decision point (PDP). In some embodiments, the service controller controls (e.g., at least in part) QoS related functions for communications devices, BTS(s), and/or a combination of both.

**[00144]** In some embodiments, charging (e.g., monitoring and/or determining associating charging or billing) for QoS service usage/transactions and/or network capacity controlled services usage/transactions is determined using various techniques described herein. For example, the service processor can assist in charging for QoS and/or network capacity controlled activities. In some embodiments, the service processor uses device assisted Charging Data Records (CDRs) or micro-CDRs to assist in charging for QoS and/or network capacity controlled activities (e.g., using QoS class related transaction codes and/or network capacity controlled related transaction codes), as described herein with respect to various embodiments. In some embodiments, charging for QoS and/or network capacity controlled services is performed in whole or in part by one or more network elements/functions (e.g., service controller, SGSN/GGSN/other gateways, and/or billing interfaces/servers).

**[00145]** In some embodiments, service usage information includes network based service usage information. In some embodiments, the network based service usage information includes network based CDRs. In some embodiments, service usage information includes device based service usage information. In some embodiments, device based service usage information includes device assisted CDRs, also referred to herein as micro-CDRs, as described herein. In some embodiments, micro-CDRs are used for CDR mediation or reconciliation that provides for service usage accounting on any device activity that is desired (e.g., providing granular service usage information, such as based on application layer service usage monitoring, transaction service usage monitoring, QoS activities/sessions/transactions, network capacity controlled activities/sessions/transactions, and/or other types of service usage information). In some embodiments, each device includes a service processor (e.g., a service processor executed on a processor of a communications device, such as a mobile device or an intermediate networking device that can communicate with a wireless network).

**[00146]** In some embodiments, each device activity that is desired to be associated with a billing event (e.g., for a QoS related billing event) is assigned a micro-CDR transaction code, and the service processor is programmed to account for that activity associated with that transaction code (e.g., various transaction codes can be associated with service usage associated with certain services, applications, and/or based on QoS classes or priorities, respectively, which can be used for providing granular service usage for these various Internet/network based services/sites/transactions and/or any other Internet/network based services/sites, which can include transactional based services). For example, using these techniques, as described herein, essentially any type of device activity (e.g., including QoS classes and prioritization and/or network capacity controlled classes and prioritization) can be individually accounted for and/or controlled (e.g., throttled, restricted, and/or otherwise controlled as desired). In some embodiments, the service processor periodically reports (e.g., during each heartbeat or based on any other periodic, push, and/or pull communication technique(s)) micro-CDR usage measures to, for example, a service controller or some other network element/function. In some embodiments, the service controller reformats the heartbeat micro-CDR usage information into a valid CDR format (e.g., a CDR format that is used and can be processed by an SGSN or GGSN or some other authorized network element/function for CDRs) and then transmits the reformatted micro-CDRs to a network element/function for performing CDR mediation.

**[00147]** In some embodiments, CDR mediation is used to properly account for the micro-CDR service usage information by depositing it into an appropriate service usage account and deducting it from the user device bulk service usage account. For example, this technique provides for a flexible service usage billing solution that uses pre-existing solutions for CDR mediation and billing. For example, the billing

system can process the mediated CDR feed from CDR mediation, apply the appropriate account billing codes to the aggregated micro-CDR information that was generated by the device, and then generate billing events in a manner that does not require changes to existing billing systems, infrastructures, and techniques (e.g., using new transaction codes to label the new device assisted billing capabilities).

**[00148]** In some embodiments, the various QoS techniques performed on or by the communications device (e.g., using a service processor to provide or assist in providing QoS session provisioning, QoS policy management, QoS policy enforcement, and/or QoS accounting/charging, such as QoS charging records and reports) are verified (e.g., using various verification techniques described herein). In some embodiments, the various network capacity controlled services techniques performed on or by the communications device (e.g., using a service processor to provide or assist in providing network capacity controlled services policy management, network capacity controlled services policy enforcement, and/or network capacity controlled services charging, such as network capacity controlled services charging records and reports) are verified (e.g., using various verification techniques described herein).

**[00149]** For example, a QoS request, QoS related policy rules (e.g., QoS activity map, QoS related service plan and/or service policy settings) and implementation, QoS policy enforcement, and QoS charging are verified (e.g., periodically, per transaction, and/or based on some other criteria/metric). In some embodiments, verification techniques include one or more of the following: compare a network based service usage measure with a first service policy associated with the communications device, compare a device assisted service usage measure with the first service policy, compare the network based service usage measure to the device assisted service usage measure, perform a test and confirm a device assisted service usage measure based on the test, perform a User Interface (UI) notification (e.g., which can include a user authentication, password, question/answer challenge, and/or other authentication technique), and/or other similar verification techniques as will now be apparent to one of ordinary skill in the art. Accordingly, in some embodiments, QoS for DAS "closes the loop" for verification of various QoS related techniques, such as QoS requests, QoS grants, QoS usage, and/or QoS charging. In some embodiments, the service processor and the service controller serve as a verifiable QoS management/coordination system for other QoS elements/functions in network. In some embodiments, if such or other verification techniques determine or assist in determining that a QoS request, QoS report, and/or QoS policy behavior (e.g., or similarly, network capacity controlled services monitoring, reporting, and/or policy behavior) does not match expected requests, reports, and/or policy, then responsive actions can be performed, for example, the communications device (e.g., and/or suspect services) can be suspended, quarantined, killed/terminated, and/or flagged for further analysis/scrutiny to determine

whether the device is malfunctioning, needs updating, has been tampered with or compromised, is infected with malware, and/or if any other problem exists.

**[00150]** In some embodiments, the communications device (e.g., the service processor) maintains a QoS flow table that associates or maps device activity to QoS level/class to RAB/QoS channel, and in some embodiments, the communications device also informs a QoS management network function/element of the relative priority of the QoS flows for the communications device (e.g., based on or using the QoS flow table). In some embodiments, the service controller receives or collects information from the communications device and maintains such a QoS flow table for the communications device and, in some embodiments, the service controller also informs a QoS management network function/element of the relative priority of the QoS flows for the communications device (e.g., based on or using the QoS flow table). In some embodiments, flows can be assigned to activities originating at the communications device in a transparent way, or simply by activity class or user preference, or using other techniques.

**[00151]** In some embodiments, the communications device maintains a table of QoS billing rates, scheduled transmission times, and/other QoS related information to implement an overlay MAC at the data networking level to manage QoS on legacy networks that are not QoS MAC enabled and/or do not have the various functionality to support QoS controls (e.g., and such techniques can also be used to provide for QoS functionality across different networks). In some embodiments, QoS related policies are exchanged between roaming and home service controllers to facilitate QoS support while roaming on a non-home network(s).

**[00152]** In some embodiments, the communications device serves as a network capacity indicator (e.g., collecting network capacity information for a local cell and communicating or reporting that network capacity information to the service controller). For example, permanent local cell communications devices can be placed in local cell areas to augment legacy equipment for such network capacity indicator/reporting functions. Various other techniques for determining network capacity and/or network availability are described herein.

**[00153]** In some embodiments, service partners and/or service providers can subsidize in whole or in part to upgrade a given user or group of users to better QoS related service level agreement(SLA)/class for a preferred destination. In some embodiments, based on monitored service usage and/or other monitored behavior of the communications device, such subsidized QoS upgrade/offers can be presented to a user of the communications device (e.g., as an incentive/reward for desired or preferred user behavior

or for other reasons). Similarly, in some embodiments, these techniques are also applied to network capacity controlled services.

**[00154]** In some embodiments, QoS charging is based on QoS channel/reservation, service flow, or RAB charging (e.g., single flow per RAB, multi-flow per RAB, multi-RAB per flow). In some embodiments, charging (e.g., for QoS and/or for network capacity controlled services) is based on one or more of the following: network busy state, time criteria, user service class request, traffic volume and class, time and class, network capacity (e.g., network busy state) and class, time of day and class, location, traffic type, application type, application class, destination, destination type, partner service, and/or other criteria/measures. In some embodiments, QoS charging is verified using the various verification techniques described herein (e.g., test charging events). In some embodiments, network capacity controlled services charging is verified using the various verification techniques described herein (e.g., test charging events). In some embodiments, QoS charging is by data usage (e.g., by Megabyte (MB)), service flow by time by QoS class, speed by time, network busy state, time of day/day of week, service plan, current network, and/or other criteria/measures. In some embodiments, network capacity controlled services charging is by data usage (e.g., by Megabyte (MB)), service flow by time by network capacity controlled services class, speed by time, network busy state, time of day/day of week, service plan, current network, and/or other criteria/measures.

**[00155]** In some embodiments, QoS for DAS includes coordinating functions with one or more of the following: DAS elements/functions, Radio Access Network (RAN), Transport network, Core network, GRX network, IPX network, and/or other networks/elements/functions.

**[00156]** FIG. 2 illustrates another functional diagram of another network architecture for providing quality of service (QoS) for device assisted services (DAS) and/or for providing DAS for protecting network capacity in accordance with some embodiments. In some embodiments, QoS for DAS techniques described herein are implemented using the network architecture shown in FIG. 2. In some embodiments, DAS for protecting network capacity techniques described herein are implemented using the network architecture shown in FIG. 2.

**[00157]** As shown, FIG. 2 includes various devices 100 including service processors 115. For example, devices 100 can include various types of mobile devices, such as phones, PDAs, computing devices, laptops, net books, tablets, cameras, music/media players, GPS devices, networked appliances, and any other networked device; and/or devices 100 can include various types of intermediate networking devices,

as described herein. The devices 100 are in communication with service control 210 and central provider access and core networks 220. Service policies and accounting functions 230 are also provided in communication with the central provider access and core networks 220. For example, devices 100 can communicate via the central provider access and core networks 220 to the Internet 120 for access to various Internet sites/services 240 (e.g., Google sites/services, Yahoo sites/services, Blackberry services, Apple iTunes and AppStore, Amazon.com, FaceBook, and/or any other Internet service or other network facilitated service).

**[00158]** In some embodiments, FIG. 2 provides a wireless network architecture that supports various DAS for protecting network capacity techniques as described herein. Those of ordinary skill in the art will appreciate that various other network architectures can be used for providing various DAS for protecting network capacity techniques as described herein, and FIG. 2 is illustrative of just another such example network architecture for which DAS for protecting network capacity techniques as described herein can be provided.

**[00159]** FIG. 3 illustrates another functional diagram of an architecture 300 including a device based service processor 115 and a service controller 122 for providing quality of service (QoS) for device assisted services (DAS) and/or for providing DAS for protecting network capacity in accordance with some embodiments. In some embodiments, QoS for DAS techniques described herein are implemented using the functions/elements shown in FIG. 3. In some embodiments, DAS for protecting network capacity techniques described herein are implemented using the functions/elements shown in FIG. 3.

**[00160]** For example, the architecture 300 provides a relatively full featured device based service processor implementation and service controller implementation. As shown, this corresponds to a networking configuration in which the service controller 122 is connected to the Internet 120 and not directly to the access network 1610. As shown, a data plane (e.g., service traffic plane) communication path is shown in solid line connections and control plane (e.g., service control plane) communication path is shown in dashed line connections. As will be apparent to one of ordinary skill in the art, the division in functionality between one device agent and another is based on, for example, design choices, networking environments, devices and/or services/applications, and various different combinations can be used in various different implementations. For example, the functional lines can be re-drawn in any way that the product designers see fit. As shown, this includes certain divisions and functional breakouts for device agents as an illustrative implementation, although other, potentially more complex, embodiments can include different divisions and functional breakouts for device agent functionality specifications, for example, in order to manage development specification and testing complexity and workflow. In

addition, the placement of the agents that operate, interact with or monitor the data path can be moved or re-ordered in various embodiments. For example, the functional elements shown in FIG. 3 are described below with respect to, for example, FIGS. 4, 12, and 13 as well as FIGS. 5 through 11 (e.g., QoS for DAS related embodiments) and FIGS. 14 through 23 (e.g., DAS for protecting network capacity related embodiments).

**[00161]** As shown in FIG. 3, service processor 115 includes a service control device link 1691. For example, as device based service control techniques involving supervision across a network become more sophisticated, it becomes increasingly important to have an efficient and flexible control plane communication link between the device agents and the network elements communicating with, controlling, monitoring, or verifying service policy. In some embodiments, the service control device link 1691 provides the device side of a system for transmission and reception of service agent to/from network element functions. In some embodiments, the traffic efficiency of this link is enhanced by buffering and framing multiple agent messages in the transmissions. In some embodiments, the traffic efficiency is further improved by controlling the transmission frequency or linking the transmission frequency to the rate of service usage or traffic usage. In some embodiments, one or more levels of security or encryption are used to make the link robust to discovery, eavesdropping or compromise. In some embodiments, the service control device link 1691 also provides the communications link and heartbeat timing for the agent heartbeat function. As discussed below, various embodiments disclosed herein for the service control device link 1691 provide an efficient and secure solution for transmitting and receiving service policy implementation, control, monitoring and verification information with other network elements.

**[00162]** As shown in FIG. 3, the service controller 122 includes a service control server link 1638. In some embodiments, device based service control techniques involving supervision across a network (e.g., on the control plane) are more sophisticated, and for such it is increasingly important to have an efficient and flexible control plane communication link between the device agents (e.g., of the service processor 115) and the network elements (e.g., of the service controller 122) communicating with, controlling, monitoring, or verifying service policy. For example, the communication link between the service control server link 1638 of service controller 122 and the service control device link 1691 of the service processor 115 can provide an efficient and flexible control plane communication link, a service control link 1653 as shown in FIG. 3, and, in some embodiments, this control plane communication link provides for a secure (e.g., encrypted) communications link for providing secure, bidirectional communications between the service processor 115 and the service controller 122. In some embodiments, the service control server link 1638 provides the network side of a system for transmission and reception of service agent to/from network element functions. In some embodiments, the traffic efficiency of this link is enhanced by

buffering and framing multiple agent messages in the transmissions (e.g., thereby reducing network chatter). In some embodiments, the traffic efficiency is further improved by controlling the transmission frequency and/or linking the transmission frequency to the rate of service usage or traffic usage. In some embodiments, one or more levels of security and/or encryption are used to secure the link against potential discovery, eavesdropping or compromise of communications on the link. In some embodiments, the service control server link 1638 also provides the communications link and heartbeat timing for the agent heartbeat function.

**[00163]** In some embodiments, the service control server link 1638 provides for securing, signing, encrypting and/or otherwise protecting the communications before sending such communications over the service control link 1653. For example, the service control server link 1638 can send to the transport layer or directly to the link layer for transmission. In another example, the service control server link 1638 further secures the communications with transport layer encryption, such as TCP TLS or another secure transport layer protocol. As another example, the service control server link 1638 can encrypt at the link layer, such as using IPSEC, various possible VPN services, other forms of IP layer encryption and/or another link layer encryption technique.

**[00164]** As shown in FIG. 3, the service controller 122 includes an access control integrity server 1654 (e.g., service policy security server). In some embodiments, the access control integrity server 1654 collects device information on service policy, service usage, agent configuration, and/or agent behavior. For example, the access control integrity server 1654 can cross check this information to identify integrity breaches in the service policy implementation and control system. In another example, the access control integrity server 1654 can initiate action when a service policy violation (e.g., QoS policy violation and/or a network capacity controlled services policy violation) or a system integrity breach is suspected.

**[00165]** In some embodiments, the access control integrity server 1654 (and/or some other agent of service controller 122) acts on access control integrity agent 1694 (e.g., service policy security agent) reports and error conditions. Many of the access control integrity agent 1654 checks can be accomplished by the server. For example, the access control integrity agent 1654 checks include one or more of the following: service usage measure against usage range consistent with policies (e.g., usage measure from the network and/or from the device); configuration of agents; operation of the agents; and/or dynamic agent download.

**[00166]** In some embodiments, the access control integrity server 1654 (and/or some other agent of service controller 122) verifies device service policy implementations by comparing various service usage

measures (e.g., based on network monitored information, such as by using IPDRs or CDRs, and/or local service usage monitoring information) against expected service usage behavior given the policies that are intended to be in place (e.g., a QoS policy and/or a network capacity controlled services policy). For example, device service policy implementations can include measuring total QoS data passed, QoS data passed in a period of time, IP addresses, data per IP address, and/or other measures such as location, downloads, email accessed, URLs, and comparing such measures expected service usage behavior given the policies that are intended to be in place.

**[00167]** In some embodiments, the access control integrity server 1654 (e.g., and/or some other agent of service controller 122) verifies device service policy, and the verification error conditions that can indicate a mismatch in QoS service measure and QoS service policy include one or more of the following: unauthorized network access (e.g., access beyond ambient service policy limits); unauthorized network speed (e.g., average speed beyond service policy limit); network data amount does not match QoS policy limit (e.g., device not stop at limit without re-up/revising service policy); unauthorized network address; unauthorized service usage (e.g., VOIP, email, and/or web browsing); unauthorized application usage (e.g., email, VOIP, email, and/or web); service usage rate too high for plan, and policy controller not controlling/throttling it down; and/or any other mismatch in service measure and service policy. Accordingly, in some embodiments, the access control integrity server 1654 (and/or some other agent of service controller 122) provides a policy/service control integrity service to continually (e.g., periodically and/or based on trigger events) verify that the service control of the device has not been compromised and/or is not behaving out of policy (e.g., a QoS policy and/or a network capacity controlled services policy).

**[00168]** As shown in FIG. 3, service controller 122 includes a service history server 1650 (e.g., charging server). In some embodiments, the service history server 1650 collects and records service usage or service activity reports from the Access Network AAA Server 1621 and the Service Monitor Agent 1696. For example, although service usage history from the network elements can in certain embodiments be less detailed than service history from the device, the service history from the network can provide a valuable source for verification of device service policy implementation, because, for example, it is extremely difficult for a device error or compromise event on the device to compromise the network based equipment and software. For example, service history reports from the device can include various service tracking information, as similarly described above. In some embodiments, the service history server 1650 provides the service history on request to other servers and/or one or more agents. In some embodiments, the service history server 1650 provides the service usage history to the device service history 1618 (e.g., CDR feed and CDR mediation). In some embodiments, for purposes of facilitating the

activation tracking service functions (described below), the service history server 1650 maintains a history of which networks the device has connected to. For example, this network activity summary can include a summary of the networks accessed, activity versus time per connection, and/or traffic versus time per connection. As another example, this activity summary can further be analyzed or reported to estimate the type of service plan associated with the traffic activity for the purpose of bill sharing reconciliation.

**[00169]** As shown in FIG. 3, service controller 122 includes a policy management server 1652 (e.g., policy decision point (PDP) server) for managing service usage policies, such as QoS policies and/or a network capacity controlled services policies. In some embodiments, the policy management server 1652 transmits policies to the service processor 115 via the service control link 1653. In some embodiments, the policy management server 1652 manages policy settings on the device (e.g., various policy settings as described herein with respect to various embodiments) in accordance with a device service profile. In some embodiments, the policy management server 1652 sets instantaneous policies on policy implementation agents (e.g., policy implementation agent 1690). For example, the policy management server 1652 can issue policy settings, monitor service usage and, if necessary, modify policy settings. For example, in the case of a user who prefers for the network to manage their service usage costs, or in the case of any adaptive policy management needs, the policy management server 1652 can maintain a relatively high frequency of communication with the device to collect traffic and/or service measures and issue new policy settings. In this example, device monitored service measures and any user service policy preference changes are reported, periodically and/or based on various triggers/events/requests, to the policy management server 1652. In this example, user privacy settings generally require secure communication with the network (e.g., a secure service control link 1653), such as with the policy management server 1652, to ensure that various aspects of user privacy are properly maintained during such configuration requests/policy settings transmitted over the network. For example, information can be compartmentalized to service policy management and not communicated to other databases used for CRM for maintaining user privacy.

**[00170]** In some embodiments, the policy management server 1652 provides adaptive policy management on the device. For example, the policy management server 1652 can issue policy settings and objectives and rely on the device based policy management (e.g., service processor 115) for some or all of the policy adaptation. This approach can require less interaction with the device thereby reducing network chatter on the service control link 1653 for purposes of device policy management (e.g., network chatter is reduced relative to various server/network based policy management approaches described above). This approach can also provide robust user privacy embodiments by allowing the user to

configure the device policy for user privacy preferences/settings so that, for example, sensitive information (e.g., geo-location data, website history, and/or other sensitive information) is not communicated to the network without the user's approval. In some embodiments, the policy management server 1652 adjusts service policy based on time of day. In some embodiments, the policy management server 1652 receives, requests, and/or otherwise obtains a measure of network availability/capacity and adjusts traffic shaping policy and/or other policy settings based on available network availability/capacity (e.g., a network busy state).

**[00171]** As shown in FIG. 3, service controller 122 includes a network traffic analysis server 1656. In some embodiments, the network traffic analysis server 1656 collects/receives service usage history for devices and/or groups of devices and analyzes the service usage. In some embodiments, the network traffic analysis server 1656 presents service usage statistics in various formats to identify improvements in network service quality and/or service profitability. In some embodiments, the network traffic analysis server 1656 estimates the service quality and/or service usage for the network under variable settings on potential service policies. In some embodiments, the network traffic analysis server 1656 identifies actual or potential service behaviors by one or more devices that are causing problems for overall network service quality or service cost. In some embodiments, the network traffic analysis server 1656 estimates the network availability/capacity for the network under variable settings on potential service policies. In some embodiments, the network traffic analysis server 1656 identifies actual or potential service behaviors by one or more devices that are impacting and/or causing problems for overall network availability/capacity.

**[00172]** As shown in FIG. 3, Service Analysis, Test & Download 122B includes a beta test server 1658 (e.g., policy creation point and beta test server). In some embodiments, the beta test server 1658 publishes candidate service plan policy settings to one or more devices. In some embodiments, the beta test server 1658 provides summary reports of network service usage or user feedback information for one or more candidate service plan policy settings. In some embodiments, the beta test server 1658 provides a mechanism to compare the beta test results for different candidate service plan policy settings or select the optimum candidates for further policy settings optimization, such as for protecting network capacity.

**[00173]** As shown in FIG. 3, service controller 122 includes a service download control server 1660 (e.g., a service software download control server). In some embodiments, the service download control server 1660 provides a download function to install and/or update service software elements (e.g., the service processor 115 and/or agents/components of the service processor 115) on the device, as described herein.

**[00174]** As shown in FIG. 3 service controller 122 includes a billing event server 1662 (e.g., micro-CDR server). In some embodiments, the billing event server 1662 collects billing events, provides service plan information to the service processor 115, provides service usage updates to the service processor 115, serves as interface between device and central billing server 1619, and/or provides trusted third party function for certain ecommerce billing transactions.

**[00175]** As shown in FIG. 3, the Access Network HLR AAA server 1621 is in network communication with the access network 1610. In some embodiments, the Access Network AAA server 1621 provides the necessary access network AAA services (e.g., access control and authorization functions for the device access layer) to allow the devices onto the central provider access network and the service provider network. In some embodiments, another layer of access control is required for the device to gain access to other networks, such as the Internet, a corporate network and/or a machine to machine network. This additional layer of access control can be implemented, for example, by the service processor 115 on the device. In some embodiments, the Access Network AAA server 1621 also provides the ability to suspend service for a device and resume service for a device based on communications received from the service controller 122. In some embodiments, the Access Network AAA server 1621 also provides the ability to direct routing for device traffic to a quarantine network or to restrict or limit network access when a device quarantine condition is invoked. In some embodiments, the Access Network AAA server 1621 also records and reports device network service usage (e.g., device network service usage can be reported to the device service history 1618).

**[00176]** As shown in FIG. 3, the device service history 1618 is in network communication with the access network 1610. In some embodiments, the device service history 1618 provides service usage data records used for various purposes in various embodiments. In some embodiments, the device service history 1618 is used to assist in verifying service policy implementation. In some embodiments, the device service history 1618 is used to verify service monitoring. In some embodiments, the device service history 1618 is used to verify billing records and/or billing policy implementation (e.g., to verify service usage charging). In some embodiments, the device service history 1618 is used to synchronize and/or verify the local service usage counter (e.g., to verify service usage accounting).

**[00177]** As shown in FIG. 3, the central billing 1619 (e.g., central provider billing server) is in network communication with the access network 1610. In some embodiments, the central provider billing server 1619 provides a mediation function for central provider billing events. For example, the central provider billing server 1619 can accept service plan changes. In some embodiments, the central provider billing server 1619 provides updates on device service usage, service plan limits and/or service policies. In some

embodiments, the central provider billing server 1619 collects billing events, formulates bills, bills service users, provides certain billing event data and service plan information to the service controller 122 and/or device 100.

**[00178]** As shown in FIG. 3, in some embodiments, modem selection and control 1811 (e.g., in communication with connection manager 1804 as shown) selects the access network connection and is in communication with the modem firewall 1655, and modem drivers 1831, 1815, 1814, 1813, 1812 convert data traffic into modem bus traffic for one or more modems and are in communication with the modem selection and control 1811. In some embodiments, different profiles are selected based on the selected network connection (e.g., different service profiles/policies for WWAN, WLAN, WPAN, Ethernet and/or DSL network connections), which is also referred to herein as multimode profile setting. For example, service profile settings can be based on the actual access network (e.g., home DSL/cable or work network) behind the Wi-Fi not the fact that it is Wi-Fi (e.g., or any other network, such as DSL/cable, satellite, or T-1), which is viewed as different than accessing a Wi-Fi network at the coffee shop. For example, in a Wi-Fi hotspot situation in which there are a significant number of users on a DSL or T-1 backhaul, the service controller can sit in a service provider cloud or an MVNO cloud, the service controls can be provided by a VSP capability offered by the service provider or the service controller can be owned by the hotspot service provider that uses the service controller on their own without any association with an access network service provider. For example, the service processors can be controlled by the service controller to divide up the available bandwidth at the hotspot according to QoS or user sharing rules (e.g., with some users having higher differentiated priority (e.g., potentially for higher service payments) than other users). As another example, ambient services (e.g., as similarly described herein) can be provided for the hotspot for verified service processors.

**[00179]** In some embodiments, the service processor 115 and service controller 122 are capable of assigning multiple service profiles associated with multiple service plans that the user chooses individually or in combination as a package. For example, a device 100 starts with ambient services that include free transaction services wherein the user pays for transactions or events rather than the basic service (e.g., a news service, eReader, PND service, pay as you go session Internet) in which each service is supported with a bill by account capability to correctly account for any subsidized partner billing to provide the transaction services (e.g., Barnes and Noble may pay for the eReader service and offer a revenue share to the service provider for any book or magazine transactions purchased from the device 100). In some embodiments, the bill by account service can also track the transactions and, in some embodiments, advertisements for the purpose of revenue sharing, all using the service monitoring capabilities disclosed herein. After initiating services with the free ambient service discussed above, the

user may later choose a post-pay monthly Internet, email, and SMS service. In this case, the service controller 122 would obtain from the billing system 123 in the case of network based billing (e.g., or the service controller 122 billing event server 1622 in the case of device based billing) the billing plan code for the new Internet, email and SMS service. In some embodiments, this code is cross referenced in a database (e.g., the policy management server 1652) to find the appropriate service profile for the new service in combination with the initial ambient service. The new superset service profile is then applied so that the user maintains free access to the ambient services, and the billing partners continue to subsidize those services, the user also gets access to Internet services and may choose the service control profile (e.g., from one of the embodiments disclosed herein). The superset profile is the profile that provides the combined capabilities of two or more service profiles when the profiles are applied to the same device 100 service processor. In some embodiments, the device 100 (service processor 115) can determine the superset profile rather than the service controller 122 when more than one "stackable" service is selected by the user or otherwise applied to the device. The flexibility of the service processor 115 and service controller 122 embodiments described herein allow for a large variety of service profiles to be defined and applied individually or as a superset to achieve the desired device 100 service features.

**[00180]** As shown in FIG. 3, an agent communication bus 1630 represents a functional description for providing communication for the various service processor 115 agents and functions. In some embodiments, as represented in the functional diagram illustrated in FIG. 3, the architecture of the bus is generally multipoint to multipoint so that any agent can communicate with any other agent, the service controller or in some cases other components of the device, such user interface 1697 and/or modem components. As described below, the architecture can also be point to point for certain agents or communication transactions, or point to multipoint within the agent framework so that all agent communication can be concentrated, or secured, or controlled, or restricted, or logged or reported. In some embodiments, the agent communication bus is secured, signed, encrypted, hidden, partitioned, and/or otherwise protected from unauthorized monitoring or usage. In some embodiments, an application interface agent (not shown) is used to literally tag or virtually tag application layer traffic so that the policy implementation agent(s) 1690 has the necessary information to implement selected traffic shaping solutions. In some embodiments, an application interface agent (not shown) is in communication with various applications, including a TCP application 1604, an IP application 1605, and a voice application 1602.

**[00181]** As shown in FIG. 3, service processor 115 includes an API and OS stack interface 1693. In some embodiments, the API and OS stack interface 1693 provides the QoS API functionality as similarly described herein with respect to various embodiments. In some embodiments, a QoS API is used to

report back QoS availability to applications. In some embodiments, the API and OS stack interface 1693 provides the network capacity controlled API and/or emulated API functionality as similarly described herein with respect to various embodiments. As shown, service processor 115 also includes a router 1698 (e.g., a QoS router agent/function and/or a network capacity controlled services router agent/function) and a policy decision point (PDP) agent 1692. In some embodiments, the router 1698 provides QoS router functionality as similarly described herein with respect to various embodiments. In some embodiments, the router 1698 provides network capacity controlled services router functionality as similarly described herein with respect to various embodiments. In some embodiments, the QoS router supports multiple QoS channels (e.g., one or more provisioned/allocated QoS links forming a QoS channel between the device and the desired end point, such as an access point/BTS/gateway/network for a single ended QoS channel or other communication device for an end to end QoS channel, depending on the QoS connection/network support/availability/etc.). In some embodiments, the QoS router supports multiple QoS channels, which can each have different QoS classes/levels. In some embodiments, the QoS router routes application/service usage traffic to an appropriate QoS channel. In some embodiments, the QoS router determines the routing/mapping based on, for example, one or more of the following: a QoS API request, a QoS activity map, a user request, a service plan, a service profile, service policy settings, network capacity, service controller or other intermediate QoS network element/function/device, and/or any other criteria/measure, as similarly described herein with respect to various embodiments. In some embodiments, multiple different applications/services are routed to a particular QoS channel using various techniques described herein. In some embodiments, different applications/services are routed to different QoS channels using various techniques described herein. In some embodiments, the QoS router assists in managing and/or optimizing QoS usage for the communications device. In some embodiments, the QoS router assists in managing and/or optimizing QoS usage across multiple communications devices (e.g., based on network capacity for a given cell area/base station or other access point). In some embodiments, PDP agent 1692 provides the PDP agent functionality as similarly described herein with respect to various embodiments. As shown, architecture 300 also includes a suspend resume interface 320, network QoS provisioning interfaces 330 (e.g., for providing the various QoS techniques described herein), and an activation/suspend resume server 340 and billing interface server 350 in the service controller 122A.

**[00182]** In some embodiments, device assisted services (DAS) techniques for providing an activity map for classifying or categorizing service usage activities to associate various monitored activities (e.g., by URL, by network domain, by website, by network traffic type, by application or application type, and/or any other service usage activity categorization/classification) with associated IP addresses are provided.

In some embodiments, a policy control agent (not shown), service monitor agent 1696 (e.g., charging agent), or another agent or function (or combinations thereof) of the service processor 115 provides a DAS activity map. In some embodiments, a policy control agent (not shown), service monitor agent, or another agent or function (or combinations thereof) of the service processor provides an activity map for classifying or categorizing service usage activities to associate various monitored activities (e.g., by Uniform Resource Locator (URL), by network domain, by website, by network traffic type, by socket (such as by IP address, protocol, and/or port), by socket id (such as port address/number), by port number, by content type, by application or application type, and/or any other service usage activity classification/categorization) with associated IP addresses and/or other criteria/measures. In some embodiments, a policy control agent, service monitor agent, or another agent or function (or combinations thereof) of the service processor determines the associated IP addresses for monitored service usage activities using various techniques to snoop the DNS request(s) (e.g., by performing such snooping techniques on the device 100 the associated IP addresses can be determined without the need for a network request for a reverse DNS lookup). In some embodiments, a policy control agent, service monitor agent, or another agent or function (or combinations thereof) of the service processor records and reports IP addresses or includes a DNS lookup function to report IP addresses or IP addresses and associated URLs for monitored service usage activities. For example, a policy control agent, service monitor agent, or another agent or function (or combinations thereof) of the service processor can determine the associated IP addresses for monitored service usage activities using various techniques to perform a DNS lookup function (e.g., using a local DNS cache on the monitored device 100). In some embodiments, one or more of these techniques are used to dynamically build and maintain a DAS activity map that maps, for example, URLs to IP addresses, applications to IP addresses, content types to IP addresses, and/or any other categorization/classification to IP addresses as applicable. In some embodiments, the DAS activity map is used for various DAS traffic control and/or throttling techniques as described herein with respect to various embodiments for providing QoS for DAS and/or for providing DAS for protecting network capacity. In some embodiments, the DAS activity map is used to provide the user various UI related information and notification techniques related to service usage as described herein with respect to various embodiments. In some embodiments, the DAS activity map is used to provide service usage monitoring, prediction/estimation of future service usage, service usage billing (e.g., bill by account and/or any other service usage/billing categorization techniques), DAS techniques for ambient services usage monitoring, DAS techniques for generating micro-CDRs, and/or any of the various other DAS related techniques as described herein with respect to various embodiments.

**[00183]** In some embodiments, all or a portion of the service processor 115 functions disclosed herein are implemented in software. In some embodiments, all or a portion of the service processor 115 functions are implemented in hardware. In some embodiments, all or substantially all of the service processor 115 functionality (e.g., as discussed herein) is implemented and stored in software that can be performed on (e.g., executed by) various components in device 100. In some embodiments, it is advantageous to store or implement certain portions or all of service processor 115 in protected or secure memory so that other undesired programs (e.g., and/or unauthorized users) have difficulty accessing the functions or software in service processor 115. In some embodiments, service processor 115, at least in part, is implemented in and/or stored on secure non-volatile memory (e.g., non volatile memory can be secure non-volatile memory) that is not accessible without pass keys and/or other security mechanisms (e.g., security credentials). In some embodiments, the ability to load at least a portion of service processor 115 software into protected non-volatile memory also requires a secure key and/or signature and/or requires that the service processor 115 software components being loaded into non-volatile memory are also securely encrypted and appropriately signed by an authority that is trusted by a secure software downloader function, such as service downloader 1663 as shown in FIG. 3. In some embodiments, a secure software download embodiment also uses a secure non-volatile memory. Those of ordinary skill in the art will also appreciate that all memory can be on-chip, off-chip, on-board, and/or off-board.

**[00184]** FIGS. 4A through 4C illustrates a functional diagram for providing quality of service (QoS) for device assisted services (DAS) in accordance with some embodiments. In some embodiments, QoS for DAS techniques described herein are implemented using the network architecture shown in FIGS. 4A through 4C.

**[00185]** Referring to FIG. 4A, in some embodiments, QoS functionality is performed at the communications device 100 using service processor 115 as similarly described herein. For example, the service processor 115 determines whether or not a QoS request is authorized (e.g., based on the associated service plan and/or other criteria/measures). If the QoS request is authorized, then the service processor 115 communicates with the base station (BTS) 125 to send the QoS request (e.g., a RAB or multi-RAB reservation request) to the local BTS. The BTS determines whether to accept or deny the QoS request (e.g., based on network capacity, such as using a first come first service QoS/network bandwidth or best effort access policy or other techniques, and/or other criteria/measures). The BTS responds to the QoS request accordingly. If the QoS request is granted, the QoS session can be initiated as similarly described herein. In some embodiments, the service processor 115 also performs various QoS charging functions using various techniques described herein, and the service processor 115 periodically sends QoS charging

records or reports to the service controller 122 (e.g., and/or another network element/function). In some embodiments, the service processor 115 and the QoS related functions performed by the service processor 115 are periodically verified using the various techniques described herein.

**[00186]** Referring to FIG. 4B, FIG. 4B is similar to FIG. 4A except that the service controller 122 is also shown to be in communication with the service processor 115 of the communications device 100, which can provide for the download and periodically updating of the QoS rules and/or other service plan/profile/policy information that can include QoS related information. In some embodiments, the service processor 115 also performs various QoS charging functions using various techniques described herein, and the service processor 115 periodically sends QoS charging records or reports to the service controller 122 (e.g., and/or another network element/function). In some embodiments, the service processor 115 and the QoS related functions performed by the service processor 115 are periodically verified using the various techniques described herein.

**[00187]** Referring to FIG. 4C, at 410, the service processor 115 sends a QoS request to the service controller 122 (e.g., the service processor can also (at least in part) determine whether the QoS request is authorized as similarly described with respect to FIG. 4A). At 420, the service controller 122 sends the QoS request to the BTS 125 if it is determined that the QoS request is authorized using various techniques described herein and/or whether the BTS 125 has network capacity for the QoS request. For example, the service controller can provide a central policy decision point function for QoS related activities (e.g., based on QoS prioritization, network capacity, and/or other criteria/measures/policies). At 430, the service controller 122 communicates the response to the QoS request accordingly. At 440, if the QoS request was approved, the device 100 initiates the QoS session (e.g., using a RAB or multi-RAB reservation) via the BTS 125. In some embodiments, the service processor 115 also performs various QoS charging functions using various techniques described herein, and the service processor 115 periodically sends QoS charging records or reports to the service controller 122 (e.g., and/or another network element/function). In some embodiments, the service processor 115 and the QoS related functions performed by the service processor 115 are periodically verified using the various techniques described herein.

**[00188]** In some embodiments, QoS techniques as described herein are implemented in the device (e.g., using the service processor 115) and one or more other network elements/functions, such as the BTS 125, service controller 125, RAN, SGSN/GGSN/other gateways and/or other network elements/functions, in which various of the QoS related functions can be distributed or allocated to such network elements/functions based on various design/network architecture approaches as will now be apparent to

one of ordinary skill in the art, in which QoS related activities and/or functions at the device 100 are verified using various verification techniques described herein.

**[00189]** In some embodiments, the device determines QoS availability by directly querying QoS link reservation equipment in the network (e.g., an access point, such as the BTS 125). In some embodiments, the device determines QoS availability based on an intermediate network function that coordinates QoS requests with one or more network QoS link resources. In some embodiments, the device requests a QoS reservation in advance of QoS link establishment with one or more QoS network link resources. In some embodiments, in response to a QoS request, a QoS channel is reported as available only if/after it is determined that the necessary one or more QoS links required to create the QoS channel are available, and, for example, the QoS channel can then be reserved based on a confirmation or automatically be reserved in response to the QoS request.

**[00190]** FIG. 5 illustrates a functional diagram for generating a QoS activity map for quality of service (QoS) for device assisted services (DAS) in accordance with some embodiments. In particular, FIG. 5 illustrates techniques for mapping a service plan or a set of service plan policies/rules for QoS 510 to a set of QoS activity rules 530. As shown, a set of QoS rules/QoS related device state information 510 (e.g., a set of associated service plan, service plan usage, other state such as network capacity or forecasted demand or time of day/day of week, activity usage, QoS level, and/or user preferences) is mapped using a QoS mapping function to a set of QoS activity rules 530 using various techniques described herein. At 530, activity rules (e.g., activity policy rules instructions) 530 are determined using the mapping function 520. In some embodiments, DAS for network capacity controlled services techniques can similarly be implemented using the techniques described with respect to FIG. 5 (e.g., for generating and implementing a network capacity controlled services activity map).

**[00191]** In some embodiments, the service plan includes a list of activity policies, and each activity policy in the service plan specifies how the activity policy is modified by rules state information. In some embodiments, each activity policy then becomes the instruction for the engine (e.g., QoS mapping function 520) that maps the activity policy to QoS activity rules 530. In some embodiments, service controller 122 downloads QoS mapping function 520, which is implemented by service processor 115.

**[00192]** In some embodiments, the service processor determines (e.g., and classifies) application/service usage activity demand with or without granular application/service usage activity (e.g., depending on various user/service plan/service provider/network/legal and/or other privacy restrictions and/or any other related requirements or settings). For example, policies (e.g., service policy settings and/or service profile

settings) can be downloaded to provide such application/service usage activity monitoring rules and a QoS activity map for assigning such monitored activities to various QoS classes or priorities, and, in some embodiments, such monitoring and the QoS activity map can also be implemented using various verification techniques described herein (e.g., periodically audited, tested, compared with network service usage information). In some embodiments, the QoS activity map is based on a service plan, service profile, and/or service policy settings associated with the communications device. In some embodiments, the QoS activity map is based on a device group and/or user group. In some embodiments, the QoS activity map is based on user input (e.g., a user of the communications device can identify QoS classes/service levels for various applications and/or service activities, in response to requests for user input, based on user configurations, user defined rules (e.g., to eliminate or mitigate privacy and/or net neutrality concerns/issues), and/or confirmed monitored user behavior QoS related patterns or preferences). In some embodiments, the QoS activity map includes mappings/associations based on one or more of the following: a user preference for a given destination, destination class, application, application class (e.g., by application class instead of with respect to a specific application can also eliminate or mitigate privacy and/or net neutrality concerns/issues), flow, traffic or flow class, time period, time of day, location, network busy state (e.g., provide QoS when you can, then charge more when busy, notify user of busy state), device type, user type, user plan, user group, user standing, partner service, tokens, service type, and/or other criteria or measures.

**[00193]** In some embodiments, various techniques described herein are managed for device 100 for incoming and/or outgoing QoS requests. In some embodiments, as shown in FIG. 6, QoS for DAS includes establishing an end to end coordinated QoS service channel control.

**[00194]** FIG. 6 illustrates a functional diagram for quality of service (QoS) for device assisted services for an end to end coordinated QoS service channel control in accordance with some embodiments. As shown in FIG. 6, a wireless communications device 100A includes a service processor 115A in secure communication with service controller 122A. A wireless communications device 100B includes a service processor 115B in secure communication with service controller 122B. In some embodiments, when, for example, device 100A initiates a QoS request for a QoS class session in communication with device 100B (e.g., a VOIP call or another application service requiring or possibly using a QoS class/level session, such as a conversational or other QoS type of class/level), as sequence of actions are performed using service controller 122A and service controller 122B to facilitate/setup an end to end coordinated QoS service channel control. In some embodiments, as similarly described herein, assuming that service processor 115A and service controller 122A determine that the QoS request from device 100A is authorized for that device, then the service controller 122A contacts registry 650 (e.g., a device registry,

such as an HLR, mobile services center, or other central database or registry including, for example, service controller mappings by device/IP address/other) to determine the service controller associated with/responsible for managing QoS/service control for device 100B. The registry 650 provides the service controller 122B information (e.g., IP address/other address) based on this lookup determination. In some embodiments, service controller 122A then initiates the QoS request with service controller 122B to determine if the device 100B is authorized and/or available for the QoS session requested by device 100A. In some embodiments, service controllers 122A/B communicate with BTSs 125A/B to determine whether the QoS request can be facilitated (e.g., based on network capacity) as similarly described herein. In some embodiments, the service controllers 122A and 122B provide the central QoS coordination function and can request appropriate QoS channels directly from the respective local BTSs. In some embodiments, the service controllers 122A and 122B also communicate with one or more of the following network elements/functions as shown in FIG. 6 in order to facilitate an end to end coordinated QoS service channel control: RAN 610/670, Core Network 620/660, and IPX network 630. In some embodiments, service controllers 122A and 122B communicate with various necessary network elements for provisioning to facilitate session provisioning through the carrier core network as similarly discussed above. In some embodiments, service controllers 122A and 122B communicate with various necessary network elements for provisioning to facilitate session provisioning through the IPX network as similarly discussed above. As will be apparent to one of ordinary skill in the art, QoS for DAS techniques as described herein can be similarly implemented using these or similar techniques to various other network architectures.

**[00195]** FIG. 7 illustrates a flow diagram for quality of service (QoS) for device assisted services (DAS) in accordance with some embodiments. At 702, the process begins. At 704, QoS rules are received or determined (e.g., a service processor receives or requests the QoS rules, which may be included in service plan, service profile, and/or service policy settings associated with the communications device). In some embodiments, the QoS rules are verified using various techniques as described herein (e.g., periodically updated, replaced, downloaded, obfuscated, and/or tested using by a service controller and/or using other verification techniques). In some embodiments, a QoS API is also used by various applications to initiate a QoS request, as described herein with respect to various embodiments. In some embodiments, the QoS rules are implemented in the form of a QoS activity map in accordance with various embodiments described herein. At 706, the communications device's standing for QoS is determined using various techniques described herein (e.g., based on the service plan, service profile, service policy settings, QoS rules, based on QoS class, current service usage, current billing standing, and/or any other criteria/measure). In some embodiments, in addition to verifying the device/user standing for the QoS

request, whether the device is following or in compliance with an assigned QoS reservation request policy is also verified using various techniques described herein. If the device is determined to not be eligible for QoS, then at 708, the device User Interface (UI) provides information concerning the denial/ineligibility for QoS session(s) (e.g., denial/ineligibility explanation and/or options for providing for one or more QoS options, such as a service plan upgrade or payment for a certain/set of/period of time for QoS session(s) access). If the device is determined to be eligible for QoS, then at 710, QoS availability is determined (e.g., based on network capacity, which may be determined at the device, via communication with the service controller, via communication with the BTS, and/or any combination thereof, using the various techniques described herein). If QoS is determined to not be available, then at 712, the UI provides information and/or options concerning the QoS availability (e.g., unavailability explanation and/or options for providing for one or more QoS options, such as a service plan upgrade or payment for a certain/set of/period of time for QoS session(s) access). If QoS is determined to be available, then at 714, a request for network resources for the QoS session is sent to one or more network resources (e.g., service controller, BTS, gateway, core/transport network, IPX/GRX networks, and/or other network elements/functions/resources). At 716, a confirmation of the approved QoS session is received to close the loop for the QoS for DAS (e.g., a QoS schedule is received that provides the QoS session confirmation information, such as a scheduled RAB/multi-RAB and/or other reserved network resource(s) by schedule/other criteria). At 718, one or more verification techniques are performed to verify the QoS for DAS implementation on the device using various verification techniques described herein (e.g., comparing QoS service usage reports from a network source with the associated device policy; comparing QoS service usage reports from a network source with the QoS service usage reports from the device, and/or using other verification techniques as similarly described herein). At 720, the process is completed.

**[00196]** FIGS. 8A through 8C each illustrate another flow diagram for quality of service (QoS) for device assisted services (DAS) in accordance with some embodiments. FIG. 8A illustrates another flow diagram for quality of service (QoS) for device assisted services (DAS) in accordance with some embodiments. At 802, the process begins. In some embodiments, the QoS policies are implemented on the device (e.g., service processor collects/receives an associated service plan that defines/specifies basic policies for QoS, which can include a QoS activity map, which, for example, maps QoS classes based on application, service usage, flow type, destination, time of day, network capacity, and/or other criteria/measures, as similarly described herein). In some embodiments, a QoS API is also used by various applications to initiate a QoS request, as described herein with respect to various embodiments. In some embodiments, the QoS rules are implemented in the form of a verified QoS activity map in

accordance with various embodiments described herein. At 804, a QoS request is determined (e.g., by QoS class for a particular associated service/application). In some embodiments, the QoS request is determined at least in part by using the QoS activity map using various techniques described herein, for example, based on service/application usage monitoring on the device (e.g., by the service processor service usage monitoring agent). In some embodiments, the QoS request is determined based on the QoS API. In some embodiments, the QoS request is determined to be associated with an outgoing connection or an incoming connection. At 806, whether the QoS request is authorized is determined (e.g., whether the QoS request supported by the service plan, sufficient charging credit exists for this QoS request, and/or other criteria/measures). If not, then at 808, the UI provides a responsive notification and/or option as similarly described herein. If the QoS request is approved, then at 810, a request for network resources for the QoS session is sent to one or more network resources (e.g., service controller, BTS, gateway, core/transport network, IPX/GRX networks, a/another service controller in communication with another communications device such as for setting up a conversational class QoS connection with the other communications device, and/or other network elements/functions/resources). If the device is determined to be eligible for QoS, then at 810, QoS availability is determined (e.g., based on network capacity, which may be determined at the device, via communication with the service controller, via communication with the BTS or another network element/function, and/or any combination thereof, using the various techniques described herein). If QoS is determined to not be available, then at 812, the UI provides information and/or options concerning the QoS availability (e.g., unavailability explanation and/or options for providing for one or more QoS options, such as a service plan upgrade or payment for a certain/set of/period of time for QoS session(s) access). If QoS is determined to be available, then at 814, a request for network resources for the QoS session is sent to one or more network resources (e.g., service controller, BTS, gateway, core/transport network, IPX/GRX networks, and/or other network elements/functions/resources, to setup, for example, a QoS end to end connection – coordinate all resources end to end for the approved and verified QoS flow). At 816, a confirmation of the approved QoS session is received to close the loop for the QoS for DAS (e.g., a QoS schedule is received that provides the QoS session confirmation information, such as a scheduled RAB/multi-RAB and/or other reserved network resource(s) by schedule/other criteria). At 818, a QoS router is executed/performed on the communications device to assist in implementing QoS for DAS using various verification techniques described herein (e.g., to perform QoS queuing, throttling, and/or other QoS router related functions as described herein). At 820, verified QoS charging is performed (e.g., at least in part) on the device using various techniques described herein (e.g., using the service processor, such as the charging/service usage monitoring and/or other agents as described herein). In some embodiments, QoS charging records and/or reports are provided to one or more network elements for managing QoS billing and/or other QoS

management/billing related service control functions (e.g., to the service controller and/or the billing interface or billing server). In some embodiments, QoS for DAS also facilitates reestablishing the QoS session/connection/channel/stream if the QoS session/connection/channel/stream is lost or goes down, using similar techniques to those described herein as would be apparent to one of ordinary skill in the art. At 822, the process is completed. In some embodiments, the QoS provisioning channel is closed when the device session is over to, for example, free up various resources.

**[00197]** FIG. 8B illustrates another flow diagram for quality of service (QoS) for device assisted services (DAS) in accordance with some embodiments. In some embodiments, QoS for DAS includes identifying the QoS requirements (e.g., QoS level or QoS class) for a service activity. At 824, the process begins. In some embodiments, the QoS policies are implemented on the device (e.g., service processor collects/receives an associated service plan that defines/specifies basic policies for QoS, which can include a QoS activity map, which, for example, maps QoS classes based on application, service usage, flow type, destination, time of day, network capacity, and/or other criteria/measures, as similarly described herein). In some embodiments, the QoS rules are implemented in the form of a verified QoS activity map in accordance with various embodiments described herein. At 826, the device monitors device activity, such as service/application usage activities. In some embodiments, the device detects the relevant activities based on various service usage monitoring techniques described herein. At 828, a QoS request is determined, for example, using various techniques described herein. At 830, a QoS level is determined based on the application and/or various device monitored service usage/application activities associated with the QoS request using various techniques described herein. For example, the QoS level can be determined using the QoS activity map, which provides a QoS policy defined by a table associating various QoS levels with a variety of activities that include various device monitored service usage/application activities. In some embodiments, the QoS activity map includes QoS level mappings based on one or more of the following: application, destination/source, traffic type, connection type, content type, time of day/day of week, network capacity, activity usage, service plan selection, current standing, user class, device class, home/roaming, network capabilities, and/or other criteria/measures as similarly described herein. In some embodiments, at 832, if the QoS level cannot be determined and/or in order to confirm a QoS level or selection among multiple potential appropriate/approved QoS levels, the UI presents options for a user to select the QoS level. At 834, the QoS request is initiated for the determined QoS level (e.g., QoS class and/or priorities). At 836, the process is completed.

**[00198]** FIG. 8C illustrates another flow diagram for quality of service (QoS) for device assisted services (DAS) in accordance with some embodiments. In some embodiments, QoS for DAS includes determining whether the network should grant the QoS request for a given device activity. At 842, the

process begins. At 844, QoS request is determined. At 846, the communications device's standing for QoS is determined using various techniques described herein (e.g., a service processor in combination with a service controller or based on a communication for authorization of the QoS request sent to the service controller determines whether the QoS request is authorized, which can be based on the service plan, service profile, service policy settings, QoS rules, based on QoS class, current service usage, current billing standing, and/or any other criteria/measure). If the device is determined to not be eligible for QoS, then at 848, the device User Interface (UI) provides information concerning the denial/ineligibility for QoS session(s) (e.g., denial/ineligibility explanation and/or options for providing for one or more QoS options, such as a service plan upgrade or payment for a certain/set of/period of time for QoS session(s) access). If the device is determined to be eligible for QoS, then at 850, QoS availability is determined (e.g., based on network capacity, which may be determined at the device, via communication with the service controller, via communication with the BTS or another network element/function, and/or any combination thereof, using the various techniques described herein). If QoS is determined to not be available, then at 852, the UI provides information and/or options concerning the QoS availability (e.g., unavailability explanation and/or options for providing for one or more QoS options, such as a service plan upgrade or payment for a certain/set of/period of time for QoS session(s) access). If QoS is determined to be available, then at 854, a request for network resources for the QoS session is sent to one or more network resources (e.g., service controller, BTS, gateway, core/transport network, IPX/GRX networks, and/or other network elements/functions/resources can be queried directly and/or a centralized QoS resource/network function/element/database can be queried for determining such network resources and coordinating such scheduling). At 856, a confirmation of the approved QoS session is received to close the loop for the QoS for DAS (e.g., a QoS schedule is received that provides the QoS session confirmation information, such as a scheduled RAB/multi-RAB and/or other reserved network resource(s) by schedule/other criteria). At 858, a QoS router is performed. In some embodiments, the QoS router is performed on the device (e.g., service processor), on a network element/function (e.g., service controller), and/or in combinations thereof. In some embodiments, the QoS router prioritizes multiple QoS requests across a given communications device. In some embodiments, the QoS router prioritizes multiple QoS requests across multiple communications devices and/or across multiple BTSs. In some embodiments, the QoS router performs various QoS class degradation, promotion, and/or other throttling related techniques as similarly described herein (e.g., based on session priority, network capacity, workload balancing, QoS priority rules, and/or other criteria/measures/rules). At 860, the process is completed.

**[00199]** FIG. 9 illustrates another flow diagram for quality of service (QoS) for device assisted services (DAS) in accordance with some embodiments. In some embodiments, QoS for DAS includes QoS

session provision for a service activity. At 902, the process begins. At 904, a new QoS session is granted and/or confirmed. At 906, a device service processor (e.g., policy decision point (PDP) agent, also referred to herein as a policy control agent) maps the QoS session grant to a QoS monitoring policy (e.g., based on a service controller provided QoS related policy, based on a service plan associated with the device, user, device/user group, and/or other criteria/measures, as similarly described herein). At 908, the QoS monitoring policy provides commands/instructions to a policy enforcement point (PEP) (e.g., PEP agent, also referred to herein as a policy implementation agent) for managing/enforcing the new QoS priorities/sessions. At 910, the PEP determines whether to allow, block, throttle, and/or queue priority (e.g., and/or otherwise control using various traffic control related techniques) a session based on the QoS monitoring policy. At 912, the process is completed.

**[00200]** FIG. 10 illustrates another flow diagram for quality of service (QoS) for device assisted services (DAS) in accordance with some embodiments. In some embodiments, Radio Access Bearer (RAB) support is available, and the following process is performed in accordance with some embodiments. At 1002, the process begins. At 1004, the device service processor detects a QoS request or QoS need (e.g., a QoS API request, a QoS request or need/benefit of QoS session based on service usage monitoring, such as by application and/or another service usage measure/activity). At 1006, the service processor and/or the service processor in communication with the service controller determines if the service plan allows/supports the requested QoS. If not, then at 1008, a UI event is generated (e.g., notifying the device user that such QoS/QoS level/class is not available, and potentially offering a QoS/service plan upgrade/purchase for that QoS/QoS level/class). At 1010, the service processor communicates the QoS request to the service controller (e.g., using a secure service control link or secure communication channel, as similarly described herein) to request the QoS level/class. At 1012, the service controller determines whether network resources are available using various techniques as described herein. In some embodiments, network capacity is determined using various techniques, such as local device measurements; dedicated local device measurement reports; BTS reports; other network element reports; by assessing, for example, a combination of one or more of available bandwidth, traffic delay or latency, available QoS level, variability in available bandwidth, variability in latency, and/or variability in available QoS level; and/or other techniques as described herein. At 1014, the service controller responds to the QoS request (e.g., grants or denies the QoS request). In some embodiments, another UI event is generated if the QoS request is denied as similarly described herein. At 1016 (assuming the QoS request is granted), the device requests a QoS channel from the BTS. In some embodiments, the request includes a QoS request authorization code received from the service controller. In some embodiments, the service controller provides a notification of the QoS request approval for the

communications device to the BTS, so that the BTS can verify the approval of the QoS request. In some embodiments, the BTS confirms the device QoS channel request directly with the service controller. For example, various other techniques for verifying the QoS channel request can also be used as similarly described herein and as would be apparent to one of ordinary skill in the art. In some embodiments, the device service processor and/or service controller provides QoS related reports informing the BTS of how many QoS channels (e.g., RABs) to provision and how many best effort resources to provision based on device demand projections. At 1018 (assuming the QoS channel request is verified), the QoS session is initiated based on an allocated RAB or multi-RAB reservation received from the BTS (e.g., and/or other network elements as similarly described herein). At 1020, the process is completed.

**[00201]** FIG. 11 illustrates another flow diagram for quality of service (QoS) for device assisted services (DAS) in accordance with some embodiments. In some embodiments, RAB support is not available, and the following process is performed in accordance with some embodiments. At 1102, the process begins. At 1104, the device service processor detects a QoS request or QoS need (e.g., a QoS API request, a QoS request or need/benefit of QoS session based on service usage monitoring, such as by application, or other service usage measure/activity). At 1106, the service processor and/or the service processor in communication with the service controller determines if the service plan allows/supports the requested QoS. If not, then at 1108, a UI event is generated (e.g., notifying the device user that such QoS/QoS level/class is not available, and potentially offering a QoS/service plan upgrade/purchase for that QoS/QoS level/class). At 1110, the service processor communicates the QoS request to the service controller (e.g., using a secure service control link or secure communication channel, as similarly described herein) to request the QoS level/class. At 1112, the service controller determines whether network resources are available using various techniques as described herein. In some embodiments, network capacity is determined using various techniques, such as local device measurements, BTS reports, other network element reports, and/or other techniques as described herein. In some embodiments, the service controller throttles other devices on the link so that the requested QoS level can be achieved (e.g., as RAB support is not available). In some embodiments, the service controller time slots traffic from the device end in synchronization with a BTS clock or absolute clock to facilitate the requested QoS level and to achieve necessary network capacity to support/facilitate the requested QoS level (e.g., minimizing jitter/inter-packet delay variation) based on current/forecasted network capacity on the link. At 1114, the service controller responds to the QoS request (e.g., grants or denies the QoS request). In some embodiments, another UI event is generated if the QoS request is denied as similarly described herein. At 1116 (assuming the QoS request is granted), the device initiates the QoS session. At 1118, the device service processor and/or the device service processor in secure communication with the

service controller monitors and verifies the QoS session using various monitoring and verification techniques described herein (e.g., checks CDRs to determine if the QoS channel is properly implemented by the device). In some embodiments, a UI event is generated to notify the device user if there are potential problems with the QoS session implementation, to periodically inform the user of QoS charging, and/or other events/information related to QoS activities. At 1120, the process is completed.

**[00202]** FIG. 12 illustrates a device stack for providing various service usage measurement techniques in accordance with some embodiments. FIG. 12 illustrates a device stack providing various service usage measurement from various points in the networking stack for a service monitor agent (e.g., for monitoring QoS related activities and/or for monitoring network capacity controlled services as described herein), a billing agent, and an access control integrity agent to assist in verifying the service usage measures, QoS related activities and functions, and billing reports in accordance with some embodiments. As shown in FIG. 12, several service agents take part in data path operations to achieve various data path improvements, and, for example, several other service agents can manage the policy settings for the data path service, implement billing for the data path service, manage one or more modem selection and settings for access network connection, interface with the user and/or provide service policy implementation verification. Additionally, in some embodiments, several agents perform functions to assist in verifying that the service control or monitoring policies intended to be in place are properly implemented, the service control or monitoring policies are being properly adhered to, that the service processor or one or more service agents are operating properly, to prevent unintended errors in policy implementation or control, and/or to prevent/detect tampering with the service policies or control. As shown, the service measurement points labeled I through VI represent various service measurement points for service monitor agent 1696 and/or other agents to perform various service monitoring activities. Each of these measurement points can have a useful purpose in various embodiments described herein. For example, each of the traffic measurement points that is employed in a given design can be used by a monitoring agent to track application layer traffic through the communication stack to assist policy implementation functions, such as the policy implementation driver/agent 1690 (e.g., policy enforcement point driver/agent), or in some embodiments the modem firewall agent 1655 or the application interface agent, in making a determination regarding the traffic parameters or type once the traffic is farther down in the communication stack where it is sometimes difficult or impossible to make a complete determination of traffic parameters. The particular locations for the measurement points provided in these figures are intended as instructional examples, and other measurement points can be used for different embodiments, as will be apparent to one of ordinary skill in the art in view of the embodiments described

herein. Generally, in some embodiments, one or more measurement points within the device can be used to assist in service control verification and/or device or service troubleshooting.

**[00203]** In some embodiments, the service monitor agent and/or other agents implement virtual traffic tagging by tracking or tracing packet flows through the various communication stack formatting, processing and encryption steps, and providing the virtual tag information to the various agents that monitor, control, shape, throttle or otherwise observe, manipulate or modify the traffic. This tagging approach is referred to herein as virtual tagging, because there is not a literal data flow, traffic flow or packet tag that is attached to flows or packets, and the book-keeping to tag the packet is done through tracking or tracing the flow or packet through the stack instead. In some embodiments, the application interface and/or other agents identify a traffic flow, associate it with a service usage activity and cause a literal tag to be attached to the traffic or packets associated with the activity. This tagging approach is referred to herein as literal tagging. There are various advantages with both the virtual tagging and the literal tagging approaches. For example, it can be preferable in some embodiments to reduce the inter-agent communication required to track or trace a packet through the stack processing by assigning a literal tag so that each flow or packet has its own activity association embedded in the data. As another example, it can be preferable in some embodiments to re-use portions of standard communication stack software or components, enhancing the verifiable traffic control or service control capabilities of the standard stack by inserting additional processing steps associated with the various service agents and monitoring points rather than re-writing the entire stack to correctly process literal tagging information, and in such cases, a virtual tagging scheme may be desired. As yet another example, some standard communication stacks provide for unused, unspecified or otherwise available bit fields in a packet frame or flow, and these unused, unspecified or otherwise available bit fields can be used to literally tag traffic without the need to re-write all of the standard communication stack software, with only the portions of the stack that are added to enhance the verifiable traffic control or service control capabilities of the standard stack needing to decode and use the literal tagging information encapsulated in the available bit fields. In the case of literal tagging, in some embodiments, the tags are removed prior to passing the packets or flows to the network or to the applications utilizing the stack. In some embodiments, the manner in which the virtual or literal tagging is implemented can be developed into a communication standard specification so that various device or service product developers can independently develop the communication stack and/or service processor hardware and/or software in a manner that is compatible with the service controller specifications and the products of other device or service product developers.

**[00204]** It will be appreciated that although the implementation/use of any or all of the measurement points illustrated in FIG. 12 is not required to have an effective implementation, such as was similarly

shown with respect to various embodiments described herein, various embodiments can benefit from these and/or similar measurement points. It will also be appreciated that the exact measurement points can be moved to different locations in the traffic processing stack, just as the various embodiments described herein can have the agents affecting policy implementation moved to different points in the traffic processing stack while still maintaining effective operation. In some embodiments, one or more measurement points are provided deeper in the modem stack where, for example, it is more difficult to circumvent and can be more difficult to access for tampering purposes if the modem is designed with the proper software and/or hardware security to protect the integrity of the modem stack and measurement point(s).

**[00205]** Referring to FIG. 12, describing the device communications stack from the bottom to the top of the stack as shown, the device communications stack provides a communication layer for each of the modems of the device at the bottom of the device communications stack. Example measurement point VI resides within or just above the modem driver layer. For example, the modem driver performs modem bus communications, data protocol translations, modem control and configuration to interface the networking stack traffic to the modem. As shown, measurement point VI is common to all modem drivers and modems, and it is advantageous for certain embodiments to differentiate the traffic or service activity taking place through one modem from that of one or more of the other modems. In some embodiments, measurement point VI, or another measurement point, is located over, within or below one or more of the individual modem drivers. The respective modem buses for each modem reside between example measurement points V and VI. In the next higher layer, a modem selection & control layer for multimode device based communication is provided. In some embodiments, this layer is controlled by a network decision policy that selects the most desirable network modem for some or all of the data traffic, and when the most desirable network is not available the policy reverts to the next most desirable network until a connection is established provided that one of the networks is available. In some embodiments, certain network traffic, such as verification, control, redundant or secure traffic, is routed to one of the networks even when some or all of the data traffic is routed to another network. This dual routing capability provides for a variety of enhanced security, enhanced reliability or enhanced manageability devices, services or applications. In the next higher layer, a modem firewall is provided. For example, the modem firewall provides for traditional firewall functions, but unlike traditional firewalls, in order to rely on the firewall for verifiable service usage control, such as access control and security protection from unwanted networking traffic or applications, the various service verification techniques and agents described herein are added to the firewall function to verify compliance with service policy and prevent/detect tampering of the service controls. In some embodiments, the modem firewall is

implemented farther up the stack, possibly in combination with other layers as indicated in other Figures and described herein. In some embodiments, a dedicated firewall function or layer is provided that is independent of the other processing layers, such as the policy implementation layer, the packet forwarding layer and/or the application layer. In some embodiments, the modem firewall is implemented farther down the stack, such as within the modem drivers, below the modem drivers, or in the modem itself. Example measurement point IV resides between the modem firewall layer and an IP queuing and routing layer (e.g., QoS IP queuing and routing layer and/or a network capacity controlled services queuing and routing layer). As shown, an IP queuing and routing layer is separate from the policy implementation layer where the policy implementation agent implements a portion of the traffic control and/or service usage control policies. As described herein, in some embodiments, these functions are separated so that a standard network stack function can be used for QoS IP queuing and routing and/or for network capacity controlled services queuing and routing, and the modifications necessary to implement the policy implementation agent functions can be provided in a new layer inserted into the standard stack. In some embodiments, the IP queuing and routing layer is combined with the traffic or service usage control layer. For example, a combined routing and policy implementation layer embodiment can also be used with the other embodiments, such as shown in FIG. 12. Measurement point III resides between the IP queuing and routing layer and a policy implementation agent layer. Measurement point II resides between the policy implementation agent layer and the transport layer, including TCP, UDP, and other IP as shown. The session layer resides above the transport layer, which is shown as a socket assignment and session management (e.g., basic TCP setup, TLS/SSL) layer. The network services API (e.g., HTTP, HTTPS, FTP (File Transfer Protocol), SMTP (Simple Mail Transfer Protocol), POP3, DNS) resides above the session layer. Measurement point I resides between the network services API layer and an application layer, shown as application service interface agent in the device communications stack of FIG. 12.

**[00206]** As shown in FIG. 12, the application service interface layer (e.g., QoS application service interface layer and/or network capacity controlled services interface layer) is above the standard networking stack API and, in some embodiments, its function is to monitor and in some cases intercept and process the traffic between the applications and the standard networking stack API. In some embodiments, the application service interface layer identifies application traffic flows before the application traffic flows are more difficult or practically impossible to identify farther down in the stack. In some embodiments, the application service interface layer in this way assists application layer tagging in both the virtual and literal tagging cases. In the case of upstream traffic, the application layer tagging is straight forward, because the traffic originates at the application layer. In some downstream

embodiments, where the traffic or service activity classification relies on traffic attributes that are readily obtainable, such as source address or URL, application socket address, IP destination address, time of day or any other readily obtained parameter, the traffic type can be identified and tagged for processing by the firewall agent or another agent as it initially arrives. In other embodiments, as described herein, in the downstream case, the solution is generally more sophisticated when a traffic parameter that is needed to classify the manner in which the traffic flow is to be controlled or throttled is not readily available at the lower levels of the stack, such as association with an aspect of an application, type of content, something contained within TLS, IPSEC or other secure format, or other information associated with the traffic. Accordingly, in some embodiments the networking stack identifies the traffic flow before it is fully characterized, categorized or associated with a service activity, and then passes the traffic through to the application interface layer where the final classification is completed. In such embodiments, the application interface layer then communicates the traffic flow ID with the proper classification so that after an initial short traffic burst or time period the policy implementation agents can properly control the traffic. In some embodiments, there is also a policy for tagging and setting service control policies for traffic that cannot be fully identified with all sources of tagging including application layer tagging.

**[00207]** As shown in FIG. 12, a service monitor agent, which is also in communication with the agent communication bus 1630, communicates with various layers of the device communications stack. For example, the service monitor agent, performs monitoring at each of measurement points I through VI, receiving information including application information, service usage and other service related information, and assignment information. An access control integrity agent is in communication with the service monitor agent via the agent communications bus 1630, as also shown.

**[00208]** FIG. 13 illustrates another device stack for providing various service usage measurement techniques in accordance with some embodiments. FIG. 13 illustrates an embodiment similar to FIG. 12 in which some of the service processor is implemented on the modem and some of the service processor is implemented on the device application processor in accordance with some embodiments. In some embodiments, a portion of the service processor is implemented on the modem (e.g., on modem module hardware or modem chipset) and a portion of the service processor is implemented on the device application processor subsystem. It will be apparent to one of ordinary skill in the art that variations of the embodiment depicted in FIG. 13 are possible where more or less of the service processor functionality is moved onto the modem subsystem or onto the device application processor subsystem. For example, such embodiments similar to that depicted in FIG. 13 can be motivated by the advantages of including some or all of the service processor network communication stack processing and/or some or all of the other service agent functions on the modem subsystem (e.g., and such an approach can be applied to one

or more modems). For example, the service processor can be distributed as a standard feature set contained in a modem chipset hardware of software package or modem module hardware or software package, and such a configuration can provide for easier adoption or development by device OEMs, a higher level of differentiation for the chipset or modem module manufacturer, higher levels of performance or service usage control implementation integrity or security, specification or interoperability standardization, and/or other benefits.

**[00209]** Referring to FIG. 13, describing the device communications stack from the bottom to the top of the stack as shown, the device communications stack provides a communication layer for modem MAC/PHY layer at the bottom of the device communications stack. Measurement point IV resides above the modem MAC/PHY layer. The modem firewall layer resides between measurement points IV and III. In the next higher layer, the policy implementation agent is provided, in which the policy implementation agent is implemented on the modem (e.g., on modem hardware). Measurement point II resides between the policy implementation agent and the modem driver layer, which is then shown below a modem bus layer. The next higher layer is shown as the IP queuing and routing layer, followed by the transport layer, including TCP, UDP, and other IP as shown. The session layer resides above the transport layer, which is shown as a socket assignment and session management (e.g., basic TCP setup, TLS/SSL) layer. The network services API (e.g., HTTP, HTTPS, FTP (File Transfer Protocol), SMTP (Simple Mail Transfer Protocol), POP3, DNS) resides above the session layer. Measurement point I resides between the network services API layer and an application layer, shown as application service interface agent in the device communications stack of FIG. 13.

**[00210]** Additional Embodiments of DAS for Protecting Network Capacity

**[00211]** In some embodiments, DAS for protecting network capacity includes classifying a service activity as a network capacity controlled service and implementing a network capacity controlled services policy. In some embodiments, DAS for protecting network capacity includes device assisted/based techniques for classifying a service activity as a network capacity controlled service and/or implementing a network capacity controlled services policy. In some embodiments, DAS for protecting network capacity includes network assisted/based techniques (e.g., implemented on a network element/function, such as a service controller, a DPI gateway, a BTS/BTSC, etc., or a combination of network elements) for classifying a service activity as a network capacity controlled service and/or implementing a network capacity controlled services policy. In some embodiments, DAS for protecting network capacity includes providing a network access API or an emulated or virtual network access API (e.g., such an API can provide network busy state information and/or other criteria/measures and/or provide a mechanism for

allowing, denying, delaying, and/or otherwise controlling network access). In some embodiments, DAS for protecting network capacity includes implementing a service plan that includes a network capacity controlled services policy (e.g., for differential network access control and/or differential charging for network capacity controlled services, which can also be based on a network busy state and/or other criteria/measures).

**[00212]** In some embodiments, DAS for protecting network capacity techniques also provide improved user privacy and facilitate network neutrality requirements. In contrast, network based techniques (e.g., DPI based techniques) can give rise to user privacy and network neutrality concerns and problems as discussed above. In some embodiments, DAS for protecting network capacity techniques include allowing a user to specify (e.g., permit or not permit) whether the network is aware of the user's Internet behavior (e.g., using UI input). In some embodiments, DAS for protecting network capacity techniques include allowing a user to select how they want their traffic usage and service plan costs to be managed.

**[00213]** FIG. 14 illustrates a flow diagram for device assisted services (DAS) for protecting network capacity in accordance with some embodiments. At 1402, the process begins. At 1404, monitoring a network service usage activity of a device in network communication (e.g., wireless network communication) is performed. At 1406, whether the monitored network service usage activity is a network capacity controlled service is determined. At 1408 (the monitored network service usage activity was determined not to be a network capacity controlled service), the network service usage activity is not classified for differential network access control. At 1410, (the monitored network service usage activity was determined to be a network capacity controlled service), the network service usage activity is classified (e.g., into one or more network capacity controlled services) for differential network access control for protecting network capacity. In some embodiments, classifying the network service usage activity includes classifying the network service usage activity into one or more of a plurality of classification categories for differential network access control for protecting network capacity (e.g., one or more network capacity controlled service classifications and/or a priority state classification, such as a background services classification and/or a background priority state classification). At 1412, associating the network service usage activity with a network capacity controlled services control policy based on a classification of the network service usage activity to facilitate differential network access control for protecting network capacity is performed. At 1414, implementing differential network access control for protecting network capacity by implementing different traffic controls for all or some of the network service usage activities (e.g., based on a network busy state or another criteria/measure) is performed. At 1416, the process is completed.

**[00214]** FIG. 15 illustrates another flow diagram for device assisted services (DAS) for protecting network capacity in accordance with some embodiments. At 1502, the process begins. At 1504, monitoring network service usage activities of a device in network communication is performed. At 1506, monitored network service usage activity of the device is reported (e.g., to a network element/function). At 1508, a statistical analysis of a reported network service usage activities across a plurality of devices is performed (e.g., by a network element/function). At 1510, the device receives a network service usage activity classification list (e.g., a network capacity controlled services list, which can be generated, for example, based on the monitored network service usage activities and the statistical analysis as well as other criteria/measures, including, for example, a service plan and/or a network busy state) from the network element. At 1512, implementing differential network access control based on the network service usage activity classification list for protecting network capacity is performed. At 1514, the process is completed. In some embodiments, DAS for protecting network capacity further includes associating the network service usage activity with a network service usage control policy (e.g., a network capacity controlled services policy) based on a classification of the network service usage activity to facilitate differential network access control for protecting network capacity. In some embodiments, DAS for protecting network capacity further includes differentially controlling the network service usage activity (e.g., network capacity controlled service) based on the service usage activity classification list.

**[00215]** FIG. 16 illustrates another flow diagram for device assisted services (DAS) for protecting network capacity in accordance with some embodiments. At 1622, the process begins. At 1624, a first report of network service usage activity of a first device is received (e.g., at a network element/function) from the first device. At 1626, a second report of network service usage activity of a second device (e.g., at a network element/function) from the second device is received. At 1628, a statistical analysis of a plurality of reported service usage activities across a plurality of devices, including the first device and the second device, is performed (e.g., by a network element/function). At 1630, a network service usage activity classification list (e.g., a network capacity controlled services classification list) is sent to the first device (e.g., from a network element/function) for classifying network service usage activities (e.g., network capacity controlled services) based on the network service usage activity classification list for differential network access control for protecting network capacity. At 1632, a network service usage activity classification list is sent to the second device (e.g., from a network element/function) for classifying network service usage activities based on the network service usage activity classification list for differential network access control for protecting network capacity. At 1634, the process is completed. In some embodiments, DAS for protecting network capacity further includes associating the network service usage activity with a service usage control policy (e.g., a network capacity controlled

services policy) based on a classification of the network service usage activity to facilitate differential network access control for protecting network capacity. In some embodiments, DAS for protecting network capacity further includes differentially controlling the network service usage activity (e.g., network capacity controlled service) based on the service usage activity classification list (e.g., network capacity controlled services classification list). In some embodiments, classifying network service usage activities is based on which network to which the device is connected. In some embodiments, the network service usage control policy is based on which network to which the device is connected.

**[00216]** FIG. 17 illustrates another flow diagram for device assisted services (DAS) for protecting network capacity in accordance with some embodiments. At 1702, the process begins. At 1704, monitoring a network service usage activity of a plurality of devices in network communication using network based techniques is performed. At 1706, a statistical analysis of monitored network service usage activities across the plurality of devices is performed. At 1708, a network service usage activity classification list (e.g., a network capacity controlled services classification list) is sent to each of the plurality of devices for classifying network service usage activities (e.g., network capacity controlled services) based on the service usage activity classification list for differential network access control for protecting network capacity. At 1710, the process is completed.

**[00217]** FIG. 18 illustrates another flow diagram for device assisted services (DAS) for protecting network capacity in accordance with some embodiments. At 1802, the process begins. At 1804, monitoring network service usage activities of a device in network communication is performed. At 1806, associating a network service usage activity (e.g., a network capacity controlled service) with a service usage control policy (e.g., a network capacity controlled services policy) based on a classification of the network service usage activity (e.g., a network capacity controlled services classification list) for differential network access control for protecting network capacity is performed. At 1808, a user notification based on the service usage control policy is generated. At 1810, the process is completed.

**[00218]** In some embodiments, the service usage control policy includes a service usage notification policy. In some embodiments, the user notification includes one or more of the following: a notification that the application to be downloaded and/or launched is a network capacity controlled service; a list of one or more service activities (e.g., applications, OS/other software functions/utilities, and/or other functions/utilities as described herein) that have a network capacity controlled services classification; type of service policy in effect for one or more network capacity controlled services; notification that a service activity belongs to a network capacity controlled services class; notification that a service activity that is classified as network capacity controlled service can have the service class changed; notification that if

the service class is changed for a service activity the service charges will change; notification that one or more networks are available (e.g., one or more alternative networks and/or network busy state information and/or charging information and/or incentives associated with such networks), a service plan upgrade/downgrade offer/option; and an offer for a service plan that rewards a user that responds to the notification a service plan is lower cost/discounted for responding to notification to use or not to use service activity based on usage level warning notification. In some embodiments, the user notification includes a user preference selection, including one or more of the following: a provision to associate an access policy control with the application (e.g., allow/block, notify of usage, notify of usage at a given threshold, traffic control settings, allow during certain times, allow when network not busy, and/or other policy controls as described herein), an over-ride option for selecting the service usage control policy; a modify option to select the service usage control policy; a select option to select a new service plan (e.g., an option to review and select alternative/new service plan upgrade/downgrade options), and an acknowledgement request (e.g., to confirm/acknowledge receipt of the notification, in which the acknowledgement can be transmitted to a network element/function and/or stored locally for later reference/transmission).

**[00219]** In some embodiments, before a given device application, process, function, OS service or other service activity is allowed to start, the intention to start is intercepted by a launch manager, the background service policy set or the network protection service policy set for the service activity is retrieved, and any necessary user notification or service launch control policies are implemented prior to allowing the service activity to launch. In such embodiments, a launch intercept manager may be used to implement this functionality. In some embodiments, this launch intercept manager is provided with a list identifying the service activities (e.g. application identifiers, OS function identifiers, aggregate service activity identifiers, and/or component service activity identifiers) that have a launch control policy in effect. In some embodiments, the list of launch control policies includes blocking or delaying launch of the one or more service activities. In some embodiments, the launch control policy includes a user notification before, during or after the service activity is launched. In some embodiments, the user is informed that a service activity that has a background service control policy in effect or a network protection service control policy in effect is attempting to launch, is about to launch or has launched. In a further set of embodiments, the launch is held up until the user is notified and is allowed to decide if they would like to launch the service activity. In some embodiments, the user notification includes a message that the service activity attempting to launch consumes a large amount of service usage and asks the user if they would like to continue (e.g. "This application consumes a large amount of data, would you like to continue?", "This application consumes data even when you are not using it, would you like to continue?"

"This application consumes data while you are roaming which adds cost to your usage bill, would you like to continue?", etc). In some embodiments, the decision on whether or not to launch a service activity is pre-programmed into the list identifying the service activities (e.g. application identifiers, OS function identifiers, aggregate service activity identifiers, and/or component service activity identifiers) that have a launch control policy in effect. In some embodiments a portion of the list is pre-programmed by the user in accordance with user preference for controlling usage of service activities. In some embodiments, a portion of the list is pre-programmed by a network element (e.g. a service controller) in accordance with network background service or network protection service policies specified by a service policy design management system operated by a service provider as described herein. In some embodiments, the policy implementation defined by the list identifying the service activities (e.g. application identifiers, OS function identifiers, aggregate service activity identifiers, and/or component service activity identifiers) that have a launch control policy in effect is verified to ensure that the user or malicious software has not defeated the policy enforcement specified in the list. In some embodiments the list identifying the service activities that have a launch control policy in effect includes launch policies that are a function of one or more of: background service state, network busy state (or performance state or QoS state), type of network the device is connected to, home or roaming connection, time of day or day of week.

**[00220]** In some embodiments, the various design techniques described herein that allow for intercepting a service activity intention to launch, and applying a background service policy set or a network protection service policy set can be designed into the OS itself. For example, the intercept and policy implementation functions can be designed into the activity manager, broadcast intent manger, media service manager, service manager, or other application or service activity management function in the Android OS. One of ordinary skill in the art will recognize that similarly, the various design techniques described herein that allow for intercepting a service activity intention to launch, and applying a background service policy set or a network protection service policy set can be designed into application launch management functions in the iPhone OS, windows mobile OS, windows PC OS, Blackberry OS, Palm OS, and other OS designs.

**[00221]** In some embodiments, the pre-launch user notification information indicates one or more of: typical service usage or cost, or projected service usage or cost for the service activity attempting to launch. In some embodiments, the user sets limitations on access for one or more service activities and once this limit is hit then when the service activities with exceeded limits attempt to launch the user is notified. In some embodiments, the user chooses from a set of service restrictions rather than simply blocking or allowing service activity launch, with example service restrictions including but not limited to: a pre-configured set of restriction policies to chose from (e.g. full access, limited access, highly

restricted access or block access), block, throttle, delay, aggregate and hold, limit amount of usage per unit time, cap usage, set limit for additional notification, specify type of network, specify busy state (performance, QoS) or background state, or choose from pre-configured settings options.

**[00222]** In some embodiments, the user notification occurs after the user attempts to download or load an application onto the device (e.g., an application downloaded from the web or an online application store for a smart phone or other wireless/network computing device, such as an Apple iPhone or iPad, or Google Android/Chrome based device). In some embodiments, the user notification occurs after the user attempts to run the service activity or to initiate usage of a cloud based service/application (e.g., Google or Microsoft cloud service based apps). In some embodiments, the user notification occurs after one or more of the following: the service usage activity hits a usage threshold event, the service usage activity attempts a network service usage that satisfies a pre-condition, an update to a network capacity protection service activity classification list or policy set, and a network message is sent to the device triggering the notification. In some embodiments, the user notification provides information on the service usage activity that is possible, typical, or likely for the service usage activity. In some embodiments, the user notification includes a user option for obtaining more information about the service usage of the service activity (e.g., a message that the service usage activity may result in a high service usage and/or that the service usage activity may or will result in a high service usage as compared in some way to a limit of the current service plan) to make informed user preference settings.

**[00223]** In some embodiments, a user notification includes displaying (e.g., and as applicable, allowing users to provide UI input) one or more of the following: current and/or past/historical/logged network service usage activity list, current and/or past/historical/logged network capacity controlled service usage activities, current activity policy settings, current or available networks, service plan options (e.g., for how to treat one or more network capacity controlled service traffic types), selection option(s) to assign a network capacity controlled service activity into a different priority traffic control and/or charging buckets, network service usage by activity (e.g., network capacity controlled services and other services), network busy state (e.g., and with resulting policies in force), service activity policy setting vs. busy state and time/day/week, network service activity priority, network service activity usage statistics (e.g., vs. network busy state and/or network service usage control policy state).

**[00224]** In some embodiments, a UI notification is displayed when user attempts a network capacity controlled service activity during a network busy state (e.g., that modifies a network capacity controlled services policy). In some embodiments, the UI notification includes information on service plan choice and a network capacity controlled services policy over-ride option (e.g., one time, time window, usage

amount, permanent by activity, and/or all), charging information based on a user selection, and/or service plan upgrade information and options.

**[00225]** In some embodiments, a UI notification is displayed for user input for preferences/configurations for multiple networks (e.g., WiFi, 4G, 3G, and/or other wired or wireless access networks) including charging policy. In some embodiments, a UI notification is displayed when a specified network traffic service usage activity (e.g., based on network capacity controlled services classification, QoS classification, priority classification, time based criteria, network capacity, service plan, charging criteria, and/or other criteria/measures) is being attempted or is occurring and providing options (e.g., allow, block, delay, throttle, and/or other options).

**[00226]** In some embodiments, a UI fuel gauge is displayed (e.g., to depict current and/or historical network service usage, for example, relative to a service plan for the device, by network, relative to network busy state, time based criteria, and/or other criteria/measures). In some embodiments, a user notification includes a communication sent to the user (e.g., an email, SMS or other text message, voice message/call, and/or other electronic form of communication). In some embodiments, the communication sent to the user includes network service usage information, network capacity controlled service usage related information, and/or an instruction to log into a web page or send a communication for more information (e.g. regarding an information update and/or alert or warning message, such as related to network service usage and/or charging for network service usage).

**[00227]** In some embodiments, a notification (e.g., a user or network service cloud notification) is generated based on an aggregate service activity reports usage (e.g., allows network provider to generate user notifications and/or to notify application provider/service activity provider). In some embodiments, a notification (e.g., a user or network service cloud notification) is generated based on a publishing of an updated/new network capacity controlled services list based on an aggregate monitored activity (e.g., based on a service plan, velocity, sockets opening frequency/rate (e.g., messaging layer behavior), total data usage, peak busy time usage to formulate or update black list for monitoring, notifying, and/or controlling, which can be applied to one, multiple, group, or all devices). In some embodiments, a notification (e.g., a user or network service cloud notification) is generated based on data usage trends for particular device relative to an associated service plan and/or other comparable devices or data usage thresholds/statistical based data usage measures.

**[00228]** In some embodiments an application is actually composed of several component applications, processes or functions. Examples of this include but are not limited to: the components of a Java

application JAR file; applications that use OS functions; applications that use a proxy service function; applications, functions or processes that coordinate with one another to implement a composite process, function or application; and OS process functions that support an application or overall OS function. In such embodiments it is important to be able to categorize all applications, functions and processes on a device that contribute to the service usage of a service activity so that the service activity can be monitored for service usage, have the service usage accounted for, implement the appropriate user notification when one or more service activity components attempts to start or use the network, implement the appropriate user notification when one or more service activity components reaches a pre-determined service usage level that requires user notification, and implement the appropriate background service or network protection service usage controls as specified herein ((including but not limited to for example: block network access, restrict network access, throttle network access, delay network access, aggregate and hold network access, select for time of day network access restrictions, select network type restrictions, select roaming network access restrictions, select service usage restrictions such as a usage limit, select service cost restrictions such as a cost limit or otherwise place on another form of background service status or network usage restriction as described herein). In the case of service activity components that belong exclusively to one aggregate service activity (e.g. an application, application JAR file or OS function), this may be accomplished by including each of the component service activities on a list that identifies the service activity components that belong to the aggregate service activity, and then monitoring, possibly controlling and providing user notifications based on the aggregate or component behavior of each service activity in accordance with the policies specified for the aggregate service activity. For example, it is necessary to group all application launch behavior and/or network access behavior under the monitoring, launch, notification, accounting and background service controls or network protection service controls (or other background or network protection service policies as specified herein) in accordance with the background service or network protection service policies for the aggregate application that the JAR file supports. As another example, if an OS network synch or update function utilizes various software components or processes to implement the network synch or update function, then each of the software components or process must be monitored and aggregated under the background service policies or network protection service policies for the aggregate OS synch or update function.

**[00229]** In some embodiments, this ability to group usage for a related set of service activity components dedicated to an aggregate service activity as described herein is used to improve usage reporting of service activities to a service controller for the purpose of statistically identifying service

activities that are candidates for background service policy controls or network protections service policy controls.

**[00230]** In some cases, multiple applications, processes, functions, OS services or other service activities can utilize a common set of component software applications, processes, functions or OS services. In such cases, in order to implement background service policies and/or network protection service policies for service activity monitoring and accounting, service activity launch control, user notification, or network access control as described herein, it is necessary to associate the specific network access data or information flows to and from the common component software applications, processes or functions that belong to the specific initiating application, process, function or other service activity that is to be managed according to a background service or network protection service policy set. In what follows, a specific set of examples are provided on how to map common component service activity for a set of common OS functions referred to as proxy service functions to a specific application, process, function, OS service or other service activity for the purpose of implementing a background service policy set or a network protection service policy set as described herein. Once these examples are reviewed, it will be obvious to one of ordinary skill in the art how to apply similar mapping of service activity for a common set of components to a service activity that is to be managed in accordance with a background service policy set or a network protection service policy set as described herein.

**[00231]** In some embodiments, this ability to group usage for a common set of service activity components as described herein is used to improve usage reporting of service activities to a service controller for the purpose of statistically identifying service activities that are candidates for background service policy controls or network protections service policy controls.

**[00232]** In some embodiments, a proxy network service manager refers to an intermediary data flow function in a device operating system that sits on a data path between a device application and a device networking stack interface to provide a level of network service abstraction from the network stack interface, a higher level service function above the network stack interface, enhanced or special traffic processing functions, media service transfer management, file download service, HTTP proxy service functions, QoS differentiation, or other similar or related higher level traffic processing. Example Proxy Service Managers include the following: media service manager (e.g. android media service library function), email service manger, DNS function, software download service manager, media download manager (e.g. audio player, streaming media player, movie downloader, media service OS function, etc), data download service manager, Android "media" library function, Android.net library function, Jave.net library function, Apache library function, other similar software/library functions or services in other

device operating systems, SMTP/IMAP/POP proxy, HTTP proxy, IM proxy, VPN service manager, SSL proxy, etc. Herein these alternative network access data flows that are initiated by an application are termed application proxy service flows. In such embodiments an app can sometimes simply requests a network access service activity from an OS component such as a proxy service component rather then directly accessing the network. In such embodiments, in order to implement background service controls or user notification of application service usage, it is necessary to monitor the application proxy service flows, classify them as being initiated by or belonging to a particular application or service activity, and implement the proper background service classifications, user notifications, application process launch intercept, background service accounting, and background service usage restrictions as described herein in accordance with the policies intended for the initiating application or service activity. This is accomplished by inserting service usage monitors that allow a mapping of (i) the initiating application identifier (e.g. app name, app fingerprint, application identification tag, application process number, application credential, or other secure or non-secure application or process identifier) to (ii) the request to the proxy service and subsequently to (iii) the network service flows between the proxy service and the network elements that service the information communications. Once this mapping is accomplished, the service usage flows of the proxy service can then be accounted back to the initiating application, device software process or other service activity, the proper policies can then be applied to each service usage flow for user notification, service activity launch control, service activity background accounting (including variable charge rating dependent on background service state and/or sponsored service charging), service activity background service controls or network usage restrictions as described herein (including but not limited to for example: block network access, restrict network access, throttle network access, delay network access, aggregate and hold network access, select for time of day network access restrictions, select network type restrictions, select roaming network access restrictions, select service usage restrictions such as a usage limit, select service cost restrictions such as a cost limit or otherwise place on another form of background service status or network usage restriction as described herein).

**[00233]** In some embodiments, this ability to track service usage for an service activity through a proxy service as described herein is used to improve usage reporting of service activities to a service controller for the purpose of statistically identifying service activities that are candidates for background service policy controls or network protections service policy controls.

**[00234]** In some embodiments, the various design techniques described herein that allow for monitoring, accounting for and/or implementing service policy for component service activities that belong to an aggregate service activity can be designed into the OS itself. For example, in certain current mobile OS implementations (e.g. Android, iPhone, Blackberry, etc) there are some applications available

in the market that allow a user to get an estimate for how much data a certain subset of applications are consuming on a wireless service provider network, but it is not possible for the user or application to get an indication of the service usage for certain OS functions, whereas the embodiments disclosed herein will allow for this. As another example, in certain current mobile OS implementations it is not possible to associate proxy service usage (e.g. media download and media streaming proxy library software functions) with the specific applications that use the proxy service, so while the user can be informed of generic common OS functions or proxy services (e.g. in the case of Android: "media service", "media", "gallery", "google service framework" and other generic common OS software library functions or proxy services), there is no way for the user to determine what applications widgets or other service activities are actually generating this common service function usage, whereas the invention described herein permits the user full visibility on such usage monitoring examples. Furthermore, if the OS is retrofitted with the intercept and policy implementation functions can be designed into the activity manager, broadcast intent manger, media service manager, service manager, or other application or service activity management function in the Android OS. One or ordinary skill in the art will recognize that similarly, the various design techniques described herein that allow for intercepting a service activity intention to launch, and applying a background service policy set or a network protection service policy set can be designed into application launch management functions in the iPhone OS, windows mobile OS, windows PC OS, Blackberry OS, Palm OS, and other OS designs.

**[00235]** FIG. 19 illustrates another flow diagram for device assisted services (DAS) for protecting network capacity in accordance with some embodiments. At 1902, the process begins. At 1904, determining a network busy state of one or more networks is performed. In some embodiments, the one or more networks are selected from an access network, a wired network, and a wireless network. At 1906, classifying a network service usage activity (e.g., a network capacity controlled service) of a device based on the network busy state determination is performed to facilitate differential network access control for protecting network capacity of the one or more networks. In some embodiments, the network busy state is based on one or more of the following: network performance, network congestion, network availability, network resource availability, network capacity, or any other network service usage measure, and one or more time windows (e.g., time based criteria). In some embodiments, protecting network capacity of the one or more networks includes protecting network capacity of a last edge segment of a wireless network (e.g., RAN, BTS, BTSC, and/or other network elements). In some embodiments, the determining and classifying are performed using device assisted/based techniques. In some embodiments, the determining and classifying are performed using network assisted/based techniques (e.g., implemented on a network element/function, such as a service controller, a DPI gateway, a BTS/BTSC,

etc., or a combination of network elements). In some embodiments, the determining and classifying are performed using a combination of device assisted/based techniques and network assisted/based techniques. At 1908, implementing differential traffic controls is performed based on the service usage activity classification for protecting network capacity is performed. At 1910, the process is completed. In some embodiments, a network busy state is determined based on one or more of the following: a time of day, a network reported busy state, and/or a device (e.g., near-end and/or far-end) determined/reported network busy state. In some embodiments, a network busy state is determined using one or more of the following: a network probe, a device query, a network probe report (e.g., including a BTS and/or BTSC), a network probe analysis, a device analysis based on performance of native traffic without probe such as TCP timeout, UDP retransmissions, a multiple network test, a device monitored network congestion based on network service usage activity (e.g., application based network access performance data) performed for a network to which the device is connected and/or one or more alternative networks. In some embodiments, a network congestion state is associated with a network busy state (e.g. a network busy state setting/level). For example, a network congestion level of 40% of network usage can be associated with a network busy state setting of 4, a network congestion level of 80% of network usage can be associated with a network busy state setting of 8, and so forth.

**[00236]** FIG. 20 illustrates another flow diagram for device assisted services (DAS) for protecting network capacity in accordance with some embodiments. At 2002, the process begins. At 2004, monitoring a network service usage activity of a device in network communication is performed. At 2006, classifying the network service usage activity (e.g., based on a classification of the network service usage activity for protecting network capacity, for example, as a network capacity controlled service) for protecting network capacity is performed. At 2008, accounting for network capacity controlled services (e.g., accounting for the network service usage activity based on a classification of the network service usage activity for protecting network capacity) is performed. At 2010, charging for network capacity controlled services is performed. At 2012, the process is completed. In some embodiments, DAS for protecting network capacity further includes classifying the network service usage activity as a network capacity controlled service. In some embodiments, DAS for protecting network capacity includes differentially accounting and/or differentially charging for network capacity controlled services and foreground services. In some embodiments, the network service usage control policy includes policies for differentially controlling, accounting, and/or charging for network capacity controlled services (e.g., based on a network busy state, a time based criteria, a service plan, network to which the device or network service usage activity is gaining access from, and/or other criteria/measures). In some embodiments, accounting for network capacity controlled services includes differentially collecting

service usage for one or more network capacity controlled service classes in which the accounting is modified/varies (e.g., dynamically) based on one or more of the following: network busy state (e.g., modify/credit accounting during network congestion not satisfying the user preference), network service activity, access network (e.g., the network to which the device/service activity is currently connected), user preference selection, time based criteria (e.g., current time of day/day of week/month), associated service plan, option to time window. In some embodiments, charging for network capacity controlled services includes mapping an accounting to a charging report. In some embodiments, charging for network capacity controlled services includes sending the charging report to a network element (e.g., a service controller, a service cloud, a billing interface/server, and/or another network element/function). In some embodiments, charging for network capacity controlled services includes mediating or arbitrating CDRs/IPDRs for network capacity controlled service(s) vs. other network service usage activities or bulk network service usage activities. In some embodiments, charging for network capacity controlled services includes converting a charging report to a billing record or billing action. In some embodiments, charging for network capacity controlled services includes generating a user notification of network capacity controlled service charges upon request or based a criteria/measure (e.g., a threshold charging level and/or a threshold network service usage level). In some embodiments, charging for network capacity controlled services includes charge by application based on a charging policy (e.g., bill by application according to billing policy rules, such as for billing to a user or to a sponsored service provider, carrier, and/or other entity).

**[00237]** FIG. 21 illustrates another flow diagram for device assisted services (DAS) for protecting network capacity in accordance with some embodiments. In some embodiments, DAS for protecting network capacity includes providing a device service access API that provides an interface for applications, OS functions, and/or other service usage activities to a network access connection (e.g., or stack) for providing differential network access for protecting network capacity. In some embodiments, the differential network access is determined by one or more of the following: a service priority of the service usage activity and a network busy state. At 2102, the process begins. At 2104, a device service access API request is received. At 2106, the device service access API request is responded to. In some embodiments, the differential network access (e.g., for network capacity controlled services and/or based on network busy state and/or other criteria/measures) is implemented by one or more of the following: providing network busy state information to the service usage activity, receiving network busy state information, receiving network capacity demands for the service usage activity, receiving a scheduled time/time slot demand from the service usage activity, receiving and/or providing network location and/or physical location information (e.g., base station, communication channel, cell sector, roaming or non-

roaming network to which the device is connected, and/or GPS or other physical location data), providing information to the service usage activity informing it when it is allowed to access the network, providing information to the service usage activity informing it what traffic controls must be applied/implemented, providing information to the service usage activity informing it when the network is available to it for access, and providing information to the service usage activity of its scheduled access time/time slot (e.g., based on one or more of the following: priority, network busy state, and time of day) (e.g., with a specified performance level or service level, such as data transfer size, speed, network capacity controlled service priority level, QoS level, data transfer type, scheduling time(s), and/or network connection parameters), and instructing the device and/or service usage activity to transition to a different state (e.g., power save state, sleep state dormant, idle, wait state, and/or an awake state). At 2108, differential network access is implemented. At 2110, the process is completed. In some embodiments, the device service access API is a programmatic interface, a virtual interface, and/or an emulated interface that provides instructions for differential access to a network to protect network capacity, as described herein.

**[00238]** In some embodiments, the API is served or located on the device, on a network element (e.g., using a secure communication between the device and the network element for the API communication, such as HTTPS, TLS, SSL, an encrypted data connection or SS7 control channel, and/or other well known secure communication techniques), and/or both/partly in both. In some embodiments, a network based API is an API that facilitates an API or other interface communication (e.g. secure communication as discussed above) between an application executing on the device and a network element and/or service cloud for protecting network capacity. For example, a network API can provide an interface for an application to communicate with a service cloud (e.g., network server) for obtaining network access control information (e.g., network busy state, multiple network information based on available networks and/or network busy state information of available networks, network capacity controlled service priorities and availability, scheduled time/time slots for network access based on network busy state, service plan, network capacity controlled service, and/or other criteria/measures). As another example, a network API can facilitate an application provider, central network/service provider, and/or a third party with access to communicate with the application to provide and/or request information (e.g., physical location of the application, network location of the application, network service usage information for the application, network busy state information provided to the application, and/or other criteria/measures). As yet another example, a network API can facilitate a broadcast to one or more applications, OS functions, and/or devices (e.g., partitioned based on geography, network, application, OS function, and/or any other criteria/measure) with network capacity related information (e.g., network busy state, availability based on network capacity controlled service classification and/or priority level, scheduled

time/time slots for certain network capacity controlled service classification and/or priority level, emergency/high priority software/antimalware/vulnerability update and scheduled time/time slots for such software updates, and/or other criteria/measures). In some embodiments, the network access API for protecting network capacity is an open API or standard/required API (e.g., required or standardized for applications for a certain network service provider, such as to be provided via the Verizon application store or the Apple AppStore) published for application and OS developers so that the applications and OS functions are designed to understand and implement the network access API for protecting network capacity. For example, a certification program can be established to provide application and OS developers with test specifications, working implementations, and/or criteria to make sure the network access API is properly implemented and is functioning in accordance with the specified requirements. In some embodiments, the network access API is an interface for communication with a service controller (e.g., service controller 122) or another network element/function (e.g., a service usage API for communication with a service usage server or billing interface/server or another network element/function that facilitates a secure communication for sending/receiving or otherwise communicating network access related information for protecting network capacity). In some embodiments, the network API provides for sponsored billing (e.g., reverse billing) of all, classified, and/or a subset of network service usage charges to a sponsored partner associated with the network service usage activity (e.g., application) that accesses the network API. In some embodiments, the network API provides for a sponsored service in which the network service usage activity (e.g., application) that accesses the network API provides a sponsored service partner credential to the network API, the credential is used as a billing mechanism to charge the sponsored partner, the user account is mediated to remove the sponsored partner charge, and the network API provides access service and/or information service (e.g., location information, local information, content information, network information, and/or any other information).

**[00239]** FIG. 22 illustrates another flow diagram for device assisted services (DAS) for protecting network capacity in accordance with some embodiments. At 2202, the process begins. At 2204, network service usage activities of a device are monitored (e.g., using a verified/verifiable service processor). At 2206, a network busy state (e.g., a measure of network capacity, availability, and/or performance) is determined based on the monitored network service usage activities (e.g., using various techniques as described herein). In some embodiments, a service processor on the device is used to determine (e.g., measure and/or characterize) a network busy state experienced by the device (e.g., which can be used to determine the network access control policy for one or more network capacity controlled services). At 2208, a network busy state report is sent to a network element/function (e.g., a service controller and/or another network element/function as described herein). At 2210, the process is completed. In some

embodiments, the service processor is verified using various techniques described herein. In some embodiments, the network busy state report includes one or more of the following: data rate, latency, jitter, bit error rate, packet error rate, number of access attempts, number of access successes, number of access failures, QoS level availability, QoS level performance, and variability in any of the preceding parameters. In some embodiments, the network busy state report includes one or more of the following: base station ID, cell sector ID, CDMA ID, FDMA channel ID, TDMA channel ID, GPS location, and/or physical location to identify the edge network element that is associated with the network busy state report to a network element. In some embodiments, the monitoring of network service usage activities includes measuring the network performance for traffic the device is transmitting/receiving and/or generating network performance testing traffic. In some embodiments, the network busy state is collected (e.g., and/or used to assist, supplement, and/or verify device based network busy state measures) by one or more network elements that can measure and/or report network busy state (e.g., BTS, BTSC, base station monitor, and/or airwave monitor). For example, airwave monitors and/or base station monitors can be provided to facilitate a reliable characterization of network busy state in a coverage area of one or more base stations and/or base station sectors, such as affixed mobile terminals (e.g., trusted terminals that can include additional network busy state monitoring and/or reporting functionality) installed (e.g., temporarily or permanently) in the coverage area of one or more base stations and/or base station sectors (e.g., in which a sector is the combination of a directional antenna and a frequency channel) so that the affixed mobile terminals perform network busy state monitoring and reporting to the service controller, the local base station, and/or other network element(s)/function(s) as similarly described herein. In some embodiments, the permanently affixed mobile terminals provide network monitors for reporting, for example, network busy state, to a central network element, such as the service controller, which can, for example, aggregate such network busy state information to determine network busy state for one or more network coverage areas. In some embodiments, the permanently affixed mobile terminals are always present in these locations where installed and always on (e.g., performing network monitoring), and can be trusted (e.g., the permanently affixed mobile terminals can be loaded with various hardware and/or software credentials). For example, using the permanently affixed mobile terminals, a reliable characterization of network busy state can be provided, which can then be reported to a central network element and aggregated for performing various network busy state related techniques as described herein with respect to various embodiments. In some embodiments, the network element/function uses the network busy state report (e.g., and other network busy state reports from other devices connected to the same network edge element) to determine the network busy state for a network edge element connected to the device. In some embodiments, network element/function sends a busy state report for the network edge element to the device (e.g., and to other devices connected to the same network edge element),

which the device can then use to implement differential network access control policies (e.g., for network capacity controlled services) based on the network busy state. In some embodiments, a network busy state is provided by a network element (e.g., service controller or service cloud) and broadcast to the device (e.g., securely communicated to the service processor).

**[00240]** FIG. 23 illustrates a network capacity controlled services priority level chart for device assisted services (DAS) for protecting network capacity in accordance with some embodiments. In some embodiments, various applications, OS functions, and/or other utilities/tools installed/loaded onto and/or launched/executing/active on a communications device (e.g., device 100) are classified as network capacity controlled services for protecting network capacity. In some embodiments, one or more of the network capacity controlled services are assigned or classified with network capacity controlled service levels or priority levels for protecting network capacity. In some embodiments, one or more of the network capacity controlled services are dynamically assigned or classified with network capacity controlled service levels or priority levels based on one or more criteria/measures (e.g., dynamic criteria/measures), such as network busy state, current access network, time based criteria, an associated service plan, and/or other criteria/measures. In some embodiments, a higher priority level means that the application or utility/function is granted higher relative priority for network access (e.g., a priority level 10 can provide for guaranteed network access and a priority level 0 can provide a blocked network access, while priority levels between 1 through 9 can provide relatively increasing prioritized network access potentially relative to allocated network access and other services requesting network access).

**[00241]** As shown in FIG. 23, the network capacity controlled services are dynamically assigned or classified with network capacity controlled service levels or priority levels based on the network busy state of the current access network. For example, an email application, Microsoft Outlook, is assigned different priority levels for protecting network capacity based on the network busy state, as shown: a priority level 6 for a network busy state (NBS) level of 10% (e.g., up to about 10% of the network capacity is being utilized based on current or recently/last measured/detected/determined network capacity/resources usage using various techniques as described herein), a priority level 5 for a network busy state (NBS) level of 25%, a priority level 4 for a network busy state (NBS) level of 50%, a priority level 3 for a network busy state (NBS) level of 75%, and a priority level 2 for a network busy state (NBS) level of 90%. As also shown, an antivirus (AV) software update application/utility/function is assigned different priority levels for protecting network capacity based on the network busy state: a priority level 9 for a network busy state (NBS) level of 10%, a priority level 7 for a network busy state (NBS) level of 25%, a priority level 5 for a network busy state (NBS) level of 50%, a priority level 3 for a network busy state (NBS) level of 75%, and a priority level 1 for a network busy state (NBS) level of 90%. Various

other applications and utilities/functions are shown with various priority level assignments/classifications based on the network busy state levels shown in the network capacity controlled services priority level chart of FIG. 23. As will be apparent to one of ordinary skill in the art, various assignments and/or techniques for dynamically assigning priority levels for network access based on network busy state levels can be applied for protecting network capacity (e.g., based on user preferences, service plans, access networks, a power state of device, a device usage state, time based criteria, and various other factors such as higher priority for urgent software and/or security updates, such as a high priority security or vulnerability software patch or update, and/or urgent or high priority emails or other communications, such as a 911 VOIP call).

**[00242]** Referring again to FIGS. 1 through 3, DAS for protecting network capacity is implemented using a service processor (e.g., a service processor 115) of the device (e.g., a device 100) using various DAS techniques as described herein to facilitate differential network service access control (e.g., for network capacity controlled services) to assist in protecting network capacity in accordance with some embodiments. In some embodiments, the service processor and/or one or more agents of the service processor is/are verified using one or more of the following verification techniques (e.g., and/or to specifically verify monitoring the network service usage activity, classifying one or more service activities into one or more network capacity controlled service classes, associating the one or more network capacity controlled service classes with one or more differential service activity policies, and/or determining a network busy state): compare a network based service usage measure with a service policy and/or service plan associated with the device, compare a device assisted service usage measure with the service policy and/or service plan associated with the device, compare the network based service usage measure to the device assisted service usage measure, compare a first device assisted service usage measure to a second device assisted service usage measure, verify presence of the service processor and/or one or more agents of the service processor, verify configuration of the service processor, verify service usage activities are reported properly (e.g., using test service usages to generate service usage events/reports for analysis and confirmation), verify billing events are reported properly, compare the network based service usage measure with reported device billing data, verify reporting of a test billing event, verify reporting of the communications device reports billing events from a transaction server, verify presence of an activation tracking system, verify device configuration or operation, verify device standing or service plan standing, verify proper operation of the service processor, verify service processor heartbeat response reports, verify monitoring of a test service event, download a new service processor (e.g., and/or one or more agents or new configuration settings of the service processor) and perform integrity checks, verify a service processor code configuration with agent self-diagnosis checks,

verify that the communications device uses the first service only after being authorized, verify user standing, verify a network busy state (e.g., compare and/or statistically process network busy state measures from more than one device in which the network busy state monitoring apparatus, for example, is located in a secure execution environment on the device), verify various differential network access control implementations (e.g., network capacity controlled services are properly monitored/determined/detected, controlled, accounted for, and/or charged for), verify various QoS implementations (e.g., as discussed above), and verify an agent communications log. Various other verification techniques are described herein and similar and other verification techniques for providing DAS for protecting network capacity using device based implementations (e.g., service processors and/or other device based agents or software/hardware techniques) will now be apparent to one of ordinary skill in the art in view of the various embodiments described herein.

**[00243]** In some embodiments, the service processor is secured using various hardware and software techniques described herein, including, for example, implementing all and/or portions of the service processor in a secure virtual machine, protected execution environment, secure storage (e.g., secure memory), secure modem, and/or other secure implementation techniques as described herein and/or other or similar techniques as will now be apparent to one of ordinary skill in the art in view of the various embodiments described herein. For example, the service processor can be implemented in software and executed in a protected area of an OS executed on the device and/or executed in protected execution partitions (e.g., in CPU, APU, SIM chipset, modem, modem secure execution partition, SIM, other hardware function on the device, and/or any combination of the above).

**[00244]** In some embodiments, a network service usage counter is embedded into a secure execution environment (e.g., a program store in secure non-volatile memory located on a modem card and/or a modem chip not accessible by device applications, secure CPU environment for executing program and/or secure program operation for data path monitoring and/or control that cannot be bypassed by device applications to get to the modem connection to the network) in a device modem (e.g., using measurement points V, VI, and/or other measurement points of FIG. 12). In some embodiments, the service usage counter counts data traffic (e.g., bytes and/or any other measure of service usage, such as file transactions, message transactions, connection time, time of connection or duration of connection, and/or traffic passed or transactions passed for a given QoS or network capacity controlled service priority level), traffic as a function of time, traffic according to a network service activity classification (e.g., by application, destination/source, port, traffic type, content type, time of day, network busy state, and/or any other criteria/measure). In some embodiments, the service usage counter counts data traffic (e.g., as discussed above) while coordinating with a VPN layer established, for example, for both layer-III (e.g., IPSEC) and

layer-II (e.g., L2TP tunnel) so that precise over the air service usage measure is counted for billing mediation and/or network service usage charging (e.g., customer billing, sponsored service bill by service and/or any other charging or billing). In some embodiments, the service usage counter counts data traffic (e.g., as discussed above) while coordinating with accelerator software (e.g., a compression/decompression engine) which transforms frames for more efficient over the air transmission. As similarly discussed above, service processor coordination with the accelerator layer facilitates a precise over the air service usage measure for billing mediation and/or network service usage charging. In some embodiments, the service usage counter counts data traffic (e.g., as discussed above) while coordinating with both the VPN layer and accelerator software layer to facilitate a precise over the air service usage measure for billing mediation and/or network service usage charging.

**[00245]** In some embodiments, the service usage counter reports the service usage to a network element (e.g., a service controller, charging gateway, PCRF, AAA, HA, billing system, mediation system, traffic accounting database, base station or base station controller, and/or another network element/function or central network element/function). In some embodiments, the information reported to the network element is encrypted or signed with a corresponding key known by the network element. In some embodiments, the communication link to the network element to pass the service usage count is conducted over a wireless network specific channel such as SMS, MMS, SS-7, or another specialized control channel. In some embodiments, the communications link to the network element to pass the service usage count is conducted over a network channel (e.g., via IP, TCP, UDP, HTTP, HTTPS, TLS, SSL, point to point signed variants of TLS or SSL, or another data network channel via the network control channel connection to the device). In some embodiments, the data network control channel traffic is injected into the PPP stream at the modem. In some embodiments, the data network control channel traffic is passed up to the device networking stack for connection to the network. In some embodiments, a signed or encrypted service usage count from the modem subsystem is coordinated to provide a service usage count for a time period that also corresponds to a similar time period for a service processor heartbeat report that includes a service usage measure or count. For example, this provides the service controller or another network element with a secondary set of information that can be used to verify and/or secure the service usage measures reported by the service processor. Various techniques can be used to synchronize the time period for the modem service usage count and the service processor service usage count. For example, the service processor can request a latest count message from the modem, in which the modem counts all service usage since the previous request for latest count until the present request for latest count, encrypts the latest count message so that the service processor or other application software or OS software on the device cannot decode and/or tamper with the message, and the

modem service usage counter then passes the encrypted message to the service processor. The service processor can then pass the encrypted service usage count message from the modem to the service controller along with the service processor service usage accounting message(s) for the same or similar time period. The service controller can then decode both service count messages from the secure modem subsystem and the service processor and correlate the two measures to verify the service usage reporting by, for example, looking for discrepancies that would indicate service usage control or charging errors or device service processor tampering. In some embodiments, the secure modem subsystem records byte counts for streams (e.g., and/or flows, socket connections, or combinations of IP destination/source/ports), potentially along with time of day, network busy state, QoS level, and/or other criteria/measures, and reports these counts for each stream that had traffic activity during the current reporting interval. For example, the service controller can then correlate the stream service usage information with the service usage information provided by the service processor heartbeat service usage report to verify that the service processor service usage report is consistent with the independent measure made in the modem subsystem. In some embodiments, service usage reports (e.g., certified service usage reports) are correlated on the device and/or in the network (e.g., using one or more network elements/functions, such as the service controller).

**[00246]** In some embodiments, a deeper analysis of traffic can be conducted in the modem subsystem service usage count. For example, a layer 7 analysis of the service usage can be conducted for HTTP or HTTPS traffic flowing through the modem in which the modem subsystem service usage counter performs an HTTP level analysis of the traffic to associate web traffic gets and other transfers with a given higher level service classification (e.g., ad server, content server, proxy server, and/or traffic that is referred by the local host serving up a web page). In some embodiments, the modem subsystem service usage count can be augmented for HTTPS, SSL or TLS traffic by including a trusted proxy server embedded in the modem system. For example, the proxy server can be trusted by the device stack so that the encryption keys for HTTPS, TLS or SSL are known by the proxy server allowing the modem based proxy server, located, for example, in a secure execution environment, to perform layer 7 analysis of encrypted traffic in a manner similar to that described above. In some embodiments, the embedded proxy server generates server SSL certificates for each connection to a specific remote host in real time based on a root certificate trusted by the device (e.g., and/or by network service usage activity, such as by application) and also trusted by the embedded proxy server, and the proxy server then becomes a middle man emulating a remote SSL host on one side and emulating the device (e.g., and/or network service usage activity, such as application) on the other side, decrypting the traffic, analyzing it and re-encrypting before forwarding to and from the remote host. Similarly, as in the case of layer 3 and 4 traffic analysis

performed by the modem service usage counting subsystem, the layer 7 service usage count messages can be encrypted and passed to the service controller via various channels. In some embodiments, the layer 7 modem subsystem service usage counting system records service usage counts for a reporting time period that is similar to the reporting time period used by the service processor so that the service controller can correlate the service processor accounting messages against the modem accounting messages with layer 7 information.

**[00247]** In some embodiments, the secure service usage reporting system elements are located in a secure execution environment that includes the modem driver. In some embodiments, all traffic that gets to the modem for the network traffic being controlled or accounted for is required to go through the secure modem driver so that an independent count can be generated and reported to the service controller as described above without the need to embed the secure service usage counting and reporting elements in the modem.

**[00248]** In some embodiments, the secure service usage reporting system elements are located in a secure execution environment that includes the modem driver and modem hardware interface controller driver (e.g. USB controller for 2/3/4G and SDIO controller for WiFi). In some embodiments, all traffic that gets to the modem for the network traffic being controlled or accounted for is required to go through the secure modem driver and modem hardware interface controller driver (e.g. USB controller for 2/3/4G and SDIO controller for WiFi) so that precise count can be generated by either the modem driver and/or modem hardware interface controller driver (e.g. USB controller for 2/3/4G and SDIO controller for WiFi) and passed to the secure service usage reporting element to send it to the service controller for customer charging/billing. This scheme provides flexibility (e.g., most of the device software and operation system and its services/applications need not be located/executed in the secure execution environment) while ensuring usage counting to occur securely as it pertains to the customer accounting and billing.

**[00249]** In some embodiments, the layer 7 proxy server traffic accounting and reporting techniques used for processing HTTPS, TLS, and SSL traffic, as discussed above, are also used in the service processor itself to allow a detailed accounting of encrypted layer 7 traffic by the device. In some embodiments, the information thus obtained is filtered so that private user information is not transmitted to the network (e.g., service controller, PCRF, and/or any other network element/function) but only service usage information sufficient to allow for accounting of service plan usage, to verify service control policy implementation, or to verify service charging policy implementation is transmitted to the network (e.g., service controller, PCRF, and/or any other network element/function). In some embodiments, the layer 7

proxy server for processing secure or in the clear device service usage accounting messages is located in secure hardware execution environments in the device application processor or within secure software partitions in the operating system.

**[00250]** Various techniques can be used to verify and/or secure service usage controls or service usage charging reports. For example, if the secondary service usage reports indicate that service usage is outside of the service usage policy limits that are intended to be in effect (e.g., based on a service plan and/or service policy associated with the device), then the service controller can indicate an error flag for further analysis and action (e.g., implementing various verification and responsive actions as described herein, such as blocking the activity, throttling the activity, quarantining the device, updating/replacing the service processor, and/or monitoring the device using various additional DAS and/or network assisted monitoring techniques). As another example, if the service usage reports from the service processor do not match up with the secondary service usage reports, then the service controller can indicate an error flag for further analysis and action. For example, the correlation can be based on bulk measures of service usage (e.g., total bytes over a given period of time), or using finer grain measures of service usage (e.g., verifying the accounting between one group of service usage activities, such as application, destination/source, port, content type, time of day, network busy state, QoS level, and/or other criteria/measures) charged to one service plan charging record versus the accounting for another group of service usage activities charged to another service plan charging record. In some embodiments, the correlation process between the two service usage accounting reports is performed continuously on all device traffic in real time or near real time as the usage accounting reports are received. In some embodiments, the usage accounting reports are stored and analyzed or correlated later (e.g., periodically, based on a request or audit, and/or based on certain events, such as threshold network service usage events and/or any other events based on various criteria/measures). In some embodiments, only an audit of a portion of time is used to correlate the two usage accounting reports, which, for example, can reduce network traffic and/or network processing load in the service controller.

**[00251]** In some embodiments, correlation techniques are applied by the service controller to compare two different service usage measures as described above based on one or more of the following: total amount of data (e.g., bytes for file transfers, sessions, and/or other measures), amount of data per unit time, total number of accesses, number of accesses per unit time or frequency of accesses, accesses during a time interval (e.g., peak time), accesses during a network busy state, access requests, and individual versus group transmissions at a point in time (e.g., each for a given set of destinations or destinations and traffic types).

**[00252]** In some embodiments, service usage monitoring includes characterizing service usage activities by streams, flows, destination/port, packet inspection, and/or other criteria/measures using the various techniques as described herein and/or other or similar techniques as would be apparent to one of ordinary skill in the art. In some embodiments, service usage monitoring includes characterizing service usage activities by streams, flows, destination/port, packet inspection, and/or other criteria/measures and then correlating to find network service usage behavior patterns that identify likely association of behavior with one or more service activities being managed.

**[00253]** In some embodiments, DAS for network capacity control includes classifying traffic to determine which network service usage activity(ies) are causing traffic (e.g., increasing network capacity/resources usage beyond a threshold), and then determining if access network service usage activity(ies) are violating any rules (e.g., service usage policies or service plan settings associated with the device/user). In some embodiments, DAS for network capacity control includes generating a list for network capacity controlled services that specifies behavioral characteristics for one or more network service usage activities with expected access limits based on access control policy for each managed network service usage activity (e.g., based on service usage policies or service plan settings associated with the device/user). In some embodiments, DAS for network capacity control includes monitoring and/or controlling network service usage activities based on limits, which, for example, can be based on one or more of the following: total access traffic counters, counters for different types of access traffic, destinations, ports, frequency of accesses, access behavior during a given time, access behavior during a given busy state, access behavior for groups of activities (e.g., verify clumping), and/or other criteria/measures.

**[00254]** Accordingly, in some embodiments, a second secure and trusted service usage measure is provided that the service controller (e.g., or another network element/function) can use to verify or secure the service control or service charging reports for the service processor. In some embodiments, the secure and trusted service usage measure also provides for enhanced verification and service security in cases, in which, for example, network based service usage measures are available for additional correlation with the service processor service usage reports. In cases in which network based service usage measures are either not available or are only available at widely spaced time intervals (e.g., roaming networks or other networks with no timely network based service usage measure), these techniques facilitate real time or near real time verification or security for the device assisted service controls and charging.

**[00255]** In some embodiments, a SIM card performs a portion or all of the secure environment processing described above, with the device modem traffic, or a copy of the device modem traffic, being

directed to the SIM secure subsystem for traffic accounting and reporting. In some embodiments, a SIM card is used to store QoS classifications and/or network capacity controlled services classifications for various service usage activities so that the user behavior in using certain network service usage activities and/or the user preferences in controlling certain network service usage activities do not need to be relearned or redownloaded as the user swaps the SIM between different devices. In some embodiments, the SIM keeps a local record of service usage activity for multiple devices that belong to the user or the user family plan, so that the service usage notification and policies can be immediately updated on a given device as the user swaps the SIM from device to device. In some embodiments, the manner in which this service usage history is stored on the SIM is secure so that it cannot be tampered with. In some embodiments, the SIM card is used to implement various application management and/or traffic control techniques described herein. In some embodiments, the SIM card is used to inspect traffic, classify traffic, create reports (e.g., certified service activity usage reports), encrypt the report, send the report to a network element/function, and the network element/function correlates the reports (e.g., using network assisted measures for comparisons and/or using various other techniques as described herein). In some embodiments, a SIM card performs a portion or all of the secure environment processing described above using one or more modem measurement points. For example, the traffic that is to be classified can be routed through the SIM and correlated with what is measured by the modem. In some embodiments, network assisted/based network service usage activity classifications are compared SIM based/assisted classifications for service usage monitoring/reporting verification (e.g., detected inconsistencies in monitored/reported network service usage activities can be identified, such as based on total traffic, streams/flows/sockets activities, and/or other criteria/measures). In some embodiments, the reports include a verified sequence so that reports cannot be spoofed and/or missing reports can be determined.

**[00256]** In some embodiments, a portion or all of the secure environment processing described above are applied to implement and/or verify QoS for DAS techniques and/or DAS for network capacity controlled services techniques as described herein.

**[00257]** In some embodiments, the reports include one or more of the following: a number of times the device is cycled from or to a power cycle state in the modem, a number of times during a time window or network busy state, a power cycle versus number of streams initiated during the cycle, and a power cycle versus the streams that are transmitted during that cycle, In some embodiments, device power cycle events trigger generating of a report.

**[00258]** In some embodiments, monitoring, reporting, control, accounting, charging, and/or policy implementation for network capacity controlled services is verified (e.g., using various verification

techniques described herein). If any of the verification techniques determine or assist in determining that the network capacity controlled services monitoring, reporting, control, accounting, and/or charging, and/or policy implementation has been tampered with, disabled, and/or is not properly implemented or functioning, then responsive actions can be performed, for example, the device (e.g., and/or suspect services) can be suspended, quarantined, killed/terminated, and/or flagged for further analysis/scrutiny to determine whether the device is malfunctioning, needs updating, has been tampered with or compromised, is infected with malware, and/or if any other problem exists.

**[00259]** In some embodiments, the service processor monitors a network service usage activity of a device. In some embodiments, monitoring of the service usage activity includes monitoring for multiple networks (e.g., to determine which networks are available and/or a network busy state of the available networks). In some embodiments monitoring a network service usage activity is performed by and/or assisted by a service cloud (e.g., one or more network elements that provide such a service). In some embodiments, monitoring the network service usage activity includes identifying the network service usage activity, measuring the network service usage of the network service usage activity, and/or characterizing the network service usage of the network service usage activity (e.g., using device assisted/based techniques, network assisted/based techniques, testing/offline monitoring/analysis techniques, and/or a combination thereof).

**[00260]** In some embodiments, the service processor implements differential network access service control (e.g., for network capacity controlled services), network service usage accounting, network service usage charging, and/or network service usage notification on the device to facilitate DAS for protecting network capacity.

**[00261]** In some embodiments, the service processor (e.g., a service processor 115) is updated, communicated with, set, and/or controlled by a network element (e.g., a service controller 122). In some embodiments, the service processor receives service policy information from a network function selected from a base station (e.g., a base station 125), a RAN gateway, a core gateway, a DPI gateway, a home agent (HA), a AAA server (e.g., AAA server 121), a service controller, and/or another network function or combinations of network functions as described herein and/or as will now be apparent to one of ordinary skill in the art in view of the various embodiments described herein. In some embodiments, the service processor is updated through over the air or over the network OS software updates or application software updates or device firmware updates. In some embodiments, the service processor uses an IP connection, SMS connection, and/or MMS connection, for a control channel with a service controller. In some embodiments, the service processor queries a service controller to determine the association of a

monitored network service usage activity with a network service usage control policy. In some embodiments, the device (e.g., service processor) maintains a network capacity controlled services list and/or network capacity controlled services policy for one or more of the active services (e.g., actively executing and/or previously installed/downloaded to the device) that have been classified as a network capacity controlled service (e.g., as the number of applications continues to grow, as hundreds of thousands of applications are already available on certain platforms, maintaining a list specific and/or a set of policies unique or specific to each application is not efficient). In this embodiment, when a new application is active/launched and/or downloaded to the device, the device can request an updated network capacity controlled services list and/or an updated network capacity controlled services policy accordingly (e.g., and/or periodically refresh such lists/policies).

**[00262]** In some embodiments, differential network access control for protecting network capacity includes controlling network services traffic generated by the device (e.g., network capacity controlled services based on a network service usage control policy (e.g., a network capacity controlled services policy). In some embodiments, differential network access control for protecting network capacity includes providing assistance in control of the distribution of bandwidth among devices, network capacity controlled services (e.g., applications, OS operations/functions, and various other network services usage activities classified as network capacity controlled services), a differentiated QoS service offering, a fair sharing of capacity, a high user load network performance, and/or preventing one or more devices from consuming so much network capacity that other devices cannot receive adequate performance or performance in accordance with various threshold and/or guaranteed service levels. In some embodiments, differential network access control for protecting network capacity includes applying policies to determine which network the service activity should be connected to (e.g., 2G, 3G, 4G, home or roaming, WiFi, cable, DSL, fiber, wired WAN, and/or another wired or wireless or access network), and applying differential network access control rules (e.g., traffic control rules) depending on which network to which the service activity is connected. In some embodiments, differential network access control for protecting network capacity includes differentially controlling network service usage activities based on the service usage control policy and a user input (e.g., a user selection or user preference). In some embodiments, differential network access control for protecting network capacity includes differentially controlling network service usage activities based on the service usage control policy and the network the device or network service activity is gaining access from.

**[00263]** In some embodiments, the network service usage control policy is dynamic based on one or more of the following: a network busy state, a time of day, which network the service activity is connected to, which base station or communication channel the service activity is connected to, a user

input, a user preference selection, an associated service plan, a service plan change, an application behavior, a messaging layer behavior, random back off, a power state of device, a device usage state, a time based criteria (e.g., time/day/week/month, hold/delay/defer for future time slot, hold/delay/defer for scheduled time slot, and/or hold/delay/defer until a busy state/availability state/QoS state is achieved), monitoring of user interaction with the service activity, monitoring of user interaction with the device, the state of UI priority for the service activity, monitoring the power consumption behavior of the service activity, modem power cycling or power control state changes, modem communication session set up or tear down, and/or a policy update/modification/change from the network. In some embodiments, the network service usage control policy is based on updated service usage behavior analysis of the network service usage activity. In some embodiments, the network service usage control policy is based on updated activity behavior response to a network capacity controlled service classification. In some embodiments, the network service usage control policy is based on updated user input/preferences (e.g., related to policies/controls for network capacity controlled services). In some embodiments, the network service usage control policy is based on updates to service plan status. In some embodiments, the network service usage control policy is based on updates to service plan policies. In some embodiments, the network service usage control policy is based on availability of alternative networks. In some embodiments, the network service usage control policy is based on policy rules for selecting alternative networks. In some embodiments, the network service usage control policy is based on network busy state or availability state for alternative networks. In some embodiments, the network service usage control policy is based on specific network selection or preference policies for a given network service activity or set of network service activities.

**[00264]** In some embodiments, associating the network service usage activity with a network service usage control policy or a network service usage notification policy, includes dynamically associating based on one or more of the following: a network busy state, a time of day, a user input/preference, an associated service plan (e.g., 25 MB data plan, 5G data plan, or an unlimited data plan or other data/service usage plan), an application behavior, a messaging layer behavior, a power state of device, a device usage state, a time based criteria, availability of alternative networks, and a set of policy rules for selecting and/or controlling traffic on one or more of the alternative networks.

**[00265]** In some embodiments, a network service usage control policy (e.g., a network capacity controlled services policy) includes defining the network service usage control policy for one or more service plans, defining network access policy rules for one or more devices or groups of devices in a single or multi-user scenarios such as family and enterprise plans, defining network access policy rules for one or more users or groups of users, allowing or disallowing network access events or attempts,

modulating the number of network access events or attempts, aggregating network access events or attempts into a group of access events or attempts, time windowing network access events or attempts, time windowing network access events or attempts based on the application or function being served by the network access events or attempts, time windowing network access events or attempts to pre-determined time windows, time windowing network access events or attempts to time windows where a measure of network busy state is within a range, assigning the allowable types of access events or attempts, assigning the allowable functions or applications that are allowed network access events or attempts, assigning the priority of one or more network access events or attempts, defining the allowable duration of network access events or attempts, defining the allowable speed of network access events or attempts, defining the allowable network destinations for network access events or attempts, defining the allowable applications for network access events or attempts, defining the QoS rules for one or more network access events or attempts, defining or setting access policy rules for one or more applications, defining or setting access policy rules for one or more network destinations, defining or setting access policy rules for one or more devices, defining or setting access policy rules for one or more network services, defining or setting access policy rules for one or more traffic types, defining or setting access policy rules for one or more QoS classes, and defining or setting access policy rules based on any combination of device, application, network destination, network service, traffic type, QoS class, and/or other criteria/measures.

**[00266]** In some embodiments, a network service usage control policy (e.g., a network capacity controlled services policy) includes a traffic control policy. In some embodiments, the traffic control policy includes a traffic control setting. In some embodiments, the traffic control policy includes a traffic control/tier, and the traffic control/tier includes the traffic control setting. In some embodiments, the traffic control policy includes one or more of the following: block/allow settings, throttle settings, adaptive throttle settings, QoS class settings including packet error rate, jitter and delay settings, queue settings, and tag settings (e.g., for packet tagging certain traffic flows). In some embodiments, QoS class settings, include one or more of the following: throttle level, priority queuing relative to other device traffic, time window parameters, and hold or delay while accumulating or aggregating traffic into a larger stream/burst/packet/group of packets. In some embodiments, the traffic control policy includes filters implemented as indexes into different lists of policy settings (e.g., using cascade filtering techniques), in which the policy filters include one or more of the following: a network, a service plan, an application, a time of day, and a network busy state. For example, a two dimensional traffic control implementation scheme can be provided using a network busy state and/or a time of day as an index into a traffic control setting (e.g., a certain application's priority level can be increased or decreased based on a network busy

state and/or time of day). In some embodiments, the traffic control policy is used for selecting the network from a list of available networks, blocking or reducing access until a connection is made to an alternative network, and/or modifying or replacing a network stack interface of the device to provide for intercept or discontinuance of network socket interface messages to applications or OS functions.

**[00267]** In some embodiments, a traffic control setting is selected based on the network service usage control policy. In some embodiments, the traffic control setting is implemented on the device based on the network service usage control policy. In some embodiments, the implemented traffic control setting controls traffic/traffic flows of a network capacity controlled service. In some embodiments, the traffic control setting is selected based on one or more of the following: a time of day, a day of week, a special time/date (e.g., a holiday or a network maintenance time/date), a network busy state, a priority level associated with the network service usage activity, a QoS class associated with the network service usage activity (e.g., emergency traffic), which network the network service activity is gaining access from, which networks are available, which network the network service activity is connected to, which base station or communication channel the network service activity is connected to, and a network dependent set of traffic control policies that can vary depending on which network the service activity is gaining access from (e.g., and/or various other criteria/measures as described herein). In some embodiments, the traffic control setting includes one or more of the following: allow/block, delay, throttle, QoS class implementation, queue, tag, generate a user notification, random back off, clear to send received from a network element, hold for scheduled transmission time slot, selecting the network from the available networks, and blocking or reducing access until a connection is made to an alternative network. In some embodiments, the traffic control setting is selected based on a network capacity controlled services priority state of the network service usage activity and a network busy state. In some embodiments, the traffic control setting is selected based on a network capacity controlled services priority state of the network service usage activity and a network busy state and is global (e.g., the same) for all network capacity controlled services activities or varies based on a network service usage activity priority, user preferences or option selection, an application, a time based criteria, a service plan, a network the device or service activity is gaining access from, a redetermination of a network congestion state after adapting to a previously determined network busy state, and/or other criteria/measures as described herein.

**[00268]** In some embodiments, network capacity controlled services traffic (e.g., traffic flows) is differentially controlled for protecting network capacity. For example, various software updates for an OS and one or more applications on the device can be differentially controlled using the various techniques described herein. As another example, security/antimalware software (e.g., antivirus, firewall, content protection, intrusion detection/prevention, and/or other security/antimalware software) can be

differentially controlled using the various techniques described herein. As yet another example, network backups/imaging, content downloads (e.g., exceeding a threshold individually and/or in aggregate, such as for image, music, video, eBook content, email attachments, content/media subscriptions, RSS/news feeds, text/image/video chat, software updates, and/or other content downloads) can be differentially controlled using the various techniques described herein.

**[00269]** For example, using the DAS for protecting network capacity techniques described herein an adaptive policy control for protecting network capacity can be provided. A network capacity controlled services list can be generated, updated, reported, and/or received by the device and stored on the device (e.g., the list can be based on adapted to the service plan associated with the device). If a monitored network service usage activity is not on the list, then the device can report the monitored network service usage activity to a network element (e.g., for a monitored network service usage activity that also exceeds a certain threshold, based on a network busy state, based on a time based criteria, and/or other criteria/measure). As an example, monitored network service usage activity can be reported if/when the monitored network service usage activity exceeds a data usage threshold (e.g., 50 MB total data usage per day, a socket opening frequency/rate, velocity of data usage at an instant in time, or more complicated thresholds over time, over peak periods, by content and time, by various other parameters/thresholds). As another example, the monitored network service usage activity can be reported based on testing of the network service usage behavior and/or application developer characterization input. The report can include information that identifies the network service usage activity and various network service usage parameters.

**[00270]** In some embodiments, a notification setting is selected based on a service usage notification policy. In some embodiments, a notification setting includes a user notification setting (e.g., various user notifications settings as described above with respect to FIG. 18).

**[00271]** In some embodiments, classifying the network service usage activity further includes classifying the network service usage activity (e.g., using a usage threshold filter and/or cascading filter techniques) into one or more of a plurality of classification categories for differential network access control for protecting network capacity. In some embodiments, classifying the network service usage activity, further includes classifying the network service usage activity into one or more network capacity controlled services in which the network capacity controlled services include one or more of the following: applications requiring data network access, application software updates, applications requiring network information, applications requiring GPS or physical location, operating system software updates, security software updates, network based backups, email downloads, and a set of

activities configured as network capacity controlled service activities based on a service profile and/or user input (e.g., and/or various other types of network service usage activities as described herein and as will now be apparent to one of ordinary skill in the art). For example, network capacity controlled services can include software updates for OS and applications, OS background network accesses, cloud synchronization services, RSS feeds & other background information feeds, browser/application/device behavior reporting, background email downloads, content subscription service updates and downloads (e.g., music/video downloads, news feeds), text/voice/video chat clients, security updates (e.g., antimalware updates), peer to peer networking application updates, inefficient network access sequences during frequent power cycling or power save state cycling, large downloads or other high bandwidth accesses, and greedy application programs that constantly/repeatedly access the network with small transmissions or requests for information. In some embodiments, a network capacity controlled services list is static, adaptive, generated using a service processor, received from a network element (e.g., service controller or service cloud), received from a network element (e.g., service controller or service cloud) and based at least in part on device activity reports received from the service processor, based on criteria set by pre-testing, report of behavior characterization performed by the application developer, and/or based at least in part on user input. In some embodiments, the network capacity controlled services list includes one or more network service activity background (QoS) classes.

**[00272]** In some embodiments, classifying the network service usage activity further includes classifying the network service usage activity based on one or more of the following: application or widget (e.g., Outlook, Skype, iTunes, Android email, weather channel weather widget, iCal, Firefox Browser, etc), application type (e.g., user application, system application/utility/function/process, OS application/utility/function/process, email, browser, widget, malware (such as a virus or suspicious process), RSS feed, device synchronization service, download application, network backup/imaging application, voice/video chat, peer to peer content application or other peer to peer application, streaming media feed or broadcast reception/transmission application, network meeting application, chat application or session, and/or any other application or process identification and categorization), OS/system function (e.g., any system application/utility/function/process and/or OS application/utility/function/process, such as a OS update and/or OS error reporting), modem function, network communication function (e.g., network discovery or signaling, EtherType messages, connection flow/stream/session set up or tear down, network authentication or authorization sequences, IP address acquisition, and DNS services), URL and/or domain, destination/source IP address, protocol, traffic type, socket (e.g., IP address, protocol, and/or port), socket address/label/identifier (e.g., port address/port number), content type (e.g., email downloads, email text, video, music, eBooks, widget update streams, and download streams), port (e.g.,

port number), QoS classification level, time of day, on peak or off peak, network time, network busy state, access network selected, service plan selected, user preferences, device credentials, user credentials, and/or status, modem power cycling or power state changes, modem authentication processes, modem link set up or tear down, modem management communications, modem software or firmware updates, modem power management information, device power state, and modem power state. In some embodiments, classifying the network service usage activity further includes associating the classified network service usage activity with an ID (e.g., an application ID, which can be, for example, a unique number, name, and/or signature). In some embodiments, classifying the network service usage activity further includes classifying the network service usage activity using a plurality of classification parameters, including one or more of the following: application ID, remote IP (e.g., URL, domain, and/or IP address), remote port, protocol, content type, a filter action class (e.g., network busy state class, QoS class, time of day, network busy state, and/or other criteria/measures), and access network selected. In some embodiments, classifying the network service usage activity further includes using a combination of parameters as discussed above to determine the classification of the network service usage activity.

**[00273]** In some embodiments, classifying the network service usage activity further includes classifying the network service usage activity as a network capacity controlled service, a non-network capacity controlled service, a blocked or disallowed service, and/or a not yet classified/identified service (e.g., unknown/yet to be determined classification or pending classification). In some embodiments, an application connection, OS connection, and/or other service activity is classified as a network capacity controlled service activity when the device has been inactive (e.g., or in a power save state) for a period of time (e.g., when the user has not interacted with it for a period of time, when it has not displayed user notification policy, and/or a user input has not been received for a period of time, and/or when a power save state is entered). In some embodiments, an application connection, OS connection, and/or other service activity is classified as a network capacity controlled service activity when the monitored network service usage activity exceeds a data usage threshold for more than one application connection, OS connection, and/or other service activity (e.g., aggregated data usage exceeds the data usage threshold); or for a specific application connection. In some embodiments, an application connection, OS connection, and/or other service activity is classified as a network capacity controlled service activity when the monitored network service usage activity exceeds a data usage threshold based on a predetermined list of one or more data usage limits, based on a list received from a network element, usage time limit (e.g., based on a period of time exceeding a usage limit), and/or based on some other usage related criteria/measures. In some embodiments, classifying the network service usage activity further includes classifying the network service usage activity as a network capacity controlled service based on a network

peak time, a network busy state, or a network connection to the device falls below a certain performance level (e.g., higher/lower priorities assigned based on various such criteria/other input/factors).

**[00274]** In some embodiments, one or more of the network capacity controlled services are associated with a different network access policy set for one or more networks and/or one or more alternative networks. In some embodiments, one or more of the network capacity controlled services are associated with a different notification policy set for one or more networks and/or one or more alternative networks. In some embodiments, the network capacity controlled services list is stored on the device. In some embodiments, the network capacity controlled services list is received/periodically updated from a network element and stored on the device. In some embodiments, the network capacity controlled services list includes network capacity controlled services, non-network capacity controlled services (e.g., foreground services or services based on various possibly dynamic criteria are not classified as network capacity controlled services), and an unclassified set of services (e.g., grey list including one or more network service activities pending classification based on further analysis and/or input, such as from a network element, service provider, and/or user). In some embodiments, the network capacity controlled services list is based on one or more of the following: predefined/predesignated (e.g., network, service plan, pre-test and/or characterized by an application developer) criteria; device assisted/based monitoring (e.g., using a service processor); network based monitoring (e.g., using a DPI gateway); network assisted analysis (e.g., based on device reports of DAS activity analysis). For example, the device can report device monitored network service usage activities (e.g., all monitored network service usage activities or a subset based on configuration, threshold, service plan, network, and/or user input) to the network element. As another example, the network element can update the network capacity controlled services list and send the updated list to the device. As yet another example, the network element can perform a statistical analysis of network service activities across a plurality of devices based on the device based and/or network based network service usage activity monitoring/reporting. In some embodiments, a network service usage activity is determined to be an active application or process (e.g., based on a user interaction with the device and/or network service usage activity, such as a pop-up and/or other criteria/measures).

**[00275]** In some embodiments, implementing traffic control for network capacity controlled services is provided using various techniques. In some embodiments, the device includes a service processor agent or function to intercept, block, modify, remove or replace UI messages, notifications or other UI communications generated by a network service activity that whose network service usage is being controlled or managed (e.g., using various measurement points as shown in and described with respect to FIGS. 12 and 13). For example, this technique can be used to provide for an improved user experience

(e.g., to prevent an application that is being controlled for protecting network capacity from generating repeated and/or confusing messages/alerts to the user). In some embodiments, a network stack interface of the device is replaced or modified to provide for intercept or discontinuance of network socket interface messages to applications or OS functions or other functions/software.

**[00276]** In some embodiments, implementing traffic control for network capacity controlled services using DAS techniques is provided using various techniques in which the network service usage activity is unaware of network capacity control (e.g., does not support an API or other interface for implementing network capacity control). For example, network service application messaging interface based techniques can be used to implement traffic control. Example network service application messaging interfaces include the following: network stack API, network communication stream/flow interface, network stack API messages, EtherType messages, ARP messages, and/or other messaging or other or similar techniques as will now be apparent to one of ordinary skill in the art in view of the various embodiments described herein. In some embodiments, network service usage activity control policies or network service activity messages are selected based on the set of traffic control policies or service activity messages that result in reduced or modified user notification by the service activity due to network capacity controlled service policies applied to the network service activity. In some embodiments, network service usage activity control policies or network service activity messages are selected based on the set of traffic control policies or service activity messages that result in reduced disruption of device operation due to network capacity controlled service activity policies applied to the network service activity. In some embodiments, network service usage activity control policies or network service activity messages are selected based on the set of traffic control policies or service activity messages that result in reduced disruption of network service activity operation due to network capacity controlled service activity policies applied to the network service activity. In some embodiments, implementing traffic control for network capacity controlled services is provided by intercepting opens/connects/writes. In some embodiments, implementing traffic control for network capacity controlled services is provided by intercepting stack API level or application messaging layer requests (e.g., socket open/send requests). For example, an intercepted request can be copied (e.g., to memory) and queued (e.g., delayed or throttled) or dropped (e.g., blocked). As another example, an intercepted request can be copied into memory and then a portion of the transmission can be retrieved from memory and reinjected (e.g., throttled). As yet another example, intercepting messaging transmissions can be parsed inline and allowed to transmit (e.g., allowed), and the transmission or a portion of the transmission can be copied to memory for classifying the traffic flow. In some embodiments, implementing traffic control for network capacity controlled services is provided by

intercepting or controlling or modulating UI notifications. In some embodiments, implementing traffic control for network capacity controlled services is provided by killing or suspending the network service activity. In some embodiments, implementing traffic control for network capacity controlled services is provided by deprioritizing the process(es) associated with the service activity (e.g., CPU scheduling deprioritization).

**[00277]** In some embodiments, implementing traffic control for network capacity controlled services using DAS techniques for network service usage activities that are unaware of network capacity control is provided by emulating network API messaging (e.g., effectively providing a spoofed or emulated network API). For example, an emulated network API can intercept, modify, block, remove, and/or replace network socket application interface messages and/or EtherType messages (e.g., EWOULDBLOCK, ENETDOWN, ENETUNREACH, EHOSTDOWN, EHOSTUNREACH, EALRADY, EINPROGRESS, ECONNREFUSED, EINPROGRESS, ETIMEDOUT, and/other such messages). As another example, an emulated network API can modify, swap, and/or inject network socket application interface messages (socket(), connect(), read(), write(), close(), and other such messages) that provide for control or management of network service activity service usage behavior. As yet another example, before a connection is allowed to be opened (e.g., before a socket is opened), transmission, or a flow/stream is initiated, it is blocked and a message is sent back to the application (e.g., a reset message in response to a sync request or another message that the application will understand and can interpret to indicate that the network access attempt was not allowed/blocked, that the network is not available, and/or to try again later for the requested network access). As yet another example, the socket can be allowed to open but after some point in time (e.g., based on network service usage, network busy state, time based criteria, and/or some other criteria/measure), the stream is blocked or the socket is terminated. As yet another example, time window based traffic control techniques can be implemented (e.g., during non-peak, not network busy state times), such as by allowing network access for a period of time, blocking for a period of time, and then repeating to thereby effectively spread the network access out either randomly or deterministically. Using these techniques, an application that is unaware of network capacity control based traffic control can send and receive standard messaging, and the device can implement traffic controls based on the network capacity control policy using messaging that the network service usage activity (e.g., application or OS or software function) can understand and will respond to in a typically predictable manner as would now be apparent to one of ordinary skill in the art.

**[00278]** In some embodiments, implementing traffic control for network capacity controlled services using DAS techniques is provided using various techniques in which the network service usage activity is aware of network capacity control (e.g., the network service usage activity supports an API or other

interface for implementing network capacity control). For example, a network access API as described herein can be used to implement traffic control for network capacity controlled services. In some embodiments, the API facilitates communication of one or more of the following: network access conditions, network busy state or network availability state of one or more networks or alternative networks, one or more network capacity controlled service policies (e.g., the network service can be of a current network access setting, such as allow/block, throttle, queue, scheduled time/time slot, and/or defer, which can be based on, for example, a current network, a current network busy state, a time based criteria, a service plan, a network service classification, and/or other criteria/measures), a network access request from a network service activity, a query/polled request to a network service activity, a network access grant to a network service activity (e.g., including a priority setting and/or network capacity controlled service classification, a scheduled time/time slot, an alternative network, and/or other criteria/measures), a network busy state or a network availability state or a network QoS state.

**[00279]** In some embodiments, implementing traffic control for network capacity controlled services using network assisted/based techniques is provided using various techniques in which the network service usage activity is unaware of network capacity control (e.g., does not support an API or other interface for implementing network capacity control). In some embodiments, DPI based techniques are used to control network capacity controlled services (e.g., to block or throttle network capacity controlled services at a DPI gateway).

**[00280]** In some embodiments, implementing traffic control for network capacity controlled services using network assisted/based techniques is provided using various techniques in which the network service usage activity is aware of network capacity control (e.g., does support an API or other interface for implementing network capacity control). In some embodiments, the application/messaging layer (e.g., a network API as described herein) is used to communicate with a network service activity to provide associated network capacity controlled service classifications and/or priorities, network busy state information or network availability of one or more networks or alternative networks, a network access request and response, and/other criteria/measures as similarly described herein.

**[00281]** In some embodiments, DAS for protecting network capacity includes implementing a service plan for differential charging based on network service usage activities (e.g., including network capacity controlled services). In some embodiments, the service plan includes differential charging for network capacity controlled services. In some embodiments, the service plan includes a cap network service usage for network capacity controlled services. In some embodiments, the service plan includes a notification when the cap is exceeded. In some embodiments, the service plan includes overage charges when the cap

is exceeded. In some embodiments, the service plan includes modifying charging based on user input (e.g., user override selection as described herein, in which for example, overage charges are different for network capacity controlled services and/or based on priority levels and/or based on the current access network). In some embodiments, the service plan includes time based criteria restrictions for network capacity controlled services (e.g., time of day restrictions with or without override options). In some embodiments, the service plan includes network busy state based criteria restrictions for network capacity controlled services (e.g., with or without override options). In some embodiments, the service plan provides for network service activity controls to be overridden (e.g., one time, time window, usage amount, or permanent) (e.g., differentially charge for override, differentially cap for override, override with action based UI notification option, and/or override with UI setting). In some embodiments, the service plan includes family plan or multi-user plan (e.g., different network capacity controlled service settings for different users). In some embodiments, the service plan includes multi-device plan (e.g., different network capacity controlled service settings for different devices, such as smart phone v. laptop v. net book v. eBook). In some embodiments, the service plan includes free network capacity controlled service usage for certain times of day, network busy state(s), and/or other criteria/measures. In some embodiments, the service plan includes network dependent charging for network capacity controlled services. In some embodiments, the service plan includes network preference/prioritization for network capacity controlled services. In some embodiments, the service plan includes arbitration billing to bill a carrier partner or sponsored service partner for the access provided to a destination, application, or other network capacity controlled service. In some embodiments, the service plan includes arbitration billing to bill an application developer for the access provided to a destination, application or other network capacity controlled service.

**[00282]** In some application scenarios, excess network capacity demand can be caused by modem power state changes on the device. For example, when an application or OS function attempts to connect to the network for any reason when the modem is in a power save state wherein the modem is not connected to the network, it can cause the modem to change power save state, reconnect to the network, and then initiate the application network connection. In some cases, this can also cause the network to re-initiate a modem connection session (e.g., PPP session) which in addition to the network capacity consumed by the basic modem connection also consumes network resources for establishing the PPP session. Accordingly, in some embodiments, network service usage activity control policies are implemented that limit or control the ability of applications, OS functions, and/or other network service usage activities (e.g., network capacity controlled services) from changing the modem power control state or network connection state. In some embodiments, a service usage activity is prevented or limited from

awakening the modem, changing the power state of the modem, or causing the modem to connect to the network until a given time window is reached. In some embodiments, the frequency a service usage activity is allowed to awakening the modem, changing the power state of the modem, or causing the modem is limited. In some embodiments, a network service usage activity is prevented from awakening the modem, changing the power state of the modem, or causing the modem until a time delay has passed. In some embodiments, a network service usage activity is prevented from awakening the modem, changing the power state of the modem, or causing the modem until multiple network service usage activities require such changes in modem state, or until network service usage activity is aggregated to increase network capacity and/or network resource utilization efficiency. In some embodiments, limiting the ability of a network service usage activity to change the power state of a modem includes not allowing the activity to power the modem off, place the modem in sleep mode, or disconnect the modem from the network. In some embodiments, these limitations on network service usage activity to awaken the modem, change the power state of the modem, or cause the modem to connect to a network are set by a central network function (e.g., a service controller or other network element/function) policy communication to the modem. In some embodiments, these power control state policies are updated by the central network function.

**[00283]** FIG. 24 depicts a diagram of a network capacity protection system 2400 utilizing device-assisted services (DAS). The system 2400 includes wireless devices 2402-1 to 2402-N (referred to collectively as the wireless devices 2402), wireless networks 2404-1 to 2404-N (referred to collectively as the wireless networks 2404), a network traffic analysis engine 2406, a network service usage classification engine 2408, and a differential network access control engine 2410.

**[00284]** The wireless devices 2402 will at a minimum include a processor, memory (though the memory could be implemented in the processor), a radio, and a radio interface (though the radio interface could be implemented as "part of" the radio). In order to make the wireless devices 2402 useful, they will typically have at least one input device and at least one output device, including input and output interfaces, if applicable.

**[00285]** The wireless devices 2402 can be implemented as stations. A station, as used herein, may be referred to as a device with a media access control (MAC) address and a physical layer (PHY) interface to the wireless medium that comply with, e.g., the IEEE 802.11 standard. A station can be described as "IEEE 802.11-compliant" when compliance with the IEEE 802.11 standard is intended to be explicit. (I.e, a device acts as described in at least a portion of the IEEE 802.11 standard.) One of ordinary skill in the relevant art would understand what the IEEE 802.11 standard comprises today and that the IEEE

802.11 standard can change over time, and would be expected to apply techniques described in this paper in compliance with future versions of the IEEE 802.11 standard if an applicable change is made. IEEE Std 802.11™-2007 (Revision of IEEE Std 802.11-1999 ) is incorporated by reference. IEEE 802.11k-2008, IEEE 802.11n-2009, IEEE 802.11p-2010, IEEE 802.11r-2008, IEEE 802.11w-2009, and IEEE 802.11y-2008 are also incorporated by reference.

**[00286]** In alternative embodiments, one or more of the wireless devices 2402 may comply with some other standard or no standard at all, and may have different interfaces to a wireless or other medium. It should be noted that not all standards refer to wireless devices as "stations," but where the term is used in this paper, it should be understood that an analogous unit will be present on all applicable wireless networks. Thus, use of the term "station" should not be construed as limiting the scope of an embodiment that describes wireless devices as stations to a standard that explicitly uses the term, unless such a limitation is appropriate in the context of the discussion.

**[00287]** The wireless networks 2404 will typically include an internetworking unit (IWU) that interconnects wireless devices on the relevant one of the wireless networks 2404 with another network, such as a wired LAN. The IWU is sometimes referred to as a wireless access point (WAP). In the IEEE 802.11 standard, a WAP is also defined as a station. Thus, a station can be a non-WAP station or a WAP station. In a cellular network, the WAP is often referred to as a base station.

**[00288]** The wireless networks 2404 can be implemented using any applicable technology, which can differ by network type or in other ways. The wireless networks 2404 can be of any appropriate size (e.g., metropolitan area network (MAN), personal area network (PAN), etc.). Broadband wireless MANs may or may not be compliant with IEEE 802.16, which is incorporated by reference. Wireless PANs may or may not be compliant with IEEE 802.15, which is incorporated by reference. The wireless networks 2404 can be identifiable by network type (e.g., 2G, 3G, WiFi), service provider, WAP/base station identifier (e.g., WiFi SSID, base station and sector ID), geographic location, or other identification criteria.

**[00289]** The wireless networks 2404 may or may not be coupled together via an intermediate network. The intermediate network can include practically any type of communications network, such as, by way of example but not limitation, the Internet, a public switched telephone network (PSTN), or an infrastructure network (e.g., private LAN). The term "Internet" as used herein refers to a network of networks which uses certain protocols, such as the TCP/IP protocol, and possibly other protocols such as the hypertext transfer protocol (HTTP) for hypertext markup language (HTML) documents that make up the World Wide Web (the web).

**[00290]** In the example of FIG. 24, the network traffic analysis engine 2406 is coupled to the wireless device 2402-1. In a specific implementation, the network traffic analysis engine 2406 is implemented on a server and is coupled to the wireless device 2402-1 through the Internet. However, at least a portion of the network traffic analysis engine 2406 can alternatively be implemented on the wireless device 2402-1, with or without a connection to a server that includes another portion (e.g., a server portion) of the network traffic analysis engine 2406.

**[00291]** As used in this paper, an engine includes a dedicated or shared processor and, typically, firmware or software modules that are executed by the processor. Depending upon implementation-specific or other considerations, an engine can be centralized or its functionality distributed. An engine can include special purpose hardware, firmware, or software embodied in a computer-readable medium for execution by the processor. As used in this paper, a computer-readable medium is intended to include all mediums that are statutory (e.g., in the United States, under 35 U.S.C. 101), and to specifically exclude all mediums that are non-statutory in nature to the extent that the exclusion is necessary for a claim that includes the computer-readable medium to be valid. Known statutory computer-readable mediums include hardware (e.g., registers, random access memory (RAM), non-volatile (NV) storage, to name a few), but may or may not be limited to hardware.

**[00292]** The network traffic analysis engine 2406 analyzes a subset of traffic between the wireless device 2402-1 and a source or destination. The analyzed traffic may or may not be limited to a network segment, such as between a cellular phone and a base station. The network traffic analysis engine 2406 can analyze traffic for a subset of devices in the wireless network 2404-1 service area. The analyzed traffic may or may not be limited to subscribers.

**[00293]** In the example of FIG. 24, the network service usage classification engine 2408 is coupled to the network traffic analysis engine 2406. In a specific implementation, the network service usage classification engine 2408 is implemented on a server, which may or may not be the same server on which the network traffic analysis engine 2406 is implemented. However, at least a portion of the network service usage classification engine 2408 can alternatively be implemented on the wireless device 2402-1, with or without a connection to a server that includes another portion (e.g., a server portion) of the network service usage classification engine 2408.

**[00294]** The network service usage classification engine 2408 can categorize traffic based upon the service class (e.g., conversational, streaming, interactive, background, or some other service class) requested or needed for a service. The categorization facilitates identification of a snapshot of service

class use at a given time, and, in some implementations, predictions of future service class use based upon the snapshot (e.g., making an assumption that future service class use is at least somewhat related to service class use of the snapshot), historical data analysis (e.g., service class usage at certain times of day/days of the week), identification of trends, or the use of some other predictive technology.

**[00295]** In the example of FIG. 24, the differential network access control engine 2410 is coupled to the network service usage classification engine 2408. In a specific implementation, the network access control engine 2410 is implemented on a server, which may or may not be the same server on which the network traffic analysis engine 2406 and/or the network service usage classification engine 2408 are implemented. However, at least a portion of the network access control engine 2410 can alternatively be implemented on the wireless device 2402-1, with or without a connection to a server that includes another portion (e.g., a server portion) of the network access control engine 2410.

**[00296]** The differential network access control engine 2410 uses the predicted service class use from the network service usage classification engine 2408 to dynamically adjust resources allocated to service classes. For example, the differential network access control engine 2410 can perform a service class availability assessment to determine whether service class capacity for service classes on a channel are sufficient for predicted service usage, and either add resources if service class availability is insufficient for predicted service usage or reduce resources if service class availability is more than sufficient for predicted service usage.

**[00297]** Alternatively, the differential network access control engine 2410 can instead or in addition control applications on devices such that the applications change service usage levels or delay consumption of wireless resources (e.g., by delaying software updates until more resources become available). In an embodiment, a service usage control policy is implemented on the wireless device 2402-1. This may be necessary in some cases to ensure the wireless device 2402-1 can adjust application settings that are normally fixed, optimize network service usage activation based on network state (e.g., if the network is busy), control over-the-air software updates, throttle resource-hungry applications, manage network service usage requests from repeated power down modes, keep PPP sessions active, or otherwise facilitate dynamic service class adjustments or other device behavior.

**[00298]** In a specific implementation, subscribers can be incented to change service classes by, for example, charging more for higher service classes. The differential network access control engine 2410 can send a notification of differential charges for service classes. Alternatively, the charges could be implemented via subscriber account settings or preferences.

**[00299]** In the example of FIG. 24, in operation, the network traffic analysis engine 2406 analyzes traffic from one or more devices, including the wireless device 2402-1. The network service usage classification engine 2408 predicts the amount of resources needed for service classes, and the differential network access control engine 2410 dynamically allocates resources on an as-needed basis to adjust the service classes that are available to the one or more devices and/or adjusts device behavior for a subset of the one or more devices or instructs a subset of the one or more devices to adjust device behavior such that the device consumes service class-specific resources in accordance with an access control policy appropriate for the resources allocated to the applicable service classes.

**[00300]** FIG. 25 depicts a diagram an example of a differential access control notification system 2500. In the example of FIG. 25, the system 2500 includes a network service usage analysis engine 2502, a network service usage classification engine 2504, a differential network access control engine 2506, a network service usage control policy datastore 2508, a network service usage notification engine 2510, a user interface 2512, and a service plan update engine 2514.

**[00301]** In the example of FIG. 25, the network service usage analysis engine 2502 analyzes network service usage activity. The analysis can include an analysis of traffic sent to or from a device, an application running on a device, a request for services, or other analysis that is informative of past, current, or future network service usage. For example, the network service usage activity can include an attempt to download or load an application onto the communications device, an attempt to execute the network service activity or the network service usage activity attempts to access the network, meeting or exceeding a network service usage threshold, satisfying a network service usage pre-condition, an update to a network capacity controlled service activity classification list, an update to a network capacity controlled services policy, and a network message is sent to the device triggering the notification, to name several by way of example. The analysis can occur on a non-WAP station, a WAP or base station, a server, or partly on one of these devices or some other device.

**[00302]** In the example of FIG. 25, the network service usage classification engine 2504 is coupled to the network service usage analysis engine 2502. The network service usage classification engine 2504 classifies the analyzed network service usage into one or more service classes. The classification can occur on a non-WAP station, a WAP or base station, a server, or partly on one of these devices or some other device.

**[00303]** In the example of FIG. 25, the differential network access control engine 2506 is coupled to the network service usage classification engine 2504. The differential network access control engine 2506

determines network access parameters using the service classes associated with the network service usage activity and network service usage control policies stored in the network service usage control policy datastore 2508. The determination can occur on a non-WAP station, a WAP or base station, a server, or partly on one of these devices or some other device. The network service usage control policy datastore 2508 can be implemented on a wireless device, but it is also possible to maintain the datastore remotely relative to the device (e.g., on a server). In a specific implementation, even if the network service usage control policy datastore 2508 is maintained remotely relative to the wireless device, the wireless device will still have a network service usage control policy implemented.

**[00304]** A datastore can be implemented, for example, as software embodied in a physical computer-readable medium on a general- or specific-purpose machine, in firmware, in hardware, in a combination thereof, or in an applicable known or convenient device or system. Datastores in this paper are intended to include any organization of data, including tables, comma-separated values (CSV) files, traditional databases (e.g., SQL), or other applicable known or convenient organizational formats. Datastore-associated components, such as database interfaces, can be considered "part of" a datastore, part of some other system component, or a combination thereof, though the physical location and other characteristics of datastore-associated components is not critical for an understanding of the techniques described in this paper.

**[00305]** Datastores can include data structures. As used in this paper, a data structure is associated with a particular way of storing and organizing data in a computer so that it can be used efficiently within a given context. Data structures are generally based on the ability of a computer to fetch and store data at any place in its memory, specified by an address, a bit string that can be itself stored in memory and manipulated by the program. Thus some data structures are based on computing the addresses of data items with arithmetic operations; while other data structures are based on storing addresses of data items within the structure itself. Many data structures use both principles, sometimes combined in non-trivial ways. The implementation of a data structure usually entails writing a set of procedures that create and manipulate instances of that structure.

**[00306]** In the example of FIG. 25, the network service usage notification engine 2510 is coupled to the differential network access control engine 2506 and the network service usage control policy datastore 2508. The network service usage notification engine 2510 is configured to generate a notification sufficient to indicate relevant access control information. For example, the notification could indicate what network service usage activities are network capacity controlled services, the type of network service policy in effect for one or more network capacity controlled services, that a network service

activity belongs to a network capacity controlled services classification, that a service activity that is classified as network capacity controlled services classification can have the classification changed, that if the service class is changed for the network service activity that the associated network service usage charges will change, a service plan upgrade/downgrade offer, and an offer for a service plan that provides discounts and/or incentives for responding to one or more user notifications for protecting network capacity, to name several by way of example.

**[00307]** The notification may or may not also include a user preference selection. For example, the notification could include a provision to associate a network service usage control policy with the network service usage activity, an over-ride option for selecting the network service usage control policy, a modify option to select the service usage control policy, and a select option to select a new service plan, to name several by way of example. Other examples include network service usage activity information for one or more network capacity controlled services, predicted network service usage activity information for one or more network capacity controlled services, an option for obtaining more information about the network service usage of the network service usage activity, a message that the network service usage activity may result in network service usage that exceeds a threshold for a service plan associated with the device, an option to review or select an alternative service plan, an acknowledgement request, and an option to submit the acknowledgement request, to name several more by way of example.

**[00308]** In the example of FIG. 25, the user interface 2512 is coupled to the network service usage notification engine 2510. It may be noted that notifications can be disposed of by consulting user preferences (e.g., when a user indicates that maximum performance or minimum cost should be automatically selected). However, unless subscriber preferences are set as a default, a user is likely to have notifications displayed in the UI 2512. The notification can be in an applicable known or convenient form, such as SMS, email, a popup window, or the like. To the extent a response is permitted, a user can input a response to the notification using an input device (not shown).

**[00309]** In the example of FIG. 25, the service plan update engine 2514 is coupled to the UI 2512. As was previously mentioned, the UI can be bypassed because of, e.g., user preferences that are determinative of a selection provided in the notification. Regardless of how the selection associated with the notification is made, the service plan update engine 2514 can update a service plan, network service usage control policy, user preferences, or other parameters in accordance with the selection. The service plan update engine 2514 can also update accounting if costs accrue.

**[00310]** FIG. 26 depicts an example of a computer system 2600 on which techniques described in this paper can be implemented. The computer system 2600 may be a conventional computer system that can be used as a client computer system, such as a wireless client or a workstation, or a server computer system. The computer system 2600 includes a computer 2602, I/O devices 2604, and a display device 2606. The computer 2602 includes a processor 2608, a communications interface 2610, memory 2612, display controller 2614, non-volatile storage 2616, and I/O controller 2618. The computer 2602 may be coupled to or include the I/O devices 2604 and display device 2606.

**[00311]** The computer 2602 interfaces to external systems through the communications interface 2610, which may include a modem or network interface. It will be appreciated that the communications interface 2610 can be considered to be part of the computer system 2600 or a part of the computer 2602. The communications interface 2610 can be an analog modem, ISDN modem, cable modem, token ring interface, satellite transmission interface (e.g. "direct PC"), or other interfaces for coupling a computer system to other computer systems.

**[00312]** The processor 2608 may be, for example, a conventional microprocessor such as an Intel Pentium microprocessor or Motorola power PC microprocessor. The memory 2612 is coupled to the processor 2608 by a bus 2670. The memory 2612 can be Dynamic Random Access Memory (DRAM) and can also include Static RAM (SRAM). The bus 2670 couples the processor 2608 to the memory 2612, also to the non-volatile storage 2616, to the display controller 2614, and to the I/O controller 2618.

**[00313]** The I/O devices 2604 can include a keyboard, disk drives, printers, a scanner, and other input and output devices, including a mouse or other pointing device. The display controller 2614 may control in the conventional manner a display on the display device 2606, which can be, for example, a cathode ray tube (CRT) or liquid crystal display (LCD). The display controller 2614 and the I/O controller 2618 can be implemented with conventional well known technology.

**[00314]** The non-volatile storage 2616 is often a magnetic hard disk, an optical disk, or another form of storage for large amounts of data. Some of this data is often written, by a direct memory access process, into memory 2612 during execution of software in the computer 2602. One of skill in the art will immediately recognize that the terms "machine-readable medium" or "computer-readable medium" includes any type of storage device that is accessible by the processor 2608 and also encompasses a carrier wave that encodes a data signal.

**[00315]** The computer system 2600 is one example of many possible computer systems which have different architectures. For example, personal computers based on an Intel microprocessor often have

multiple buses, one of which can be an I/O bus for the peripherals and one that directly connects the processor 2608 and the memory 2612 (often referred to as a memory bus). The buses are connected together through bridge components that perform any necessary translation due to differing bus protocols.

**[00316]** Network computers are another type of computer system that can be used in conjunction with the teachings provided herein. Network computers do not usually include a hard disk or other mass storage, and the executable programs are loaded from a network connection into the memory 2612 for execution by the processor 2608. A Web TV system, which is known in the art, is also considered to be a computer system, but it may lack some of the features shown in FIG. 26, such as certain input or output devices. A typical computer system will usually include at least a processor, memory, and a bus coupling the memory to the processor.

**[00317]** In addition, the computer system 2600 is controlled by operating system software which includes a file management system, such as a disk operating system, which is part of the operating system software. One example of operating system software with its associated file management system software is the family of operating systems known as Windows® from Microsoft Corporation of Redmond, Washington, and their associated file management systems. Another example of operating system software with its associated file management system software is the Linux operating system and its associated file management system. The file management system is typically stored in the non-volatile storage 2616 and causes the processor 2608 to execute the various acts required by the operating system to input and output data and to store data in memory, including storing files on the non-volatile storage 2616.

**[00318]** FIG. 27 depicts a diagram of an example of a system 2700 for application-specific differential network access control. In the example of FIG. 27, the system 2700 includes a network service consuming application 2702, a network service usage analysis engine 2704, an application behavior datastore 2706, a network service usage classification engine 7708, an application traffic prioritization engine 2710, a network service usage control policy datastore 2712, a differential network access control engine 2714, an application traffic cache 2716, an application traffic override engine 2718, and a network interface 2720. The system 2700 is intended to represent a specific implementation of techniques described previously in this paper for illustrative purposes. The techniques may be applicable to an applicable known or convenient (wired or wireless) device for which there is a motivation to control network service usage.

**[00319]** In the example of FIG. 27, the network service consuming application 2702 is a application that is implemented on a device. In an expected use, the application is a software application stored at least in part in memory on a wireless device, though kernel-level instructions could be implemented as firmware or even hardware. The application can be referred to as "running" on the device or as being "executed" by the device in accordance with known uses of those terms. Wireless media are known to have more bandwidth constraints, which is why a wireless device is an expected use, though the technique may be applicable to wired devices in certain situations.

**[00320]** In the example of FIG. 27, the network service usage analysis engine 2704 is coupled to the network service consuming application 2702. The network service usage analysis engine 2704 analyzes traffic from the network service consuming application 2702 and stores relevant data in the application behavior datastore 2706. The data can include all traffic that is sent by the application, or a subset of the traffic (e.g., that which has a certain QoS classification or priority, that which has high resource consumption due to frequent transmission from the application, that which is sent to a particular destination, etc.) The data can also include traffic that is received for the application. The application behavior datastore 2706 can alternatively or in addition be implemented as a traffic source/destination datastore, which can be valuable if differential access control is based upon the source and/or destination of traffic. The application behavior datastore 2706 includes data structures (e.g., records) representative of data that is organized with implementation-specific granularity. For example, the data structures could be representative of frames (L2), packets (L3), or messages. (It may be noted that the term "packets" is often used to mean collections of data that are not limited to L3.) The desired granularity may depend upon where the network service usage analysis engine 2704 is located. Whether the data structures are changed over time (e.g., to change data associated with a record), replaced as records age, or maintained as historical data is also implementation-specific.

**[00321]** In the example of FIG. 27, the network service usage classification engine 2708 is coupled to the network service usage analysis engine 2704 and the application behavior datastore 2706. The network service usage classification engine 2708 can categorize the traffic stored in the application behavior datastore 2706 based on, e.g., network type, time of day, connection cost, whether home or roaming, network busy state, QoS, and whether the particular service usage activity is in foreground of user interaction or in the background of user interaction, or other characteristics that are obtained from network service usage analysis or through other means. Classification rules can include, for example, examining if one or more of the following has taken place within a specified period of time: user has interacted with the device, user has interacted with the service usage activity, user has picked up the device, service usage activity UI content is in the foreground of the device UI, audio or video information

is being played by the service usage activity, a certain amount of data has been communicated by the service usage activity, service usage activity is or is not on a foreground or background service list. Rules that define which service usage activities to classify as, e.g., background service usage activities can be user-selected, set by a service provider, or through some other applicable means.

**[00322]** Advantageously, the network service usage analysis engine 2704 can examine a particular service usage activity and the network service usage classification engine 2708 can determine if the particular service usage activity fits a set of one or more classification rules that define the particular service usage activity as, e.g., a background service usage activity.

**[00323]** In the example of FIG. 27, the application traffic prioritization engine 2710 uses a policy stored in the network service usage control policy datastore 2712 to determine an appropriate prioritization for traffic to and/or from the network service consuming application 2702. Prioritization can enable the system 2700 to fine-tune the amount of network resources consumed by the network service consuming application 2702, or the rate of network resource consumption. The control policy can require applications to throttle network resource consumption, prohibit the use of network resources by certain applications, etc.

**[00324]** Advantageously, the application traffic prioritization engine 2710 can determine a particular service usage activity has a particular characteristic, such as being a background service usage activity. This can involve checking whether a condition is satisfied.

**[00325]** In the example of FIG. 27, the differential network access control engine 2714 is coupled to the application traffic prioritization engine 2710 and the network service usage control policy datastore 2712. The differential network access control engine 2714 causes the network service consuming application 2702 traffic to be queued in the application traffic cache 2716. (If no throttling is required to follow the control policy, of course, the traffic need not be cached anywhere other than is typical, such as in an output buffer.) The application traffic cache 2716 is intended to represent a cache that is implemented on top of an output buffer or other standard caching device, and is used by the differential network access control engine 2714 to facilitate control over "rogue" applications, applications having anomalous behavior, or applications that must otherwise be controlled to conform with the control policy.

**[00326]** Advantageously, the differential network access control engine can restrict network access of a particular service usage activity when a condition is satisfied, such as when the service usage activity is a background activity.

**[00327]** In the example of FIG. 27, the application traffic override engine 2718 is coupled to the differential network access control engine 2714 and the application traffic cache 2716. The application traffic override engine 2718 enables a user or device to deviate from the control policy. Such deviation can be prompted by, for example, an incentive offer or a notification of cost.

**[00328]** In an illustrative example, the device 2700 blocks chatter for an application running in the background that is attempting to report device or user behavior. The application traffic prioritization engine 2710 determines that the chatter has zero priority, such that the network service consuming application 2702 is prevented from consuming any resources. The user can be sent a notification by the application traffic override engine 2718 that their control policy prohibits the application from consuming network resources, but that the user can opt to deviate from the control policy if they are willing to pay for the consumed resources. If the user is willing to pay for the resources, traffic can be sent at a certain rate from the application traffic cache 2716 through the network interface 2720, or perhaps sent without using the application traffic cache 2716.

**[00329]** As another illustrative example, the device 2700 could identify application traffic as a software update. The differential network access control engine 2714 may determine that software updates can be received at a throttled rate (perhaps even slower than the lowest QoS categorization). The application traffic override engine 2718 can receive an indication from the user, from user preferences, service provider settings, or the like that the updates can ignore the control policy for a particular application (or for all applications).

**[00330]** Advantageously, the control policy can set up a priority to communicate cached elements, set minimum update frequencies, provide control policy overrides (typically for payment), or the like to fine-tune differential network access control policies. This can enable the system 2700 to encourage certain behavior, such as sending low QoS traffic when it is cheaper (e.g., when the network does not have a busy state, at historically low-use times of day, when on a certain type of network, such as Wi-Fi, as opposed to another, such as cellular, etc.).

**[00331]** FIG. 28 depicts an example of a system 2800 for flow tracking. In the example of FIG. 28, the system 2800 includes a network 2802, a content datastore 2804, a network element 2806, and a service policy implemented device 2808.

**[00332]** In the example of FIG. 28, the network 2802 is intended to include an applicable communications network such as the Internet, a public switched telephone network (PSTN), an infrastructure network (e.g., private LAN), or some other network that is capable of acting as a link

between the various components depicted in FIG. 2. The term "Internet" as used herein refers to a network of networks which uses certain protocols, such as the TCP/IP protocol, and possibly other protocols such as the hypertext transfer protocol (HTTP) for hypertext markup language (HTML) documents that make up the World Wide Web (the web). A PSTN can include wired or wireless (e.g., 4G/3G/2G) network operated by, for example, a central provider. An infrastructure network that offers wireless connectivity can include wired and wireless devices in communication with wireless access points (WAPs). The wired and wireless devices can include various network equipment including by way of example but not limitation a cable network head end, a DSL network DSLAM, a fiber network aggregation node, and/or a satellite network aggregation node.

**[00333]** The network 2802, if it includes a wireless network, will typically include an internetworking unit (IWU) that interconnects wireless devices on the network 2802 with another network, such as a wired LAN on the network 2802. The IWU is sometimes referred to as a wireless access point (WAP). In the IEEE 802.11 standard, a WAP is also defined as a station. Thus, a station can be a non-WAP station or a WAP station. In a cellular network, the WAP is often referred to as a base station. The network 2802 can be implemented using an applicable technology, which can differ by network type or in other ways. The network 2802 can include networks of any appropriate size (e.g., metropolitan area network (MAN), personal area network (PAN), etc.). Broadband wireless MANs may or may not be compliant with IEEE 802.16, which is incorporated by reference. Wireless PANs may or may not be compliant with IEEE 802.15, which is incorporated by reference. Networks can be identifiable by network type (e.g., 2G, 3G, WiFi), service provider, WAP/base station identifier (e.g., WiFi SSID, base station and sector ID), geographic location, or other identification criteria.

**[00334]** In the example of FIG. 28, the network 2802 is coupled to the content datastore 2804. The content datastore 2804 is intended to illustrate any applicable content that is accessed by the service policy implemented device 2808. A datastore can be implemented, for example, as software embodied in a physical computer-readable medium on a general- or specific-purpose machine, in firmware, in hardware, in a combination thereof, or in an applicable known or convenient device or system. Datastores in this paper are intended to include any organization of data, including tables, comma-separated values (CSV) files, traditional databases (e.g., SQL), or other applicable known or convenient organizational formats. Datastore-associated components, such as database interfaces, can be considered "part of" a datastore, part of some other system component, or a combination thereof, though the physical location and other characteristics of datastore-associated components is not critical for an understanding of the techniques described in this paper.

**[00335]** Datastores can include data structures. As used in this paper, a data structure is associated with a particular way of storing and organizing data in a computer so that it can be used efficiently within a given context. Data structures are generally based on the ability of a computer to fetch and store data at any place in its memory, specified by an address, a bit string that can be itself stored in memory and manipulated by the program. Thus some data structures are based on computing the addresses of data items with arithmetic operations; while other data structures are based on storing addresses of data items within the structure itself. Many data structures use both principles, sometimes combined in non-trivial ways. The implementation of a data structure usually entails writing a set of procedures that create and manipulate instances of that structure.

**[00336]** In the example of FIG. 28, the network element 2806 is coupled to the network 2802 and includes hardware 2810 and a network stack 2812. In operation, the network stack 2812 can be implemented as an engine on the hardware 2810. As used in this paper, an engine includes a dedicated or shared processor and, typically, firmware or software modules that are executed by the processor. Depending upon implementation-specific or other considerations, an engine can be centralized or its functionality distributed. An engine can include special purpose hardware, firmware, or software embodied in a computer-readable medium for execution by the processor. As used in this paper, a computer-readable medium is intended to include all mediums that are statutory (e.g., in the United States, under 35 U.S.C. 101), and to specifically exclude all mediums that are non-statutory in nature to the extent that the exclusion is necessary for a claim that includes the computer-readable medium to be valid. Known statutory computer-readable mediums include hardware (e.g., registers, random access memory (RAM), non-volatile (NV) storage, to name a few), but may or may not be limited to hardware.

**[00337]** In the example of FIG. 28, the service policy implemented device 2808 is coupled to the network element 2806. As the name suggests, the service policy implemented device 2808 has an implemented service policy. Cellular phones often have implemented service policies, such as those described previously in this paper, but the service policy implemented device 2808 need not necessarily be limited to a cellular phone implementation. In an embodiment, the service policy implemented device 2808 includes any applicable computing device on which a service policy is implemented. The service policy implemented device 2808 can implement device-assisted services as described in this paper.

**[00338]** The service policy implemented device 2808 includes an initiator 2814, an optional control application 2816, and a proxy 2818. In operation, the initiator 2814, optional control application 2816, and proxy 2818 can be implemented as engines. In an instance and/or embodiment in which the optional control application 2816 is not present, the initiator 2814 can invoke the proxy 2818 through, e.g., a

media service API. Where the optional control application 2816 is not necessary, the initiator 2814 will typically include an app that is capable of its own rendering or control. The optional control application 2816 can include a rendering or control application that invokes the proxy 2818 on behalf of the initiator 2814. This can be useful for a requesting app that does not include rendering or control capabilities, such as an audio file. In this particular example, the optional control application 2816 can include a media player that has been registered to handle attempts to certain audio files, much like a program on a personal computer can be registered to handle files of certain types (e.g., on a personal computer, an attempt to open a Word document results in launching Microsoft Word to open the Word document because Microsoft Word has been registered to handle files of that type on the personal computer). Proxies 2818 can include download, media (e.g., streaming audio, streaming video, etc.), VoIP, instant messaging (IM), video conference/IM (including, e.g., a 2-way video client), backup, or other managers/services.

**[00339]** In operation, traffic can be tagged at various points. For example, traffic can be tagged at an activity stack between the initiator 2814 and the optional control application 2816. As another example, traffic can be tagged at a manager/service API between the optional control application 2816 and the proxy 2818 (or in an instance or embodiment that does not include the optional control application 2816, at a manager/service API between the initiator 2814 and the proxy 2818). As another example, traffic can be tagged at a network interface between the proxy 2818 and the network stack 2812.

**[00340]** The example of FIG. 28 will now be used to illustrate a specific implementation with reference to actual apps by name by way of example, but not limitation. An initiator (skysport) triggers a control application (HTC player) to utilize a proxy (media service). The activity stack and API data from the HTC player are provided to a classification and enforcement engine. The technique used to obtain traffic information for the purpose of tagging can be by, for example, a hook, call-back, injection point, broadcast receiver, intent filter, or some other applicable mechanism. In this way, traffic from a thread that is identified as that of the media server can be attributed to skysport, and appropriate policy (e.g., traffic control, notification, and billing) can be enforced. Similarly, traffic from a thread that is identified as that of HTC player can be attributed to skysport and appropriate policy can be enforced.

**[00341]** After tagging a flow, it may be desirable to act on the flow in various ways related to the relevant service policy. For example, a mobile data limit can be set. Advantageously, it is possible to go to each app to restrict background and/or foreground data. It is also possible to disable background for a device across the board. Because of the way the flow is tagged, an app will not even be aware of restrictions to, e.g., background data.

**[00342]** FIG. 29 depicts a flowchart 2900 of an example of a method of flow tracking. For illustrative purposes, a mapping (flow tracking) of an application is depicted to the right of the flowchart 2900. In the example of FIG. 29, the flowchart 2900 starts at module 2902 with activating A. In this example, A is intended to identify an electronic traffic source, such as a URL, phone number, or other applicable mechanism for forming a connection such that data can flow between a service policy implemented device and some other device. Thus, activating A can entail clicking on a URL, dialing a phone number, or initiating a connection with another device in some other applicable manner. The data can flow in one direction or in more than one direction, depending upon the instance and/or implementation.

**[00343]** In the example of FIG. 29, the flowchart 2900 continues to module 2904 with an initiator calling an activity stack. In this paper, the activity stack is located between an initiator (e.g., a file and system components that identify the control app) and a control app. Where no control app is used, the term activity stack is not used in favor of making reference to a proxy API. For the purposes of this example, the initiator is the engine, component, or otherwise identifiable thing that is responsible for traffic associated with A. In a system that tracks service usage for the purpose of implementing a service policy in a manner that is described in this paper, it may be desirable to be able to identify the initiator and charge for the traffic appropriately. (As opposed to, for example, charging the proxy or control app or controlling policy in some other manner that is not as finely tuned.) It may be noted that the activity stack is located between an initiator and a control app, but if there is no control app, the initiator instead calls a service API. The initiator can be mapped to A at the activity stack.

**[00344]** In the example of FIG. 29, the flowchart 2900 continues to module 2906 with a control app calling a service API to handle A. An example of a control app that could be used in this manner is the HTC player (or some other media player). In a specific example, the HTC player could be registered to handle files of a certain type. (For the sake of this example, let us assume it is registered to handle "audio files"). A user could click on audio file content of a website. The audio file itself does not have rendering capabilities; so the HTC player runs on the audio file's behalf to play the audio file for a user. The control app can be mapped to A at the service API.

**[00345]** In the example of FIG. 29, the flowchart 2900 continues to module 2908 with a proxy opening a network connection to A. Naturally, opening a connection to A can require certain actions by the proxy, such as finding A in a network. In a specific implementation, the proxy uses an IP lookup to find an IP address (generally having a format 1.2.3.4). The proxy can be mapped to A at the network interface. It is possible that A will have moved to B, in which case a DNS request can be used to find B. If that happens, A can be mapped to B, and the thread can be tracked back to A and, ultimately, the initiator.

**[00346]** In the example of FIG. 29, the flowchart 2900 continues to module 2910 with data flowing from A to the proxy (or from B to the proxy if A was moved to B). The traffic of the data flow can be tagged, and because the initiator, control app (if applicable), and proxy were all mapped to A, it is possible to figure out that the network resources can be charged to A (or to some other component to which the traffic has been mapped, if applicable).

**[00347]** In the example of FIG. 29, the flowchart 2900 continues to module 2912 with the proxy talking to the control app and to module 2914 with the control app controlling the content. Thus, in the example where A is an audio file and the control app is an audio player, the proxy provides streamed audio to the player, which plays the audio content for a user. As was previously noted, the content can be matched to the location of the content (e.g., on a website) and can be treated in a manner that is appropriate for an active service policy.

**[00348]** In the example of FIG. 29, the flowchart 2900 ends at module 2916 with charging traffic associated with A to the initiator. It may be noted that traffic tagging can occur at different points in the network stack, such as at socket flows or IP packet transmissions. Also, an initiator could at least in theory have any number of intervening apps between the initiator and the proxy, and traffic could be tagged between each app. Advantageously, it is possible to track whether apps have other characteristics. For example, tracking is possible when in foreground or background. This can include background service protocols and background network access. This can have an impact on how traffic is charged or otherwise controlled in accordance with the applicable service policy.

**[00349]** Traffic tagging may or may not entail the use of hooks. The amount of control over the proxy will depend upon whether, for example, the proxy was written by the same party that wrote other components of a device framework. It is somewhat more likely that a third party will make use of hooks. It may also be desirable to hook at certain locations, such as in the socket, to tag back to a traffic stack "opened socket for thread" and give a socket-to-thread mapping. Combined with an API mapping, it is possible to map socket-to-app, which can then be pushed to a low level interface where traffic can be observed (e.g., a driver, in a kernel, etc.). As was previously discussed, the activity stack makes it possible to use hooks (if applicable) to map socket-to-control app-to-initiating app. Where every packet is counted at, e.g., a firewall, the low level interface can see the thread and can map each packet to the appropriate app even though the counted packets are, e.g., identified as those of the proxy. This facilitates traffic can being accurately dropped into the appropriate service policy buckets.

**[00350]** Tagging traffic flows enables discrete service control policy enforcement. For example, a service policy could block A (or B) in accordance with a service control policy even if the proxy is not normally blocked (for example, for other content). Blocking can occur at the network and is possible even in the case where an initiator calls a control app that is not necessarily blocked because tagging happens in the activity stack. It may also be the case that a control app should be blocked regardless of whether A (or B) should be blocked, which is possible because the traffic is tagged at the API. It may be noted that blocking is not the only traffic control policy, and other traffic control policies could be used, as well, such as notification.

**[00351]** In an implementation in which the proxy includes a VoIP manager, the proxy can run encoding/protocols (SIP, H323, etc.). A VoIP service control cloud can ensure routing to a low latency backbone. The VoIP service manager can do core functions of VoIP there. An API enables running consistent VoIP services with a consistent set of tools for apps. A VoIP service manager can have special performance features, QoS functions, interactive cloud service, and can be charged differently, routed to APN or server, manage offloading to WiFI/2G/3G/4G, manage roaming aspects, and manage presence.

**[00352]** FIG. 30 depicts an example of a system 3000 with a mapped traffic flow. The system 3000 includes a user 3002, a data usage settings datastore 3004, system managers 3006, an ItsOn service engine 3008, an app 3010, a proxy 3012, a thread 3014, a socket 3016, and an ItsOn classification engine 3018. Although reference is made to "ItsOn" in this example, it should be noted that this is simply one specific implementation, and that the techniques described in association with this example are broadly applicable, not limited to any actual ItsOn implementation.

**[00353]** In the example of FIG. 30, a user 3002 can provide data usage settings to the data usage settings datastore 3004 and start/stop/foreground/background/… instructions to the system managers 3006. It may be noted that a user agent, network agent, service provider agent, or some other agent can provide data usage settings instead of or in addition to the user 3002. Similarly, a user agent, network agent, service provider agent, or some other agent can provide start/stop/foreground/background/… instructions instead of or in addition to the user 3002.

**[00354]** In the example of FIG. 30, the data usage settings datastore 3004 includes service policy that can be accessed by the ItsOn service engine 3008. Service policy can be implemented and/or enforced using techniques described elsewhere in this paper. An example of policy that may be used by the ItsOn service engine 3008 is "allow app" or "restrict app."

**[00355]** In the example of FIG. 30, the system managers 3006 (or a system manager thereof) launch the app 3010 and report app state to the ItsOn service engine 3008. An example of app state is "call-back on state change." This can, for example, result in a call-back if an app changes from running in the background to running in the foreground, or vice versa, or when the app is shut down.

**[00356]** In the example of FIG. 30, the app 3010 utilizes an API to trigger the proxy 3012 which in turn passes through a socket connection at the socket 3016 as traffic. In operation, the app 3010, the proxy 3012, and the socket 3016 can be implemented as engines. The proxy 3012 generates the thread 3014 and registers the thread with the ItsOn service engine 3008. The socket 3016 registers the socket connection with the ItsOn service engine 3008.

**[00357]** In the example of FIG. 30, the ItsOn service engine 3008 has data sufficient to map the socket to the app, using the thread registration from the proxy 3012 and the socket registration from the socket 3016. The ItsOn service engine 3008 sends the socket-to-app mapping to the ItsOn classification engine 3018, along with a filter, which can be to allow, block, or perform some other filtering. The ItsOn service engine 3008 can be logically (or physically) divided into at least two components: a network policy manager and a traffic stack. The network policy manager can include, e.g., a policy decision point agent. *See, e.g.,* FIG. 3, policy decision point agent 1692. The network policy manager accesses policy in the data usage settings datastore 3004, receives the app state from the system managers 3006, and provides a filter parameter to the ItsOn classification engine 3018. The traffic stack receives the registration of the thread and the registration of the socket and provides the socket → app map to the ItsOn classification engine 3018.

**[00358]** In the example of FIG. 30, the ItsOn classification engine 3018 is capable of enforcing policy for a thread (mapped to an app), including, e.g., traffic control, notification, and/or charging. The ItsOn classification engine 3018 can be logically (or physically) divided into at least two components: a firewall (e.g., iptables) and a tagging engine (e.g., qtaguid). The tagging engine receives the socket → app map from the traffic stack and provides a tag to the firewall. The firewall receives the filter from the network policy manager and the tag from the tagging engine and provides a count back to the tagging engine. The firewall also filters (e.g., blocks, allows, or performs some other filtering) traffic from the socket 3016.

**[00359]** It is becoming increasingly important to associate device access network service usage (e.g., network data services usage, voice services usage, etc.) to the applications (e.g., application program, widget, service, process, embedded object, or any combination of these, etc.) that are using the services.

This information may be used in a variety of ways, including but not limited to: (1) classifying service usage to assist a user to understand one or more aspects of service usage (e.g., notifying a user about which applications are consuming service usage, or how much service usage one or more applications are consuming (e.g., amount of usage); (2) classifying service usage for the purpose of service control policy enforcement (e.g., traffic control, quality-of-service (QoS) control, QoS channel set-up, application-based service classification or usage controls, etc.); (3) classifying service usage for the purpose of service charging accounting.

**[00360]** Various embodiments disclosed herein provide a way for device software agents, integrated into the device in addition to an operating system or as an integral set of functions in an operating system, to track network service usage through a proxy service function back to an originating application that uses the proxy service function o assist in transferring data between a network and the application (e.g., application program, widget, service, process, embedded object, or any combination of these, etc.).

**[00361]** In some existing device operating systems, a proxy service function is used to manage the network service flows between the network and an application (e.g., application program, widget, service, process, embedded object, or any combination of these, etc.), and the proxy service is stored in the operating system (OS) as the application responsible for using services rather than the application actually using the network service. For example, in the Android OS, there exists a "media service" OS library software program function that manages the network stack interface for download of network data (typically, but not limited to, multimedia data). The device makes a request to the media service, which then performs various network stack interface functions to transfer the network data between the device application and the network. The media service can also process media files to determine how best to decode the multimedia and play the multimedia on the device user interface (UI). For example, the media service can determine the media filing coding standard (e.g., MP3, MP4, OGG, H.264, VP8, etc.), decode the media, select a player for the media (e.g., libstagefright (an Android streaming service library function), a third-party or OEM media player, etc.), and send the decoded media to the media player for UI playback. In the case of the media service, the data flows to the network can be classified by various device service usage monitoring agents (e.g., a kernel agent in the network stack) as belonging to the media service, not the originating application, and the OS provides no mechanism for tracking the usage back to the originating application.

**[00362]** Another example in the Android OS is the "media" OS library software program that is used by applications such as the Android browser, Android store app downloader, the Gmail client, OS updater, etc. The media function manages network data transfers for such applications, allowing an application to

launch a data transfer request and then continue other operations while the media service is managing the network data transfer. In the case of the media function, the data flows to the network can be classified as belonging to the media function, not the originating application, and the OS provides no techniques or mechanisms to track the usage back to the originating application.

**[00363]** As another example, some higher-level library software functions or framework software functions provide proxy server client functions that encapsulate native application traffic to send application flows to a network proxy server for further network traffic processing, and this proxy client function sits above the network stack. Examples of this include the Android.net library function, the Apache library function, and the Java.net library function, third-party proxy server client functions or tunneling protocol functions, and other proxy server client functions or tunneling protocol functions.

**[00364]** As another example, there are system services (e.g., DNS, certificate management, etc.) for may OS (e.g., Windows 7 and other Windows versions). Similar to the OS functions discussed above, these OS functions manage data transfer with the OS network stack interface for an originating application, and the device network stack service flows can be classified back to these OS functions, but not to the originating applications.

**[00365]** Disclosed herein are techniques and mechanisms to identify an application name, identifier, process, etc. for an application (e.g., application program, widget, service, process, embedded object, or any combination of these, etc.) that requests from a media service manager a data transfer (data transfer request) that includes a network resource identifier (e.g., an IP address, a URL, a remote file name or address, a stream name, an object name, or any combination of these identifiers) that identifies a source (or a proxy to the source) of the data to be transferred or a data object to be transferred. In some embodiments, a software agent (e.g., a service classification and accounting agent) identifies the originating application. In some embodiments, the software agent monitors and stores the application name, identifier, process, etc., for each application that requests a data transfer from the media service manager or that conducts a data transfer with the media service manager. In some embodiments, the software agent (e.g., the service classification and accounting agent) is implemented by including a requesting-application storing function in the media services manager. In some embodiments, the software agent (e.g., the service classification and accounting agent) further identifies and stores information about the network resource identifiers along with the entry specifying the requesting application name, identifier, process, etc.

**[00366]** In some embodiments, techniques or mechanisms within the media service manager transfer the requested data from the network resource identifier by mapping the transfer request and network resource identifier into one or more data flow connections communicated through a device networking stack (and, in some embodiments, managing the resulting flow of data between the network and device stack and/or between the network stack and the application).

**[00367]** In some embodiments, techniques or mechanisms are used to identify the resulting network data flows. In some embodiments, a service classification and accounting agent identifies the resulting network data flows by monitoring and recording the resulting network data flow identifiers (e.g., a data flow tag, an IP address, a TCP-IP identifier, a layer 7 identifier, a socket tuple, etc.).

**[00368]** In some embodiments, techniques or mechanisms associate the resulting network data flows back to the application name, identifier, process, etc. For example, in an Android system, the resulting network data flows can be associated with the UID. In some embodiments, a service classification and accounting agent associates the resulting network data flows back to the application name, identifier, process, etc. by inspecting the resulting network data flows to determine a match between one or more aspects of the network resource identifier stored in association with the requesting application name, identifier, process, etc. In some embodiments, a service classification and accounting agent associates the resulting network data flows back to the application name, identifier, process, etc. by tracking the data flow from the interface between the media service manager and the application, through each stage of media service manager data flow processing to the resulting network data flow between the media service manager and the network stack. In some embodiments, virtual tagging is used, and the tracking is accomplished by identifying and recording, at each traffic processing step within the media services manager, an association between the traffic flows at one side of the traffic processing step and the traffic flows at the other side of the traffic processing step. In some embodiments with more than one traffic-processing step, the associations made for each step are followed to create an association for all steps. In some embodiments, literal tagging is used, and that tracking is accomplished by tagging the data flows at one side of the media service manager traffic processing and identifying the tag at the other side of the media service manager traffic processing.

**[00369]** In some embodiments, techniques or mechanisms are used to create an accounting record for the resulting network data flow usage or to enforce a network traffic control policy on the resulting network data flows, or to create a service usage notification for the resulting network data flow usage.

**[00370]** In some embodiments, the results of the service usage classification or accounting can be stored in a local device (or operating system) database. The results of the service usage classification or accounting can be provided to a device (or operating system) user interface (UI) function for the purpose of displaying usage classifications to a user. The results of the service usage classification or accounting can be provided to other applications, operating system service functions, other device software functions, or network-based service classification or accounting functions.

**[00371]** In some embodiments, a proxy network service manager refers to an intermediary data flow function in a device operating system that sits on a data path between a device application and a device networking stack interface to provide a level of network service abstraction from the network stack interface, a higher-level service function above the network stack interface, enhanced or special traffic processing functions, media service transfer management, file download service, HTTP proxy service functions, quality-of-service (QoS) differentiation, or other similar or related higher-level traffic processing. Examples of proxy service managers include but are not limited to: a media service manager (e.g., the Android media service library function), an e-mail service manager, a domain name server (DNS) function, a software download service manager, a media download manager, a data download service manager, an Android "media" library function, the Android.net library function, the Java.net library function, an Apache library function, other similar software or library functions or services in other device operating systems, an SMTP, IMAP, or POP proxy, an HTTP proxy, an IM proxy, a VPN service manager, an SSL proxy, etc.

**[00372]** In some embodiments, techniques or mechanisms identify an application name, identifier, process, etc. for an application (e.g., an application program, a widget, a service, a process, an embedded object, or any combination of these, etc.) that requests from a proxy service manager a data transfer (a data transfer request) that includes a network resource identifier (e.g., an IP address, a URL, a remote filename or address, a stream name, an object name, or any combination of these identifiers, etc.) that identifies a source (or a proxy to the source) of the data to be transferred or a data object to be transferred. In some embodiments, a service classification and accounting agent identifies the originating application by monitoring and storing the application name, identifier, process, etc. for each application that requests a data transfer from the proxy service manager or that conducts a data transfer with the proxy service manager. In some embodiments, the service classification and accounting agent is implemented by including a requesting application storing function in a proxy services manager. In some such embodiments, the service classification and accounting agent further identifies and stores information about the network resource identifier along with the entry specifying the requesting application name, identifier, process, etc.

**[00373]** In some embodiments, techniques or mechanisms within the proxy service manager are used to transfer the requested data from the network resource identifier by mapping the transfer request and network resource identifier into one or more data flow connections communicated through a device networking stack (and possibly managing the resulting flow of data between the network and device stack or between the network stack and the application).

**[00374]** In some embodiments, techniques or mechanisms are used to identify the resulting network data flows. In some embodiments, a service classification and accounting agent identifies the resulting network data flows by monitoring and recording the resulting network data flow identifiers (e.g., a data flow tag, an IP address, a TCP-IP identifier, a layer 7 identifier, a socket tuple, etc.).

**[00375]** In some embodiments, techniques or mechanisms are used to associate the resulting network data flows back to the application name, identifier, process, etc. For example, in an Android system, the resulting network data flows can be associated with the UID. In some embodiments, a service classification and accounting agent associates the resulting network data flows back to the application name, identifier, process, etc. by inspecting the resulting network data flows to determine a match between one or more aspects of the network resource identifier stored in association with the requesting application name, identifier, process, etc. In some embodiments, a service classification and accounting agent associates the resulting network data flows back to the application name, identifier, process, etc. by tracking the data flow from the interface between the media service manager and the application, through each stage of media service manager data flow processing to the resulting network data flow between the media service manager and the network stack. In some embodiments, virtual tagging is used, and the tracking is accomplished by identifying and recording, at each traffic processing step within the media services manager, an association between the traffic flows at one side of the traffic processing step and the traffic flows at the other side of the traffic processing step. In some embodiments with more than one traffic-processing step, the associations made for each step are followed to create an association for all steps. In some embodiments, literal tagging is used, and that tracking is accomplished by tagging the data flows at one side of the media service manager traffic processing and identifying the tag at the other side of the media service manager traffic processing.

**[00376]** In some embodiments, techniques or mechanisms are used to create an accounting record for the resulting network data flow usage or to enforce a network traffic control policy on the resulting network data flows, or to create a service usage notification for the resulting network data flow usage.

**[00377]** In some embodiments, the results of the service usage classification or accounting can be stored in a local device (or operating system) database. The results of the service usage classification or accounting can be provided to a device (or operating system) user interface (UI) function for the purpose of displaying usage classifications to a user. The results of the service usage classification or accounting can be provided to other applications, operating system service functions, other device software functions, or network-based service classification or accounting functions.

**[00378]** FIGS. 31A and 31B depict a flowchart 3100 of an example of a method of virtual tagging. As will be appreciated by a person having ordinary skill in the art, the number of detailed embodiments are numerous, and this detailed description is provided for instructive purposes and not to indicate any limitation to the general embodiments described herein. The example references a specific well-known application (Pandora), but the techniques described are broadly applicable. In the example of FIGS. 31A and 31B, the flowchart 3100 starts at module 3102 with Pandora application calls a media service function with a network resource indicator (NRI) that includes a Pandora URL with a song identifier included in the URL descriptor.

**[00379]** In the example of FIGS. 31A and 31B, the flowchart 3100 continues to module 3104 with Pandora receives back from the media service function a media object handle descriptor so that the Pandora application can control playback, etc. by sending commands back to the media service function for that handle descriptor (e.g., pause on xyz song handle, play xyz song handle, etc.).

**[00380]** In the example of FIGS. 31A and 31B, the flowchart 3100 continues to module 3106 with the media service function initiates an HTTP download by calling libstagefright, which conducts the HTTP song download process.

**[00381]** In the example of FIGS. 31A and 31B, the flowchart 3100 continues to module 3108 with, at some point in the download process, the media service function begins playback with a media player under the control of the media service function and in accordance with the Pandora application playback commands for the media object handle for the song being played back.

**[00382]** In the example of FIGS. 31A and 31B, the flowchart 3100 continues to module 3110 with a classification and accounting agent function included in the media service function writing the NRI descriptor into a table located in an application usage/flow mapping element.

**[00383]** In the example of FIGS. 31A and 31B, the flowchart 3100 continues to module 3112 with the classification and accounting agent function associates the NRI with the Pandora application by writing a

Pandora application identifier descriptor into the same table entry within the application usage/flow mapping element.

**[00384]** In the example of FIGS. 31A and 31B, the flowchart 3100 continues to module 3114 with the table entry being communicated to a usage/classification reconciliation element.

**[00385]** In the example of FIGS. 31A and 31B, the flowchart 3100 continues to module 3116 with the classification and enforcement agent identifies the network data flows (e.g., socket (e.g., IP address, destination port, source port, protocol, etc.) indexed data flows) originating from the media service function (and/or possibly the libstagefright function originating the flows), identifies the NRI via packet flow layer 7 inspection, and logs the service usage accounting for these packet flows.

**[00386]** In the example of FIGS. 31A and 31B, the flowchart 3100 continues to module 3118 the classification and enforcement agent writes into a table entry the following associations: (1) identifier for the media service function originating the flows (and/or possibly the identifier for the libstagefright function originating the flows), (2) the NRI, (3) the service usage classification for these flows and accounting for these flows, and (4) possibly the service usage accounting for these flows.

**[00387]** In the example of FIGS. 31A and 31B, the flowchart 3100 continues to module 3120 with this table entry being communicated to the usage/classification reconciliation element.

**[00388]** In the example of FIGS. 31A and 31B, the flowchart 3100 continues to module 3122 with the usage/classification reconciliation element using these two table entries, which both have common entries for the NRI and the media service function (and/or possibly the libstagefright function) to make the association between the Pandora application and the service usage classification and possibly the service usage accounting.

**[00389]** In the example of FIGS. 31A and 31B, the flowchart 3100 continues to module 3124 with these parameters may then be written into the usage/classification database.

**[00390]** FIG. 32 depicts an example of a system 3200 for classification mapping using virtual tagging. The system 3200 includes an application 3202, a control application 3204, a proxy service manager 3206, a network stack (driver) 3208, traffic processes 3210-1 to 3210-N (collectively, traffic processes 3210), a flow tracking agent 3212, an application usage/flow mapping engine 3214, a usage/classification reconciliation engine 3216, a usage/classification datastore 3218, a user interface (UI) engine 3220, and an application interface engine 3222. In operation, the application 3202, control application 3204, proxy

service manager 3206, network stack (driver) 3208, and flow tracking agent 3212 are implemented as engines.

**[00391]** In the example of FIG. 32, the application 3202 may or may not, depending upon instance and/or implementation, need to use the control application 3204 (e.g., to render content) and/or the proxy service manager 3206. This is represented by the three double arrows from the application 3202 to the control application 3204, the proxy service manager 3206, and the network stack (driver) 3208.

**[00392]** In the example of FIG. 32, traffic processes associated with the application 3202 are depicted as traffic processes 3210. The flow tracking agent 3212 can obtain information about the traffic processes 3210 at the start and end of the traffic flow that comprises the traffic processes 3210. The start and end are intended to illustrate, for example, a hook, call-back, injection point, etc., at a proxy service manager API (the start) and at a socket connection (the end). It may be noted that in an instance or embodiment where the application 3202 does not use the proxy service manager 3206, data at the socket will accurately identify the app as the initiator of the data flow. In an instance or embodiment where the application 3202 uses the proxy service manager 3206, data at the socket will be insufficient to identify the application 3203 as the initiator of the data flow, making it desirable to add a virtual tag at the proxy API or some other applicable upstream location. In an instance or embodiment where the application 3203 uses the control application 3204, an additional virtual tag is necessitated at the activity stack.

**[00393]** In the example of FIG. 32, the virtual tags are sent from the flow tracking agent 3212 to the app usage/flow mapping engine 3214, which communicates with the usage/classification reconciliation engine 3216, which in turn communicates with the network stack (driver) 3208. The usage/classification reconciliation engine 3216 can track usage of the app, classify the app, and to the extent there is disagreement at different system locations, reconcile usage in accordance with rules. The usage/classification reconciliation engine 3216 saves the usage/classification in the usage/classification datastore 3218, which can be made available to a user via the user interface 3220 or an application via the application interface 3222.

**[00394]** In an alternative embodiment, flow tracking agents are coupled between traffic process elements 3210. For example, between traffic process 3210-1 and traffic process 3210-2.

**[00395]** In some embodiments, the proxy service manager can perform application identification and classification, usage monitoring, and counting. This allows service usage to be classified and associated with an application prior to proxy processing. Classification can be accomplished with a software agent (e.g.. the service classification and accounting agent) added to the proxy service manager software

program (or library function). It may be noted that a software agent, in operation, can be implemented as an engine. The service classification and accounting proxy agent can identify which application requested or is processing the data transfer with the network and can include this as part of the data flow classification for the data transfer. The service classification and accounting proxy agent can inspect the traffic to determine other parameters such as network destination (e.g., domain, URL, network address, IP address, traffic flow identifier, port address, etc.) or type of traffic (e.g., data or voice, network protocol (e.g., TCP-IP, UDP, native IP, HTTP, SSL, etc.)). The service classification and accounting proxy agent can also classify the traffic with other parameters such as active network, network state (network busy state, time of day, type of network (e.g., 3G, 4G, WiFi, etc.)). The service classification and accounting proxy agent may also monitor service usage and account for traffic.

**[00396]** In some embodiments, the proxy service manager includes a service classification and accounting proxy agent that uses a flow tracking function as discussed in a pervious embodiment description to associate the requesting application network service flows between the requesting application and the proxy service manager and tracks these flows through the traffic processing or other service processing that takes place in the proxy service manager and then tracks the network service flows into the operating system network stack interface. The service classification and accounting proxy agent can then provide the classification or usage accounting results to the usage classification and reconciliation agent, which can then reconcile the service classification and usage that is reported by the proxy service manager service classification and accounting proxy agent against classification or usage accounting results that are reported by other agents on other parts of the data path between the requesting application and the network (e.g., a service classification and accounting driver agent located in the network stack driver that is discussed in various embodiments in other applications and patents, that have been incorporated by reference in the cross-reference to related applications section, above).

**[00397]** In some embodiments, the results of the service usage classification or accounting can be stored in a local device (or operating system) database. The results of the service usage classification or accounting can be provided to a device (or operating system) UI function for the purpose of displaying usage classifications to a user. The results of the service usage classification or accounting can be provided to other applications, operating service functions, other device software functions, or network-based service classification or accounting functions.

**[00398]** In some embodiments, the proxy service manager encapsulates the received frames (or packets) by adding its own header and trailer fields. The encapsulated frames (or packets) traffic is then forwarded with a header (and possibly trailer) to a network proxy server or proxy gateway. The encapsulated frames

are then forwarded to the network stack, where the service classification and accounting driver agent inspects the traffic to classify and possibly account for it.

**[00399]** In some embodiments, the classification includes the service classification and accounting driver agent steps of first determining that the frame (or packet) is a packet with a proxy forwarding destination specification, determine the inspection range of proxy encapsulated frame within the encapsulated frame traffic (this is the encapsulated packet byte offset where the destination information and/or other classification information from the original requesting application packet is located), then inspecting this byte offset range to determine the classification of the original requesting application traffic, and then associating the classification or usage accounting with the original packet information and/or the requesting application.

**[00400]** In some embodiments, the results of the service usage classification or accounting can be stored in a local device (or operating system) database. The results of the service usage classification or accounting can be provided to a device (or operating system) UI function for the purpose of displaying usage classifications to a user. The results of the service usage classification or accounting can be provided to other applications, operating service functions, other device software functions, or network-based service classification or accounting functions.

**[00401]** FIG. 33 depicts an example of a media service classification system 3300. The system 3300 includes an applications layer 3302, an application framework 3304, libraries 3306, a netlink interface 3308, and a Linux kernel 3310. The applications layer 3302 includes an ItsOn UI 3312 and an ItsOn service 3314. Although explicit mention is made of an ItsOn implementation, the techniques described with reference to this example are broadly applicable, and are not limited to any particular ItsOn (or other) specific implementation. It may be noted that other applications, including system apps (e.g., home, phone, browser, contacts, etc.) and other apps (e.g., news, social network, etc.) can reside in the applications layer 3302, but are omitted to avoid obscuring the drawing.

**[00402]** In the example of FIG. 33, the application framework 3304 includes an activity manager 3316. It may be noted that other managers, including a window manager, package manager, telephony manager, location manager, etc. can reside in the application framework 3304, but are omitted to avoid obscuring the drawing. Moreover, other managers can provide data to, e.g., the ItsOn service 3314 that is useful (e.g., the package manager can provide an indication that an app is installed), but a detailed description is not necessary for an understanding of the techniques presented.

**[00403]** In the example of FIG. 33, the libraries 3306 include a media services framework datastore 3318 and an android runtime datastore 3320. It may be noted that other libraries, including surface manager, java.net, android.net, apache, media, WebKit, freetype, SQLite, and libc datastores can reside in the libraries 3306, but are omitted to avoid obscuring the drawing. The android runtime datastore 3320 can include a core libraries datastore and a dalvik VM datastore, to name two.

**[00404]** In the example of FIG. 33, the netlink interface 3308 couples the libraries 3306 to the Linux kernel 3310.

**[00405]** In the example of FIG. 33, the Linux kernel 3310 includes an ItsOn filter 3322 and an ItsOn classification engine 3324. It should be noted that although the Linux kernel 3310 is described in association with a particular OS (Linux), the techniques described with reference to this example are broadly applicable to other than Linux kernels, OSs, or other applicable engines. It may be noted that other low level devices, including, e.g., a display driver, audio driver, network stack (e.g., 3G/4G, WiFi, others, or a combination), a camera driver, and a keypad driver can reside in the Linux kernel 3310, but are omitted to avoid obscuring the drawing.

**[00406]** In the example of FIG. 33, in operation, the activity manager 3316 (which is called out as a representative manager) can provide runtime state to the ItsOn service 3314. The ItsOn service 3314 can communicate with the media service framework datastore 3318 and the android runtime library 3320 (and specifically, for example, core libraries of the android runtime library). The media service framework datastore 3318 can provide a mapping through the netlink interface 3308 to the ItsOn classification engine 3324 and the ItsOn service 3314 can provide filters through the netlink interface 3308 to the ItsOn classification engine 3324. The ItsOn UI 3312 can provide a window into the traffic classification and flow and the ItsOn filter 3322 can facilitate enforcement of applicable policy.

**[00407]** FIG. 34 depicts a proxy encapsulated frame 3400. The frame 3400 includes a proxy header 3402, a header 3404, network traffic payload 3406, and a proxy trailer 3408. The header 3404 corresponds to an inspection range of proxy encapsulated frame 3412.

**[00408]** FIG. 35 depicts an example of a system 3500 for proxy client counting. The system 3500 includes a proxy service manager 3502, a proxy/library API 3504, an app ID 3506, usage classify/count 3508, a traffic processing/other services 3510, a service classification and accounting proxy agent 3512, a flow tracking agent 3514, a network stack (driver) 3516, a stack API 3518, an app ID/library function ID 3520, usage classify/count 3522, a service classification and accounting driver agent 3524, a

usage/classification reconciliation engine 3526, a usage/classification datastore 3528, a UI interface 3530, an application interface 3532, and a UI 3534.

**[00409]**

**[00410]** FIG. 36 depicts an example of a system 3600 for classifying traffic and enforcing a service policy based upon the classification. The system 3600 includes a proxy manager 3602, an app traffic flow 3604, a traffic stack 3606, a socket manager 3608, and a traffic classification and enforcement engine 3610. The proxy manager 3602 and the socket manager 3608 can be implemented as engines. The traffic stack 3606 can be implemented as an engine or a datastore. Where the traffic stack 3606 is implemented as a datastore, the proxy manager 3602, the socket manager 3608, the traffic classification and enforcement engine 3610, or some other engine can provide the processor to carry out activities that are attributed to the traffic stack 3606.

**[00411]** In the example of FIG. 36, the proxy manager 3602 tags the app traffic flow 3604 at a first point in the flow. The first point in the flow corresponds to an API call by an app to the proxy manager 3602, or an equivalent activity. The proxy manager 3602 can identify the app making the call and identify the thread that is (or will be) associated with the app. In this way, the proxy manager 3602 can identify a mapping of the app to the app traffic flow 3604. The proxy manager 3602 registers the thread (e.g., the app-to-flow mapping) at the traffic stack 3606.

**[00412]** In the example of FIG. 36, the socket manager 3608 tags the app traffic flow 3604 at a second point in the flow. The second point in the flow corresponds to a socket call by the proxy manager 3602 to the socket manager 3608, or an equivalent activity. The socket manager 3608 can identify the proxy making the call and identify the thread that is associated with the proxy. In this way, the socket manager 3608 can identify a mapping of the proxy to the app traffic flow 3604. The socket manager 3608 registers the socket (e.g., the proxy-to-flow mapping) at the traffic stack 3606.

**[00413]** In the example of FIG. 36, the traffic classification and enforcement engine 3610 uses the thread registration to identify the app-to-flow and the socket registration to identify the proxy-to-flow. Because the traffic classification and enforcement engine 3610 knows the app called the proxy (from the thread registration) and the proxy called the socket (from the socket registration), the traffic classification and enforcement engine 3610 can properly identify the app as the initiator of the app traffic flow 3604, as opposed to, for example, the proxy manager 3602 that made the socket call. With this knowledge, the traffic classification and enforcement engine 3610 can use the appropriate traffic control, notification, and

charging policies to control the traffic, notify relevant parties, and/or assign the app traffic flow 3604 to the appropriate bucket or buckets.

**[00414]** In the example of FIG. 36, an optional activity manager 3612 tags the app traffic flow 3604 at a third point in the flow. The third point in the flow corresponds to a control application call made on behalf of the app. The activity manager 3612 can identify the app making the call to the control application and identify the activity that is associated with the app. Conceptually, relative to the description just provided with reference to the proxy manager 3602 and the socket manager 3608, the activity manager 3612 pushes the app up one more level, such that the data flow is from the app to a control application and to the proxy. Using the registered activity, the traffic classification and enforcement engine 3610 can trace the app traffic flow back up the chain to the app, rather than identifying the control application as the initiator.

**[00415]** FIG. 37 depicts a flowchart 3700 of an example of a method for flow tagging and enforcing service policies associated with an identified initiator of the flow. In the example of FIG. 37, the flowchart 3700 starts at module 3702 and ends at module 3712, which include the following: tagging a network activity traffic flow at a first point in the flow, wherein the first point is associated with an API call to a proxy manager for a thread; registering the thread; tagging the network activity traffic flow at a second point in the flow, wherein the second point is associated with a socket call to a socket manager for the thread; registering the socket; using the registration of the thread and the registration of the socket to determine that the network activity traffic flow is associated with an initiator of the network activity, wherein the initiator of the network activity is not the proxy manager; and enforcing service policies associated with the initiator of the network activity for the network activity traffic flow.

**[00416]** Unless the context clearly indicates otherwise, the word "or" is used in its broadest sense. The phrase "A or B" thus includes "A only," "B only," and "A and B." Phrases of the form "A and/or B" in this document are sometimes used instead of "A or B" for emphasis. The use of "A and/or B" is not be interpreted as somehow implying that "A or B" has a narrower meaning than "A only," "B only," and "A and B."

**[00417]** Algorithmic descriptions and representations are the means used by those skilled in the data processing arts to effectively convey the substance of their work to others skilled in the art. An algorithm is here, and generally, conceived to be a self-consistent sequence of operations leading to a desired result. The operations are those requiring physical manipulations of physical quantities. Usually, though not necessarily, these quantities take the form of electrical or magnetic signals capable of being stored,

transferred, combined, compared, and otherwise manipulated. It has proven convenient at times, principally for reasons of common usage, to refer to these signals as bits, values, elements, symbols, characters, terms, numbers, or the like.

**[00418]** It should be borne in mind, however, that all of these and similar terms are to be associated with the appropriate physical quantities and are merely convenient labels applied to these quantities. Unless specifically stated otherwise as apparent from the following discussion, it is appreciated that throughout the description, discussions utilizing terms such as "processing" or "computing" or "calculating" or "determining" or "displaying" or the like, refer to the action and processes of a computer system, or similar electronic computing device, that manipulates and transforms data represented as physical (electronic) quantities within the computer system's registers and memories into other data similarly represented as physical quantities within the computer system memories or registers or other such information storage, transmission or display devices.

**[00419]** The present invention, in some embodiments, also relates to apparatus for performing the operations herein. This apparatus may be specially constructed for the required purposes, or it may comprise a general purpose computer selectively activated or reconfigured by a computer program stored in the computer. Such a computer program may be stored in a computer readable storage medium, such as, but is not limited to, read-only memories (ROMs), random access memories (RAMs), EPROMs, EEPROMs, magnetic or optical cards, any type of disk including floppy disks, optical disks, CD-ROMs, and magnetic-optical disks, or any type of media suitable for storing electronic instructions, and each coupled to a computer system bus.

**[00420]** The algorithms and displays presented herein are not inherently related to any particular computer or other apparatus. Various general purpose systems may be used with programs in accordance with the teachings herein, or it may prove convenient to construct more specialized apparatus to perform the required method steps. The required structure for a variety of these systems will appear from the description below. In addition, the present invention is not described with reference to any particular programming language, and various embodiments may thus be implemented using a variety of programming languages.

**[00421]** Although the foregoing embodiments have been described in some detail for purposes of clarity of understanding, the invention is not limited to the details provided. There are many alternative ways of implementing the invention. The disclosed embodiments are illustrative and not restrictive.

INCORPORATION BY REFERENCE

**[00422]** This document incorporates by reference for all purposes the following non-provisional U.S. patent applications: Application No. 12/380,778 (Attorney Docket No. RALEP004), filed March 2, 2009, entitled VERIFIABLE DEVICE ASSISTED SERVICE USAGE BILLING WITH INTEGRATED ACCOUNTING, MEDIATION ACCOUNTING, AND MULTI-ACCOUNT, now U.S. Patent No. 8,321,526 (issued November 27, 2012); Application No. 12/380,780 (Attorney Docket No. RALEP007), filed March 2, 2009, entitled AUTOMATED DEVICE PROVISIONING AND ACTIVATION, now U.S. Patent No. 8,839,388 (issued September 16, 2014); Application No. 12/695,019 (Attorney Docket No. RALEP022), filed January 27, 2010, entitled DEVICE ASSISTED CDR CREATION, AGGREGATION, MEDIATION AND BILLING, now U.S. Patent No. 8,275,830 (issued September 25, 2012); Application No. 12/695,020 (Attorney Docket No. RALEP024), filed January 27, 2010, entitled ADAPTIVE AMBIENT SERVICES, now U.S. Patent No. 8,406,748 (issued March 26, 2013); Application No. 12/694,445 (Attorney Docket No. RALEP025), filed January 27, 2010, entitled SECURITY TECHNIQUES FOR DEVICE ASSISTED SERVICES, now U.S. Patent No. 8,391,834 (issued March 5, 2013); Application No. 12/694,451 (Attorney Docket No. RALEP026), filed January 27, 2010, entitled DEVICE GROUP PARTITIONS AND SETTLEMENT PLATFORM, now U.S. Patent No. 8,548,428 (issued October 1, 2013); Application No. 12/694,455 (Attorney Docket No. RALEP027), filed January 27, 2010, entitled DEVICE ASSISTED SERVICES INSTALL, now U.S. Patent No. 8,402,111, now U.S. Patent No. 8,402,111 (issued March 19, 2013); Application No. 12/695,021 (Attorney Docket No. RALEP029), filed January 27, 2010, entitled QUALITY OF SERVICE FOR DEVICE ASSISTED SERVICES, now U.S. Patent No. 8,346,225 (issued January 1, 2013); Application No. 12/695,980 (Attorney Docket No. RALEP030), filed January 28, 2010, entitled ENHANCED ROAMING SERVICES AND CONVERGED CARRIER NETWORKS WITH DEVICE ASSISTED SERVICES AND A PROXY, now U.S. Patent No. 8,340,634 (issued December 25, 2012); Application No. 13/134,005 (Attorney Docket No. RALEP049), filed May 25, 2011, entitled SYSTEM AND METHOD FOR WIRELESS NETWORK OFFLOADING, now U.S. Patent No. 8,635,335 (issued January 21, 2014); Application No. 13/134,028 (Attorney Docket No. RALEP032), filed May 25, 2011, entitled DEVICE-ASSISTED SERVICES FOR PROTECTING NETWORK CAPACITY, now U.S. Patent No. 8,589,541 (issued November 19, 2013); Application No. 13/229,580 (Attorney Docket No. RALEP033), filed September 9, 2011, entitled WIRELESS NETWORK SERVICE INTERFACES, now U.S. Patent No. 8,626,115 (issued January 7, 2014); Application No. 13/237,827 (Attorney Docket No. RALEP034), filed September 20, 2011, entitled ADAPTING NETWORK POLICIES BASED ON DEVICE SERVICE PROCESSOR CONFIGURATION, now U.S. Patent No. 8,832,777 (issued September 9, 2014);

Application No. 13/239,321 (Attorney Docket No. RALEP036), filed September 21, 2011, entitled SERVICE OFFER SET PUBLISHING TO DEVICE AGENT WITH ON-DEVICE SERVICE SELECTION, now U.S. Patent No. 8,898,293; Application No. 13/248,028 (Attorney Docket No. RALEP037), filed September 28, 2011, entitled ENTERPRISE ACCESS CONTROL AND ACCOUNTING ALLOCATION FOR ACCESS NETWORKS, now U.S. Patent No. 8,924,469; Application No. 13/247,998 (Attorney Docket No. RALEP038), filed September 28, 2011, entitled COMMUNICATIONS DEVICE WITH SECURE DATA PATH PROCESSING AGENTS, now U.S. Patent No. 8,725,123 (issued May 13, 2014); Application No. 13/248,025 (Attorney Docket No. RALEP043), filed September 28, 2011, entitled SERVICE DESIGN CENTER FOR DEVICE ASSISTED SERVICES, now U.S. Patent No. 8,924,543; Application No. 13/253,013 (Attorney Docket No. RALEP035), filed October 4, 2011, entitled SYSTEM AND METHOD FOR PROVIDING USER NOTIFICATIONS, now U.S. Patent No. 8,745,191 (issued June 3, 2014); Application No. 13/309,556 (Attorney Docket No. RALEP040), filed December 1, 2011, entitled END USER DEVICE THAT SECURES AN ASSOCIATION OF APPLICATION TO SERVICE POLICY WITH AN APPLICATION CERTIFICATE CHECK, now U.S. Patent No. 8,893,009; Application No. 13/309,463 (Attorney Docket No. RALEP041), filed December 1, 2011, entitled SECURITY, FRAUD DETECTION, AND FRAUD MITIGATION IN DEVICE-ASSISTED SERVICES SYSTEMS, now U.S. Patent No. 8,793,758 (issued July 29, 2014); and Application No. 13/374,959 (Attorney Docket No. RALEP046), filed January 24, 2012, entitled FLOW TAGGING FOR SERVICE POLICY IMPLEMENTATION, now U.S. Patent No. 8,606,911 (issued December 10, 2013).

**[00423]** This document incorporates by reference for all purposes the following provisional patent applications: Provisional Application No. 61/206,354 (Attorney Docket No. RALEP001+), filed January 28, 2009, entitled SERVICES POLICY COMMUNICATION SYSTEM AND METHOD; Provisional Application No. 61/206,944 (Attorney Docket No. RALEP002+), filed February 4, 2009, entitled SERVICES POLICY COMMUNICATION SYSTEM AND METHOD; Provisional Application No. 61/207,393 (Attorney Docket No. RALEP003+), filed February 10, 2009, entitled SERVICES POLICY COMMUNICATION SYSTEM AND METHOD; and Provisional Application No. 61/207,739 (Attorney Docket No. RALEP004+), entitled SERVICES POLICY COMMUNICATION SYSTEM AND METHOD, filed February 13, 2009; Provisional Application No. 61/270,353 (Attorney Docket No. RALEP022+), filed on July 6, 2009, entitled DEVICE ASSISTED CDR CREATION, AGGREGATION, MEDIATION AND BILLING; Provisional Application No. 61/275,208 (Attorney Docket No. RALEP023+), filed August 25, 2009, entitled ADAPTIVE AMBIENT SERVICES; and Provisional Application No. 61/237,753 (Attorney Docket No. RALEP024+), filed August 28, 2009, entitled

ADAPTIVE AMBIENT SERVICES; Provisional Application No. 61/252,151 (Attorney Docket No. RALEP025+), filed October 15, 2009, entitled SECURITY TECHNIQUES FOR DEVICE ASSISTED SERVICES; Provisional Application No. 61/252,153 (Attorney Docket No. RALEP026+), filed October 15, 2009, entitled DEVICE GROUP PARTITIONS AND SETTLEMENT PLATFORM; Provisional Application No. 61/264,120 (Attorney Docket No. RALEP027+), filed November 24, 2009, entitled DEVICE ASSISTED SERVICES INSTALL; Provisional Application No. 61/264,126 (Attorney Docket No. RALEP028+), filed November 24, 2009, entitled DEVICE ASSISTED SERVICES ACTIVITY MAP; Provisional Application No. 61/348,022 (Attorney Docket No. RALEP031+), filed May 25, 2010, entitled DEVICE ASSISTED SERVICES FOR PROTECTING NETWORK CAPACITY; Provisional Application No. 61/381,159 (Attorney Docket No. RALEP032+), filed September 9, 2010, entitled DEVICE ASSISTED SERVICES FOR PROTECTING NETWORK CAPACITY; Provisional Application No. 61/381,162 (Attorney Docket No. RALEP033+), filed September 9, 2010, entitled SERVICE CONTROLLER INTERFACES AND WORKFLOWS; Provisional Application No. 61/384,456 (Attorney Docket No. RALEP034+), filed September 20, 2010, entitled SECURING SERVICE PROCESSOR WITH SPONSORED SIMS; Provisional Application No. 61/389,547 (Attorney Docket No. RALEP035+), filed October 4, 2010, entitled USER NOTIFICATIONS FOR DEVICE ASSISTED SERVICES; Provisional Application No. 61/385,020 (Attorney Docket No. RALEP036+), filed September 21, 2010, entitled SERVICE USAGE RECONCILIATION SYSTEM OVERVIEW; Provisional Application No. 61/387,243 (Attorney Docket No. RALEP037+), filed September 28, 2010, entitled ENTERPRISE AND CONSUMER BILLING ALLOCATION FOR WIRELESS COMMUNICATION DEVICE SERVICE USAGE ACTIVITIES; Provisional Application No. 61/387,247 (Attorney Docket No. RALEP038+), filed September 28, entitled SECURED DEVICE DATA RECORDS, 2010; Provisional Application No. 61/407,358 (Attorney Docket No. RALEP039+), filed October 27, 2010, entitled SERVICE CONTROLLER AND SERVICE PROCESSOR ARCHITECTURE; Provisional Application No. 61/418,507 (Attorney Docket No. RALEP040+), filed December 1, 2010, entitled APPLICATION SERVICE PROVIDER INTERFACE SYSTEM; Provisional Application No. 61/418,509 (Attorney Docket No. RALEP041+), filed December 1, 2010, entitled SERVICE USAGE REPORTING RECONCILIATION AND FRAUD DETECTION FOR DEVICE ASSISTED SERVICES; Provisional Application No. 61/420,727 (Attorney Docket No. RALEP042+), filed December 7, 2010, entitled SECURE DEVICE DATA RECORDS; Provisional Application No. 61/422,565 (Attorney Docket No. RALEP043+), filed December 13, 2010, entitled SERVICE DESIGN CENTER FOR DEVICE ASSISTED SERVICES; Provisional Application No. 61/422,572 (Attorney Docket No. RALEP044+), filed December 13, 2010, entitled SYSTEM INTERFACES AND WORKFLOWS FOR DEVICE ASSISTED SERVICES; Provisional Application No. 61/422,574

(Attorney Docket No. RALEP045+), filed December 13, 2010, entitled SECURITY AND FRAUD DETECTION FOR DEVICE ASSISTED SERVICES; Provisional Application No. 61/435,564 (Attorney Docket No. RALEP046+), filed January 24, 2011, entitled FRAMEWORK FOR DEVICE ASSISTED SERVICES; Provisional Application No. 61/472,606 (Attorney Docket No. RALEP047+), filed April 6, 2011, entitled MANAGING SERVICE USER DISCOVERY AND SERVICE LAUNCH OBJECT PLACEMENT ON A DEVICE; Provisional Application No. 61/550,906 (Attorney Docket No. RALEP048+), filed October 24, 2011, entitled SECURITY FOR DEVICE-ASSISTED SERVICES; and Provisional Application No. 61/589,830 (Attorney Docket No. RALEP052+), filed January 23, 2012, entitled METHODS AND APPARATUS TO PRESENT INFORMATION ABOUT VOICE, MESSAGING, AND DATA SERVICES ON WIRELESS MOBILE DEVICES.

**[00424]** We claim:

CLAIMS

1. A system, comprising:

a traffic stack;

a proxy manager coupled to the traffic stack;

a socket manager coupled to the traffic stack;

a traffic classification and enforcement engine coupled to the traffic stack;

wherein, in operation:

the proxy manager tags a network activity traffic flow at a first point in the flow, wherein the first point is associated with an API call to the proxy manager for a thread;

the proxy manager registers the thread at the traffic stack;

the socket manager tags the network activity traffic flow at a second point in the flow, wherein the second point is associated with a socket call to the socket manager for the thread;

the socket manager registers the socket at the traffic stack;

the traffic classification and enforcement engine uses the registration of the thread and the registration of the socket to determine that the network activity traffic flow is associated with an initiator of the network activity, wherein the initiator of the network activity is not the proxy manager;

the traffic classification and enforcement engine enforces service policies assocated with the initiator of the network activity for the network activity traffic flow.

**ABSTRACT**

A flow tagging technique includes tagging a data flow at a plurality of points in the data flow. For example, the data flow can be tagged at a socket and at a proxy manager API. By tagging the data flow at multiple points, it becomes possible to map network service usage activities to the appropriate initiating applications.

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# DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

| | |
|---|---|
| **Title of Invention** | TECHNIQUES FOR ATTRIBUTION OF MOBILE DEVICE DATA TRAFFIC TO INITIATING END-USER APPLICATION (RALEP046C2) |

As the below named inventor, I hereby declare that:

This declaration is directed to:

- [x] The attached application, or
- [ ] United States application or PCT international application number _____ filed on _____.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

## WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: Gregory G. Raleigh Date (Optional): 2/22/14

Signature: _____

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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# DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

| Title of Invention | TECHNIQUES FOR ATTRIBUTION OF MOBILE DEVICE DATA TRAFFIC TO INITIATING END-USER APPLICATION (RALEP046C2) |
|---|---|

As the below named inventor, I hereby declare that:

This declaration is directed to:

- [x] The attached application, or
- [ ] United States application or PCT international application number _____ filed on _____.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

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LEGAL NAME OF INVENTOR

Inventor: James Lavine Date (Optional): 7/7/14

Signature: _____

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

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The information provided by you in this form will be subject to the following routine uses:

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
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7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant ( *i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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# DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

| Title of Invention | TECHNIQUES FOR ATTRIBUTION OF MOBILE DEVICE DATA TRAFFIC TO INITIATING END-USER APPLICATION (RALEP046C2) |
|---|---|

As the below named inventor, I hereby declare that:

This declaration is directed to:

- [x] The attached application, or
- [ ] United States application or PCT international application number _____ filed on _____

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

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LEGAL NAME OF INVENTOR

Inventor: Jeffrey Green Date (Optional) : _____

Signature: _____

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

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# DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

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|---|---|

As the below named inventor, I hereby declare that:

This declaration is directed to:

- [x] The attached application, or
- [ ] United States application or PCT international application number _____ filed on _____.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

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LEGAL NAME OF INVENTOR

Inventor: Vien-Phuong Nguyen Date (Optional): 7/22/2014

Signature: _____

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

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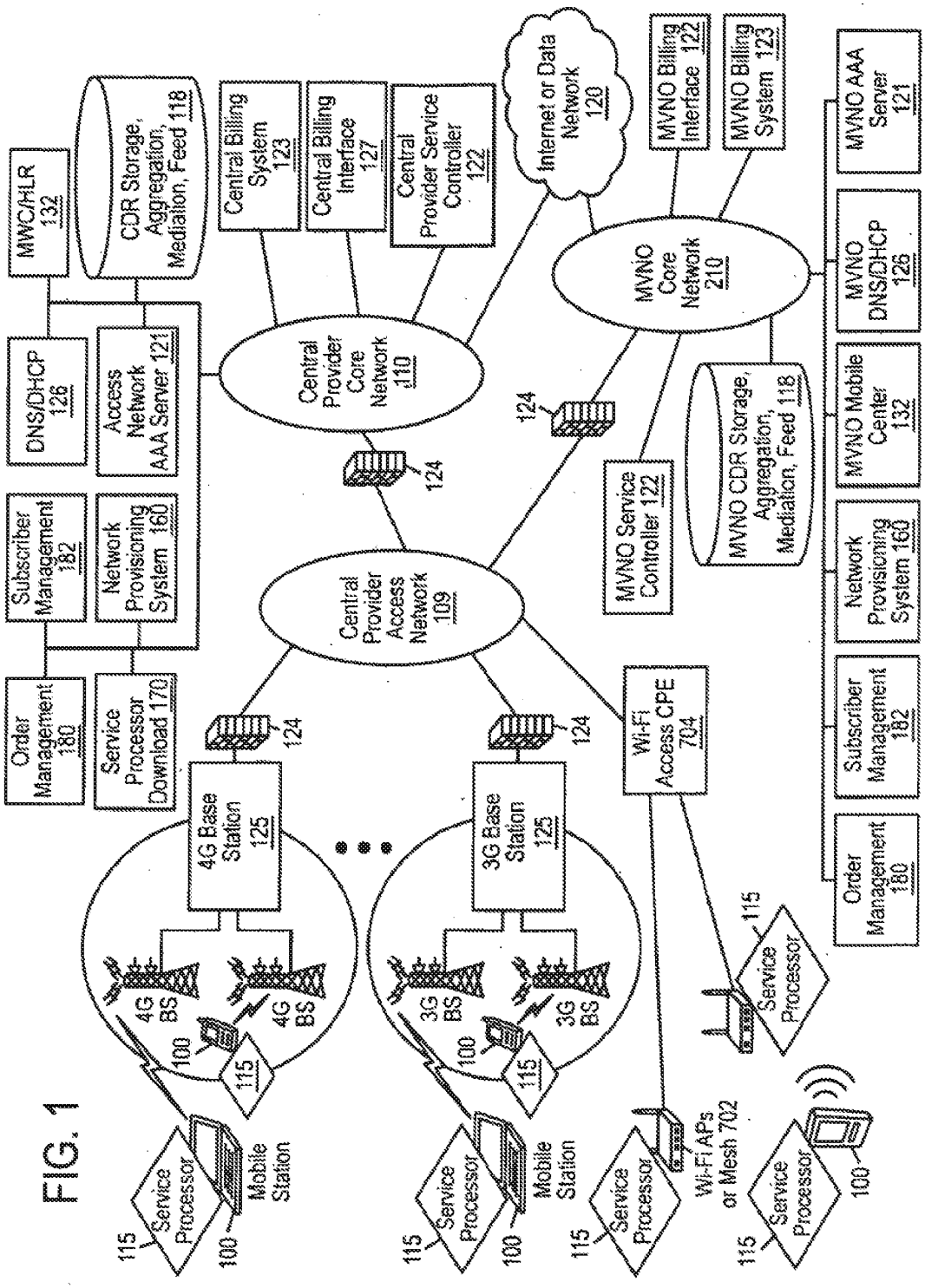

MWC/HLR 132
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Central Billing System 123
Central Billing Interface 127
Central Provider Service Controller 122
Internet or Data Network 120
MVNO Billing Interface 122
MVNO Billing System 123
MVNO AAA Server 121
DNS/DHCP 126
Access Network AAA Server 121
Central Provider Core Network 110
MVNO Core Network 210
MVNO DNS/DHCP 126
Subscriber Management 182
Network Provisioning System 160
MVNO Mobile Center 132
Order Management 180
Service Processor Download 170
Central Provider Access Network 109
MVNO Service Controller 122
MVNO CDR Storage, Aggregation, Mediation, Feed 118
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4G Base Station 125
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Service Processor
Mobile Station
Wi-Fi APs or Mesh 702

FIG. 1

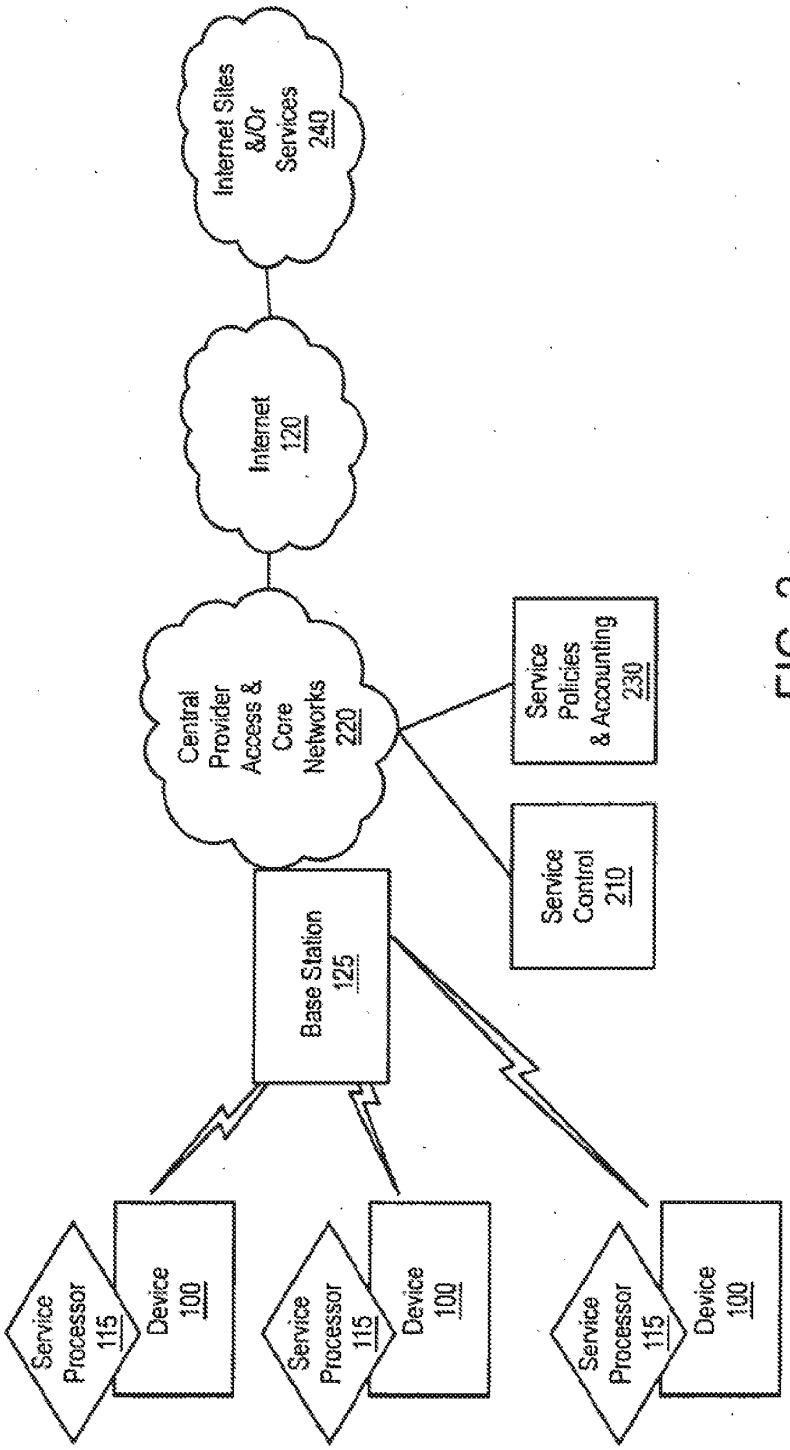

Internet Sites &/Or Services 240
Internet 120
Central Provider Access & Core Networks 220
Service Policies & Accounting 230
Service Control 210
Base Station 125
Service Processor 115
Device 100
Service Processor 115
Device 100
Service Processor 115
Device 100

FIG. 2

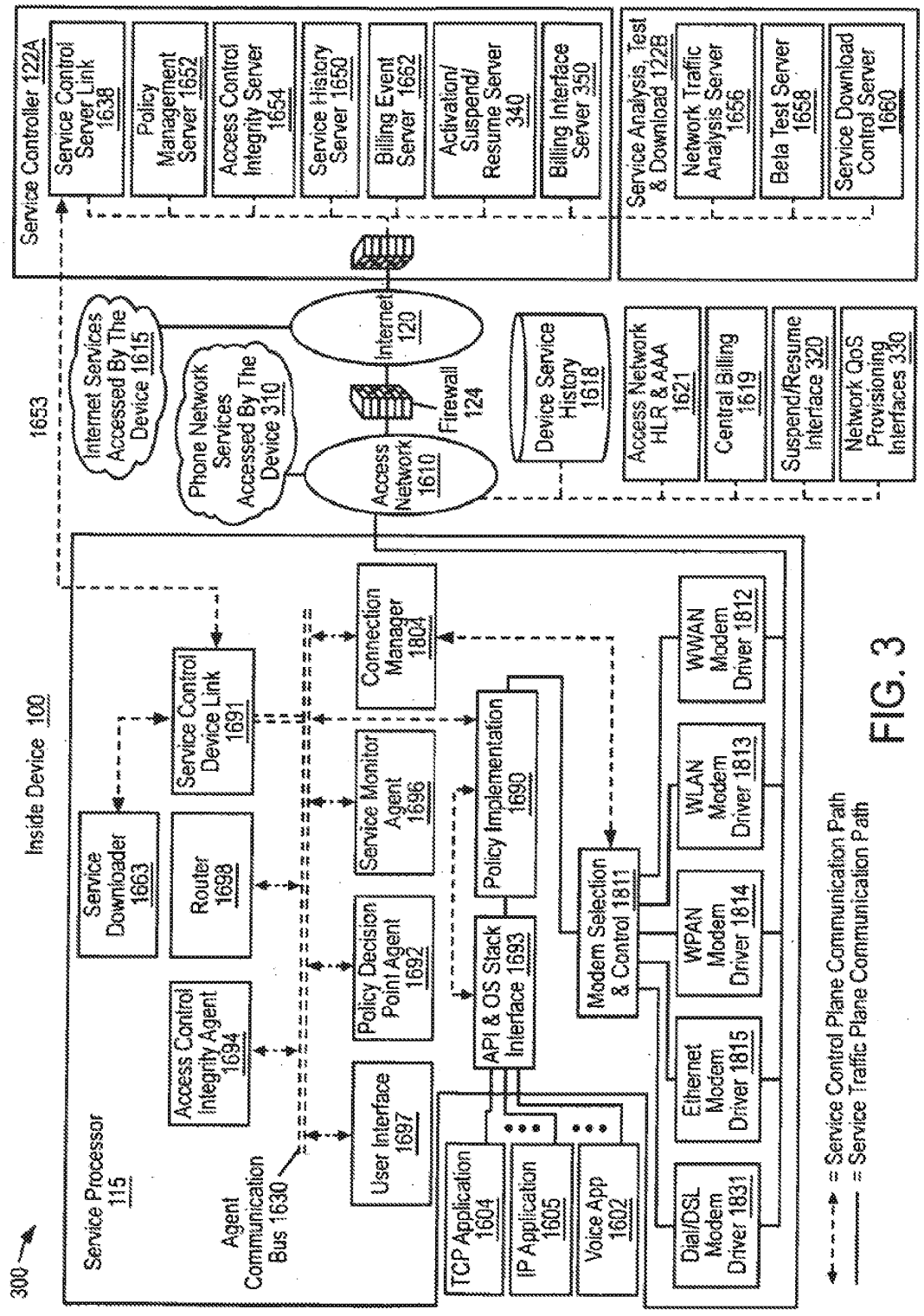

300
Inside Device 100
1653
Service Processor 115
Agent Communication Bus 1630
Service Downloader 1663
Router 1698
Service Control Device Link 1691
Access Control Integrity Agent 1694
Policy Decision Point Agent 1692
Service Monitor Agent 1696
Connection Manager 1804
User Interface 1697
API & OS Stack Interface 1693
Policy Implementation 1690
Modem Selection & Control 1811
TCP Application 1604
IP Application 1605
Voice App 1602
Dial/DSL Modem Driver 1831
Ethernet Modem Driver 1815
WPAN Modem Driver 1814
WLAN Modem Driver 1813
WWAN Modem Driver 1812
Internet Services Accessed By The Device 1615
Phone Network Services Accessed By The Device 310
Access Network 1610
Firewall 124
Internet 120
Device Service History 1618
Service Controller 122A
Service Control Server Link 1638
Policy Management Server 1652
Access Control Integrity Server 1654
Service History Server 1650
Billing Event Server 1662
Activation/ Suspend/ Resume Server 340
Billing Interface Server 350
Service Analysis, Test & Download 122B
Network Traffic Analysis Server 1656
Beta Test Server 1658
Service Download Control Server 1660
Access Network HLR & AAA 1621
Central Billing 1619
Suspend/Resume Interface 320
Network QoS Provisioning Interfaces 330
= Service Control Plane Communication Path
= Service Traffic Plane Communication Path

FIG. 3

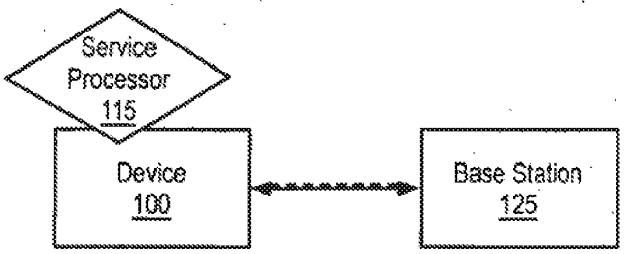



FIG. 4A

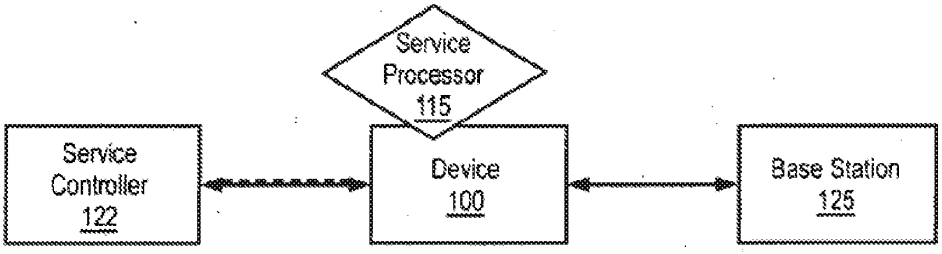



FIG. 4B

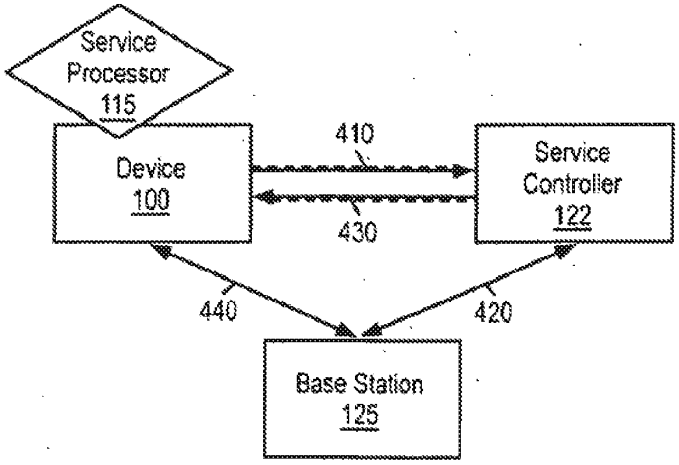



FIG. 4C

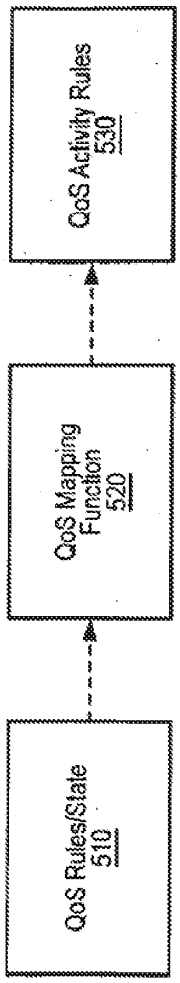

QoS Rules/State
510
QoS Mapping
Function
520
QoS Activity Rules
530

FIG. 5

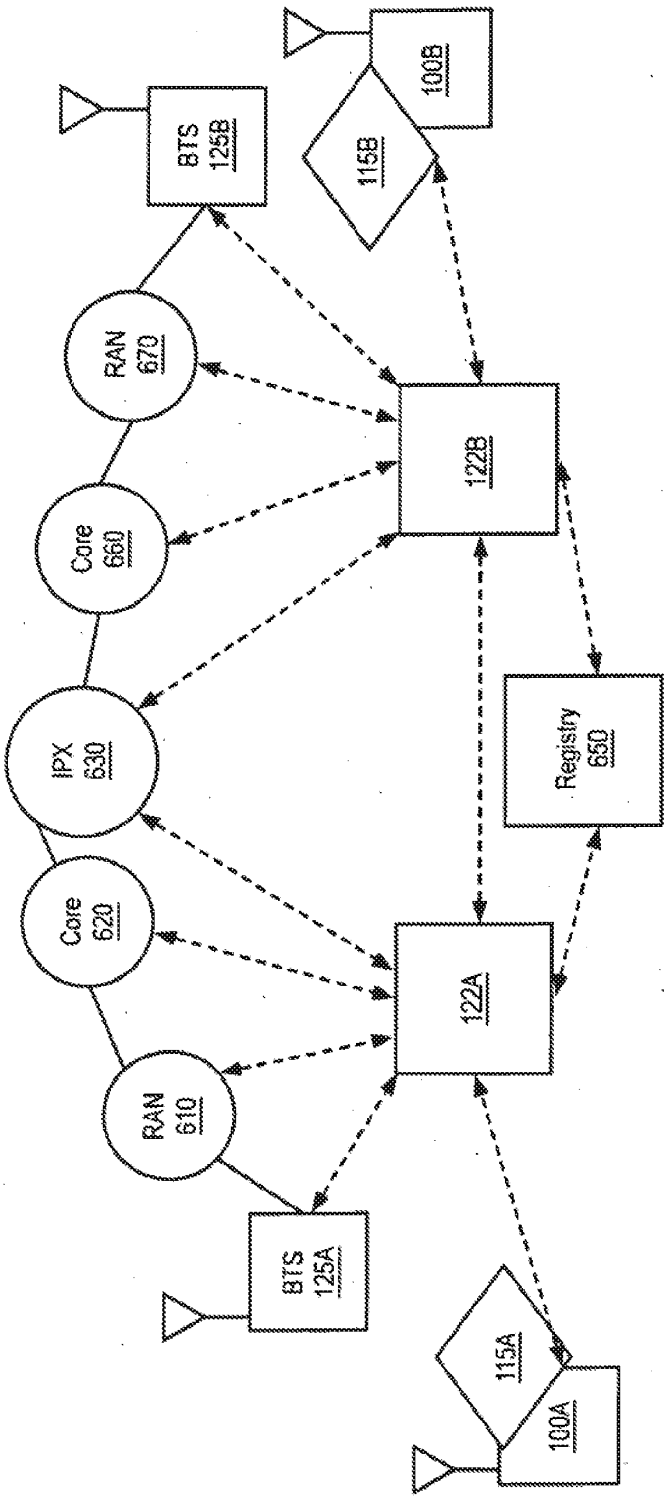

100B
115B
BTS 125B
RAN 670
Core 660
122B
IPX 630
Registry 690
Core 620
122A
RAN 610
BTS 125A
115A
100A

FIG. 6

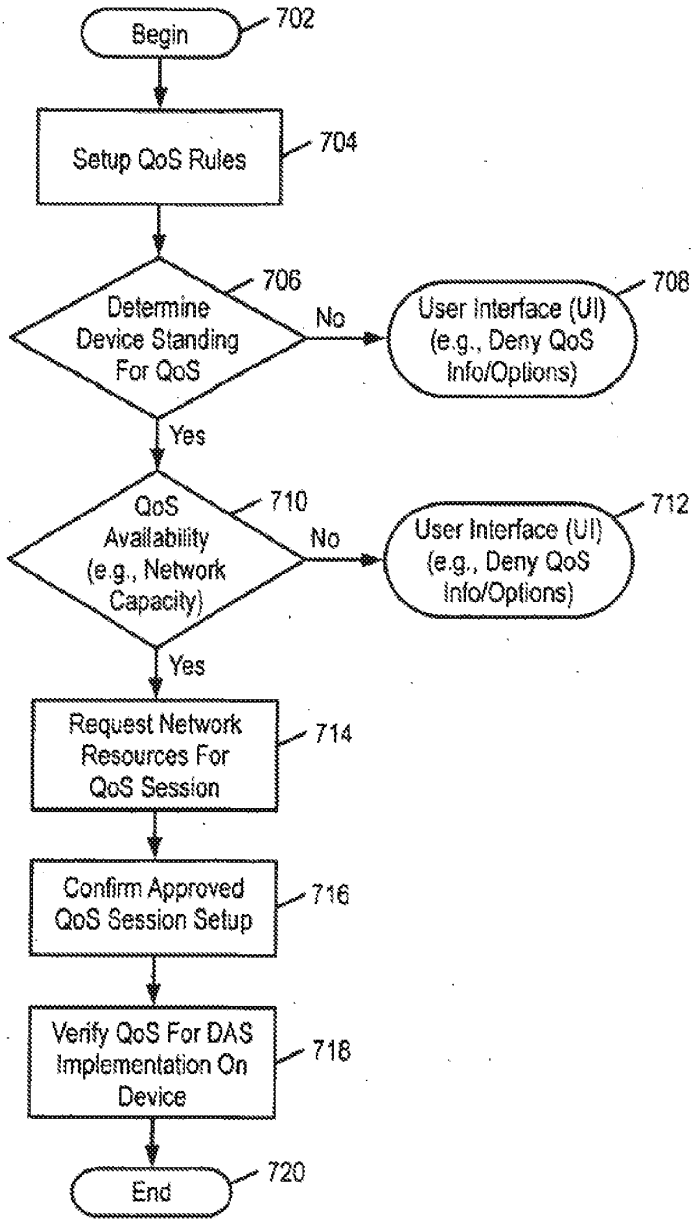

Begin
702
Setup QoS Rules
704
Determine Device Standing For QoS
706
No
User Interface (UI) (e.g., Deny QoS Info/Options)
708
Yes
QoS Availability (e.g., Network Capacity)
710
No
User Interface (UI) (e.g., Deny QoS Info/Options)
712
Yes
Request Network Resources For QoS Session
714
Confirm Approved QoS Session Setup
716
Verify QoS For DAS Implementation On Device
718
End
720

FIG. 7

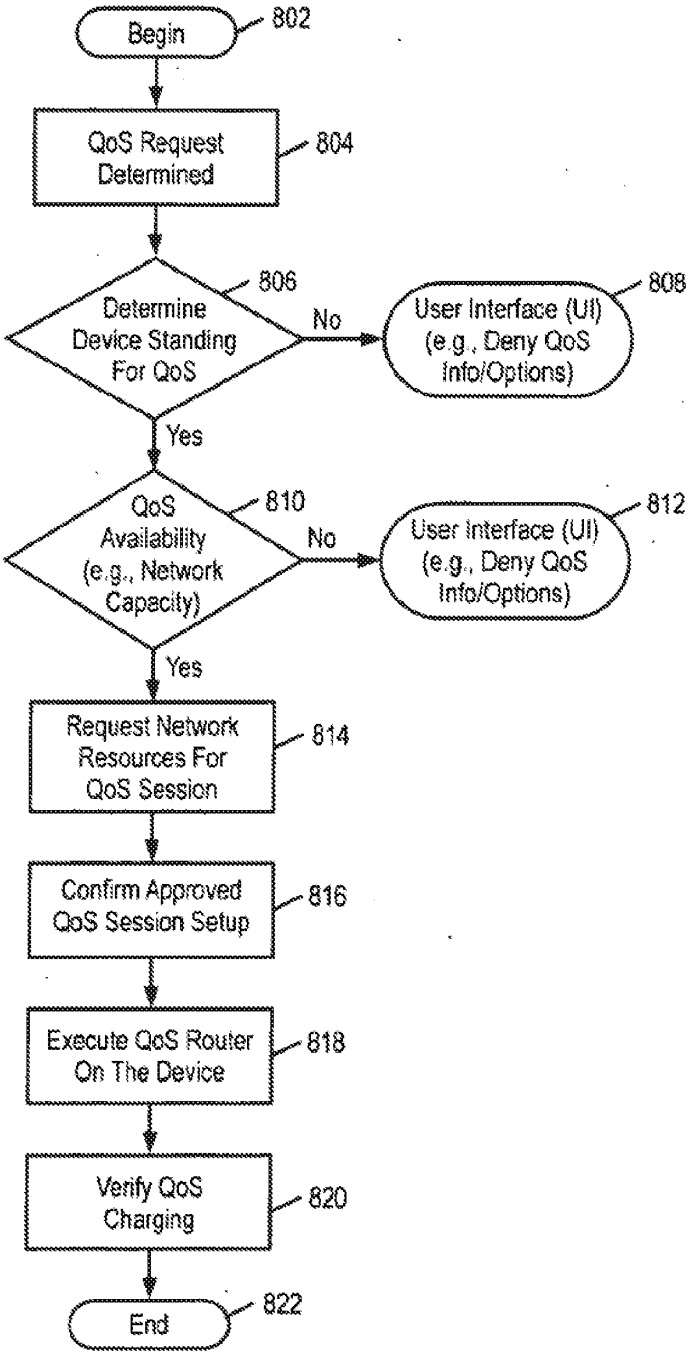

Begin
802
QoS Request Determined
804
Determine Device Standing For QoS
806
No
User Interface (UI) (e.g., Deny QoS Info/Options)
808
Yes
QoS Availability (e.g., Network Capacity)
810
No
User Interface (UI) (e.g., Deny QoS Info/Options)
812
Yes
Request Network Resources For QoS Session
814
Confirm Approved QoS Session Setup
816
Execute QoS Router On The Device
818
Verify QoS Charging
820
End
822

FIG. 8A

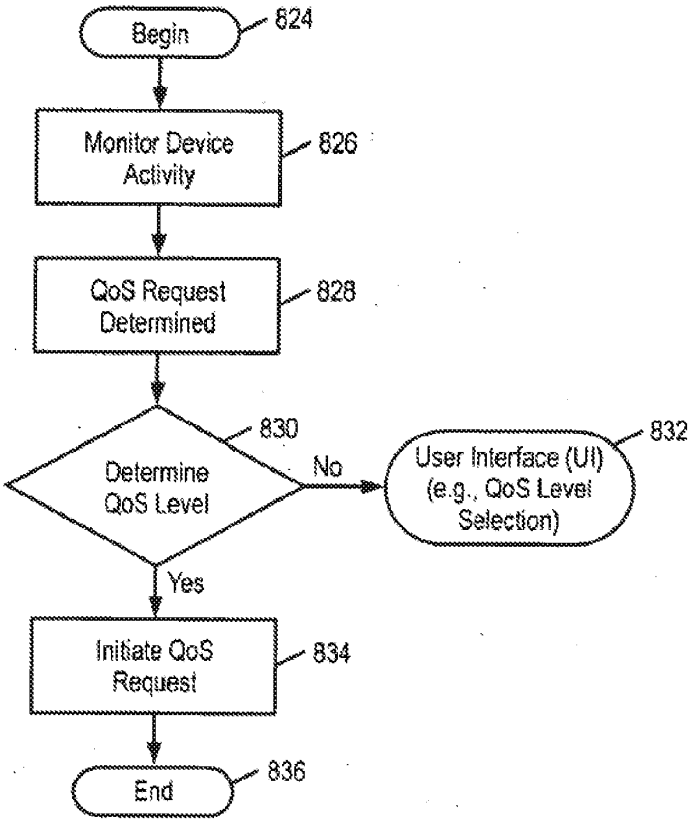

Begin
824
Monitor Device Activity
826
QoS Request Determined
828
Determine QoS Level
830
No
User Interface (UI) (e.g., QoS Level Selection)
832
Yes
Initiate QoS Request
834
End
836

FIG. 8B

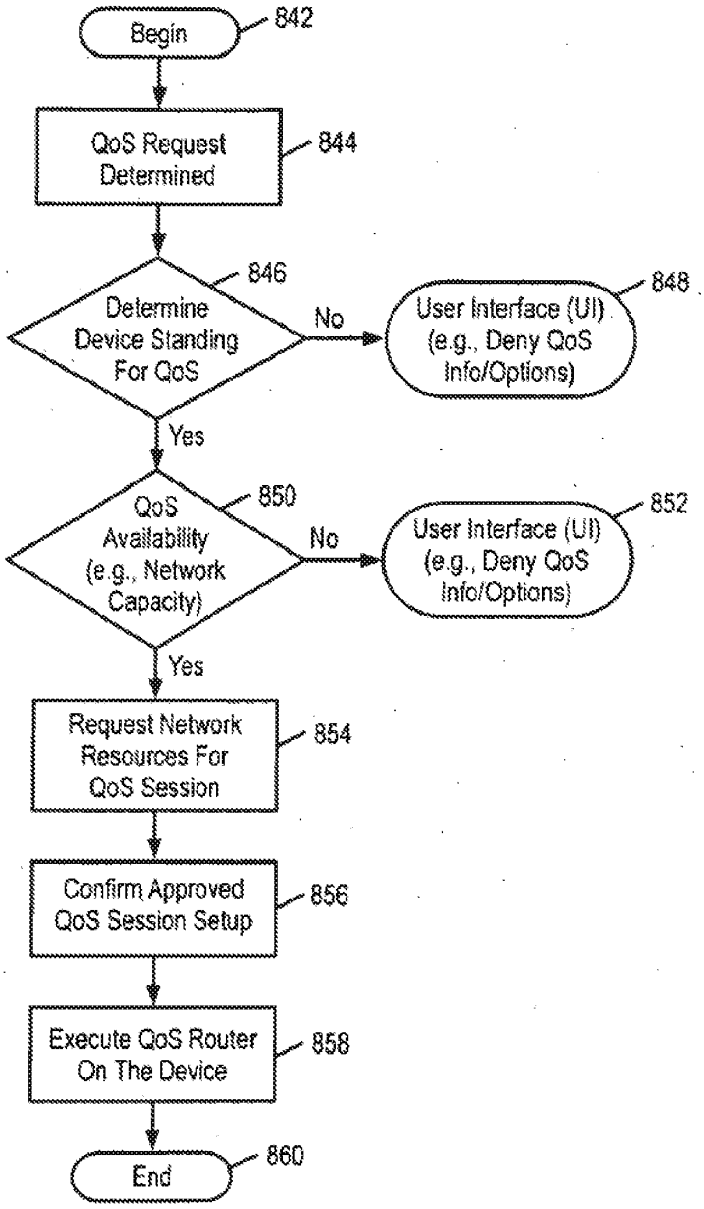

Begin
842
QoS Request Determined
844
Determine Device Standing For QoS
846
No
User Interface (UI) (e.g., Deny QoS Info/Options)
848
Yes
QoS Availability (e.g., Network Capacity)
850
No
User Interface (UI) (e.g., Deny QoS Info/Options)
852
Yes
Request Network Resources For QoS Session
854
Confirm Approved QoS Session Setup
856
Execute QoS Router On The Device
858
End
860

FIG. 8C

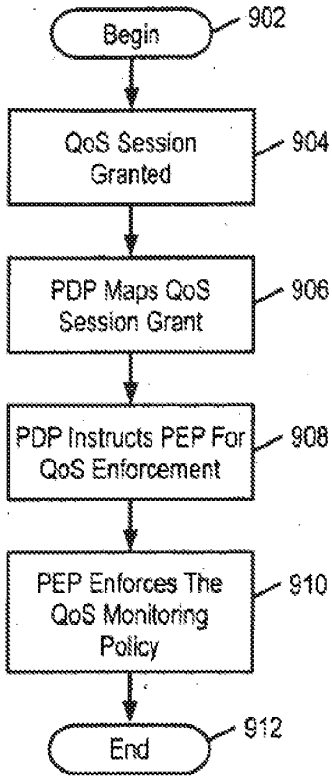

Begin
902
QoS Session Granted
904
PDP Maps QoS Session Grant
906
PDP Instructs PEP For QoS Enforcement
908
PEP Enforces The QoS Monitoring Policy
910
End
912

FIG. 9

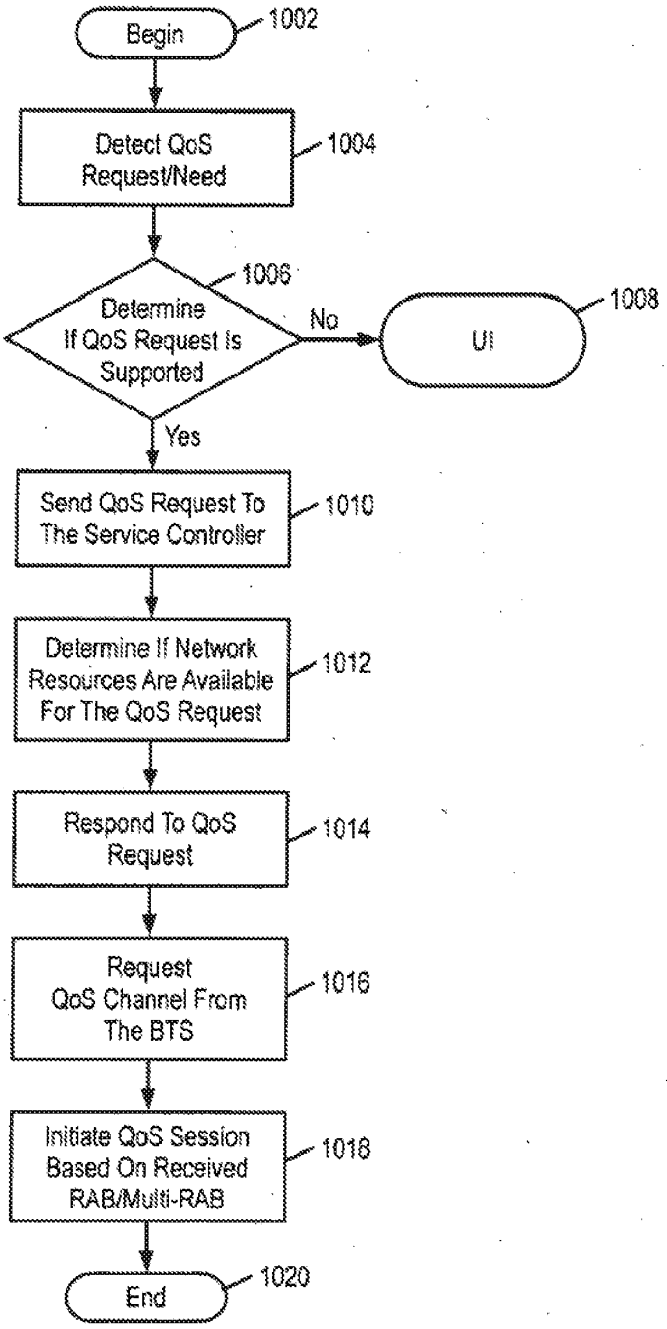

Begin
1002
Detect QoS Request/Need
1004
Determine If QoS Request Is Supported
1006
No
UI
1008
Yes
Send QoS Request To The Service Controller
1010
Determine If Network Resources Are Available For The QoS Request
1012
Respond To QoS Request
1014
Request QoS Channel From The BTS
1016
Initiate QoS Session Based On Received RAB/Multi-RAB
1018
End
1020

FIG. 10

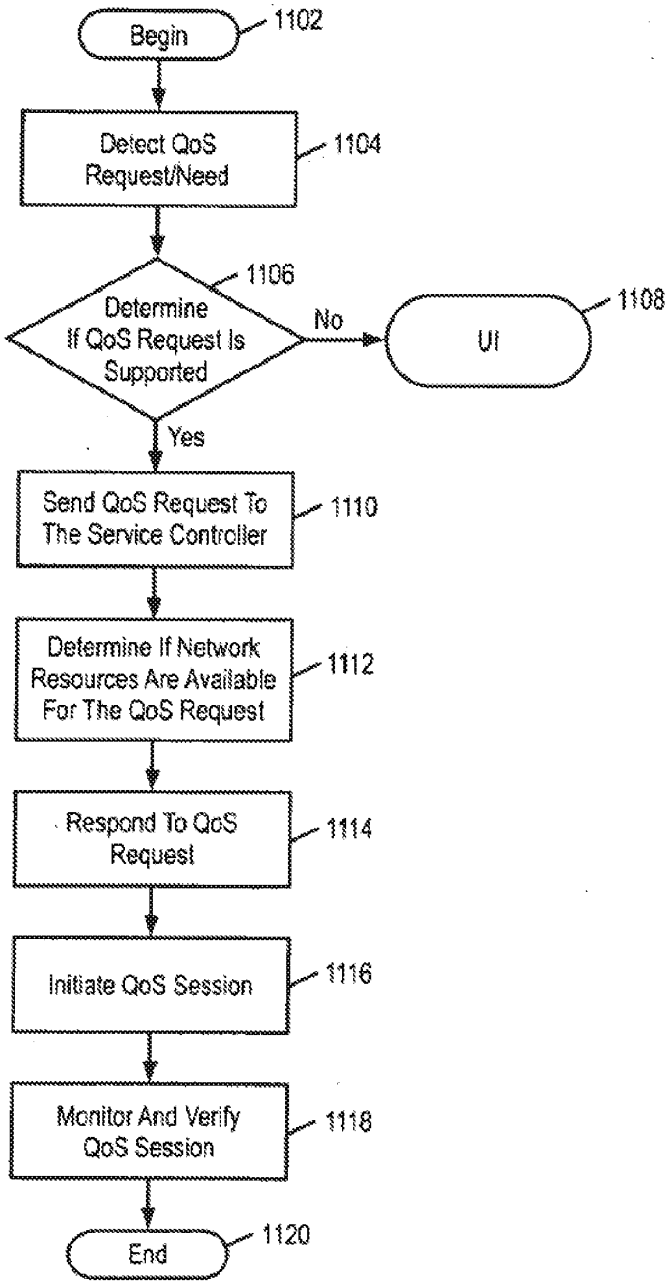

Begin
1102
Detect QoS Request/Need
1104
Determine If QoS Request Is Supported
1106
No
UI
1108
Yes
Send QoS Request To The Service Controller
1110
Determine If Network Resources Are Available For The QoS Request
1112
Respond To QoS Request
1114
Initiate QoS Session
1116
Monitor And Verify QoS Session
1118
End
1120

FIG. 11

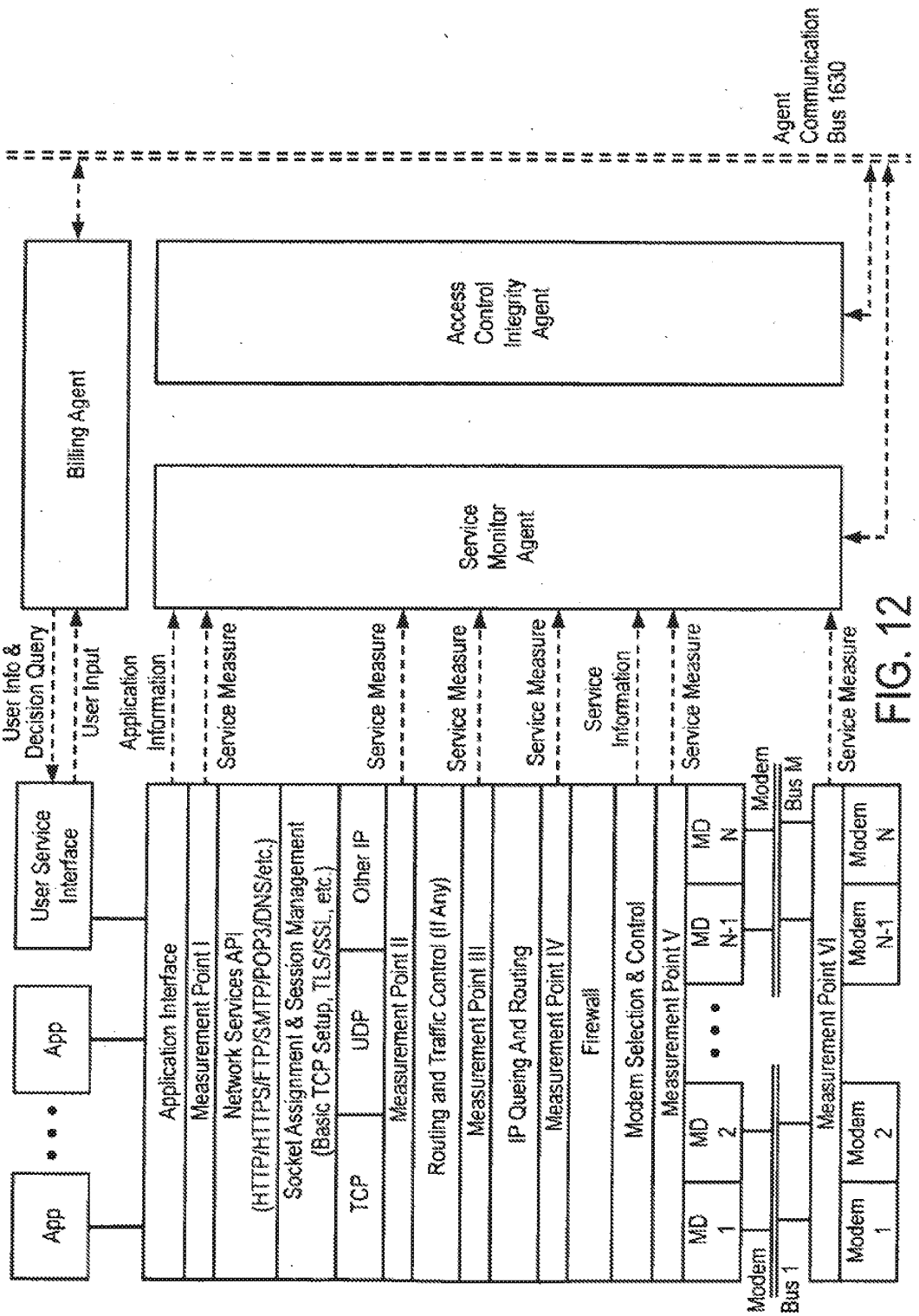

App
App
User Service Interface
User Info & Decision Query
User Input
Application Information
Service Measure
Billing Agent
Access Control Integrity Agent
Agent Communication Bus 1630
Application Interface
Measurement Point I
Network Services API (HTTP/HTTPS/FTP/SMTP/POP3/DNS/etc.)
Socket Assignment & Session Management (Basic TCP Setup, TLS/SSL, etc.)
TCP
UDP
Other IP
Measurement Point II
Routing and Traffic Control (If Any)
Measurement Point III
IP Queing And Routing
Measurement Point IV
Firewall
Modem Selection & Control
Measurement Point V
Service Measure
Service Monitor Agent
MD 1
MD 2
MD N-1
MD N
Modem
Bus M
Bus 1
Modem 1
Modem 2
Modem N-1
Modem N
Measurement Point VI

FIG. 12

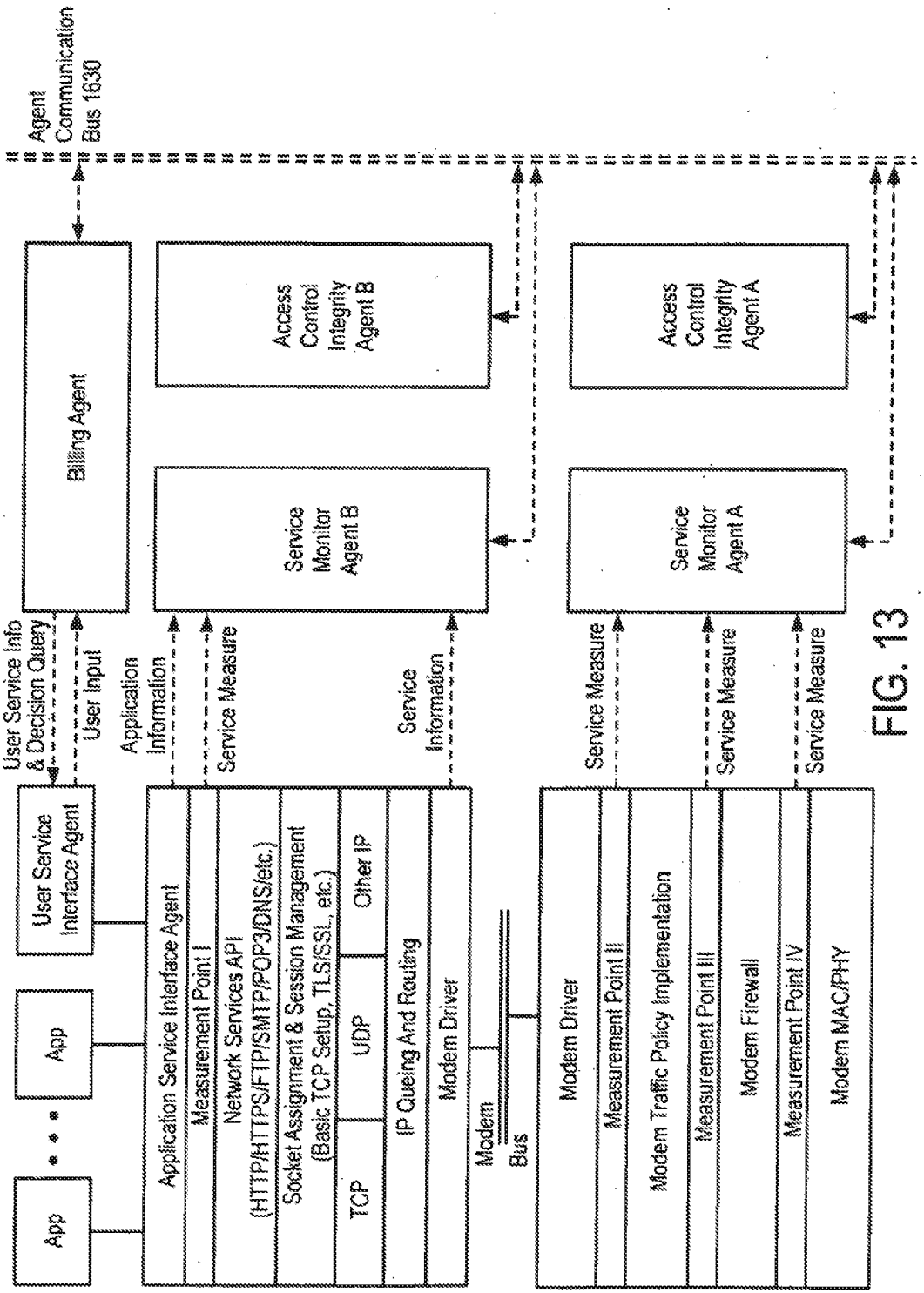

App
App
User Service Interface Agent
Application Service Interface Agent
Measurement Point I
Network Services API
(HTTP/HTTPS/FTP/SMTP/POP3/DNS/etc.)
Socket Assignment & Session Management
(Basic TCP Setup, TLS/SSL, etc.)
TCP
UDP
Other IP
IP Queuing And Routing
Modem Driver
Modem
Bus
Modem Driver
Measurement Point II
Modem Traffic Policy Implementation
Measurement Point III
Modem Firewall
Measurement Point IV
Modem MAC/PHY
User Service Info & Decision Query
User Input
Application Information
Service Measure
Service Information
Service Measure
Billing Agent
Service Monitor Agent B
Service Monitor Agent A
Access Control Integrity Agent B
Access Control Integrity Agent A
Service Measure
Service Measure
Agent Communication Bus 1630

FIG. 13

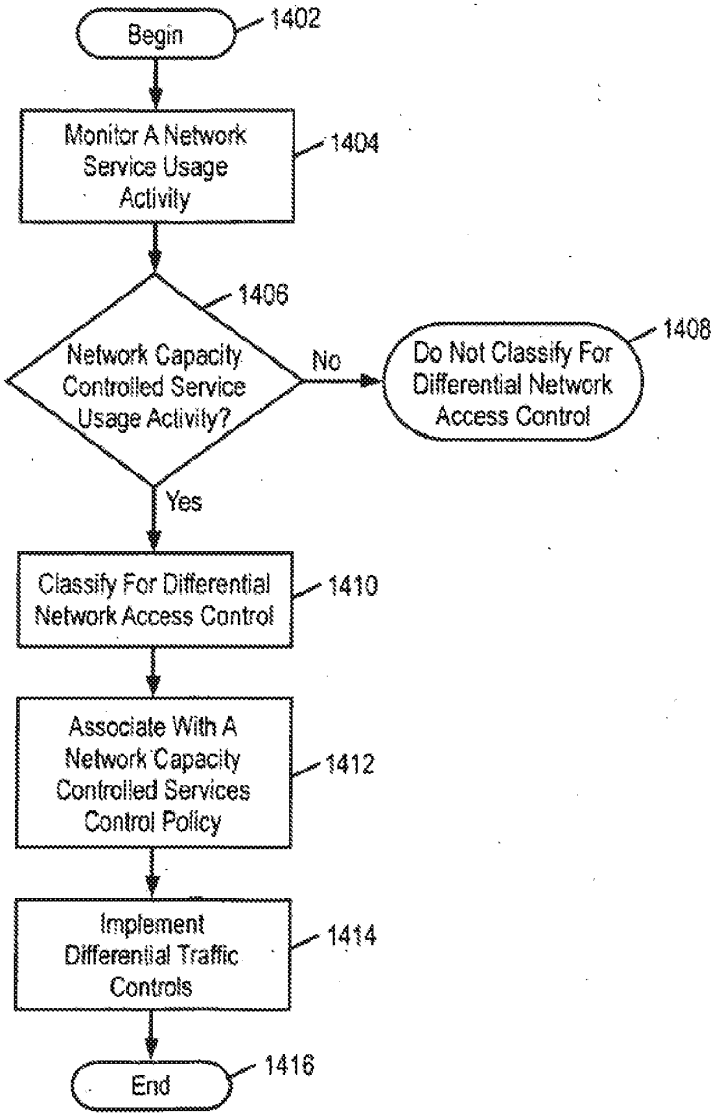

Begin
1402
Monitor A Network Service Usage Activity
1404
Network Capacity Controlled Service Usage Activity?
1406
No
Do Not Classify For Differential Network Access Control
1408
Yes
Classify For Differential Network Access Control
1410
Associate With A Network Capacity Controlled Services Control Policy
1412
Implement Differential Traffic Controls
1414
End
1416

FIG. 14

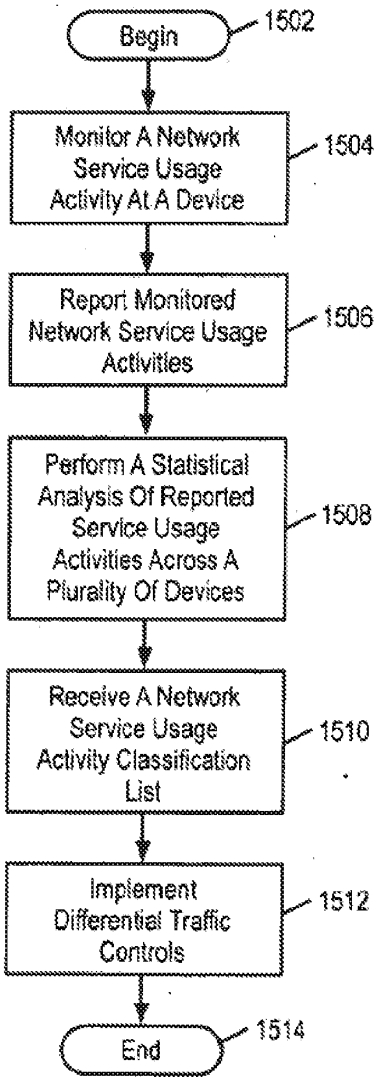

Begin
1502
Monitor A Network Service Usage Activity At A Device
1504
Report Monitored Network Service Usage Activities
1506
Perform A Statistical Analysis Of Reported Service Usage Activities Across A Plurality Of Devices
1508
Receive A Network Service Usage Activity Classification List
1510
Implement Differential Traffic Controls
1512
End
1514

FIG. 15

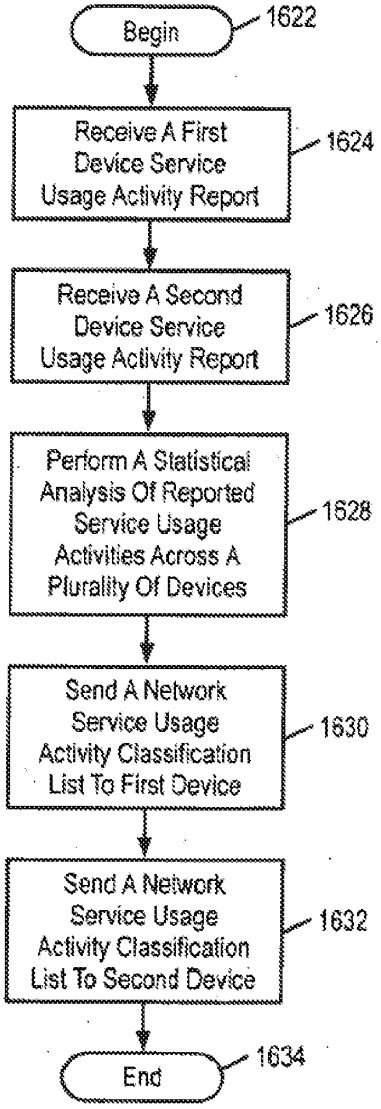

Begin
1622
Receive A First Device Service Usage Activity Report
1624
Receive A Second Device Service Usage Activity Report
1626
Perform A Statistical Analysis Of Reported Service Usage Activities Across A Plurality Of Devices
1628
Send A Network Service Usage Activity Classification List To First Device
1630
Send A Network Service Usage Activity Classification List To Second Device
1632
End
1634

FIG. 16

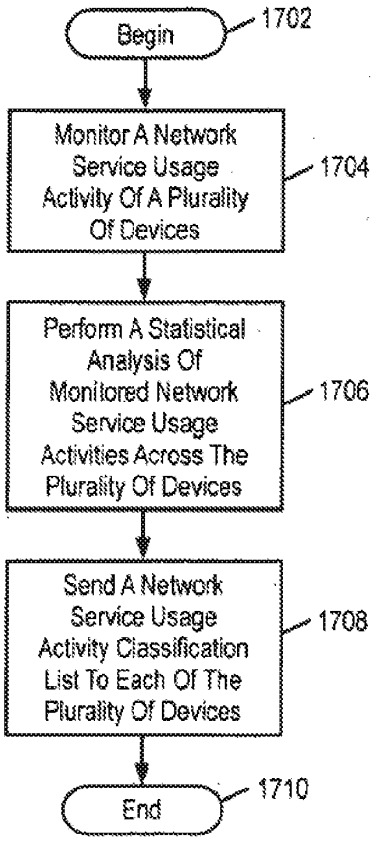

Begin
1702
Monitor A Network Service Usage Activity Of A Plurality Of Devices
1704
Perform A Statistical Analysis Of Monitored Network Service Usage Activities Across The Plurality Of Devices
1706
Send A Network Service Usage Activity Classification List To Each Of The Plurality Of Devices
1708
End
1710

FIG. 17

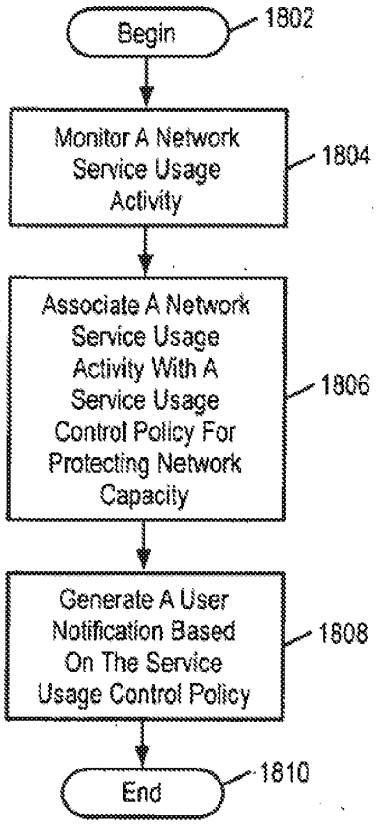

Begin
1802
Monitor A Network Service Usage Activity
1804
Associate A Network Service Usage Activity With A Service Usage Control Policy For Protecting Network Capacity
1806
Generate A User Notification Based On The Service Usage Control Policy
1808
End
1810

FIG. 18

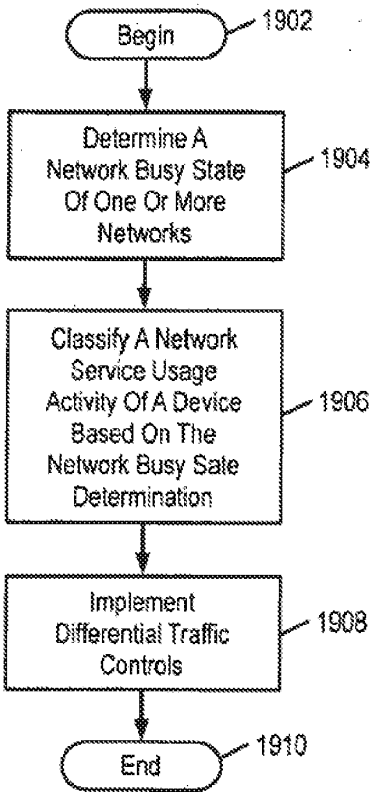

Begin
1902
Determine A Network Busy State Of One Or More Networks
1904
Classify A Network Service Usage Activity Of A Device Based On The Network Busy Sate Determination
1906
Implement Differential Traffic Controls
1908
End
1910

FIG. 19

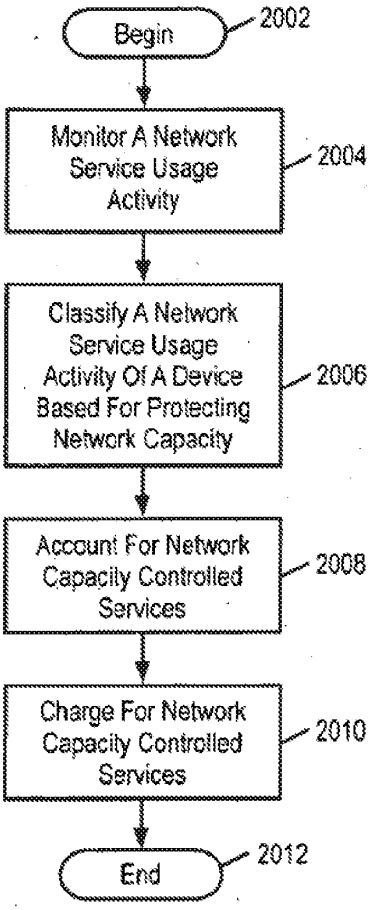

Begin
2002
Monitor A Network Service Usage Activity
2004
Classify A Network Service Usage Activity Of A Device Based For Protecting Network Capacity
2006
Account For Network Capacity Controlled Services
2008
Charge For Network Capacity Controlled Services
2010
End
2012

FIG. 20

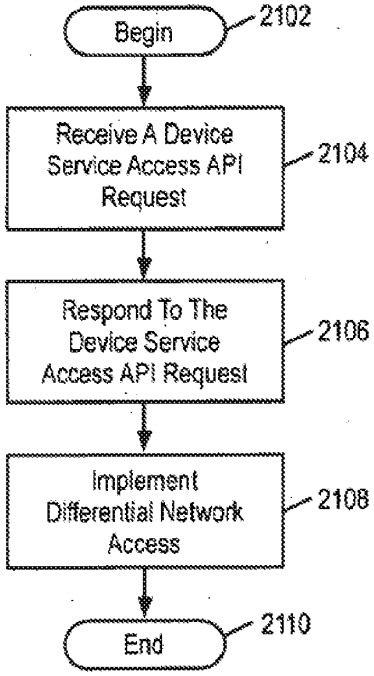

Begin
2102
Receive A Device Service Access API Request
2104
Respond To The Device Service Access API Request
2106
Implement Differential Network Access
2108
End
2110

FIG. 21

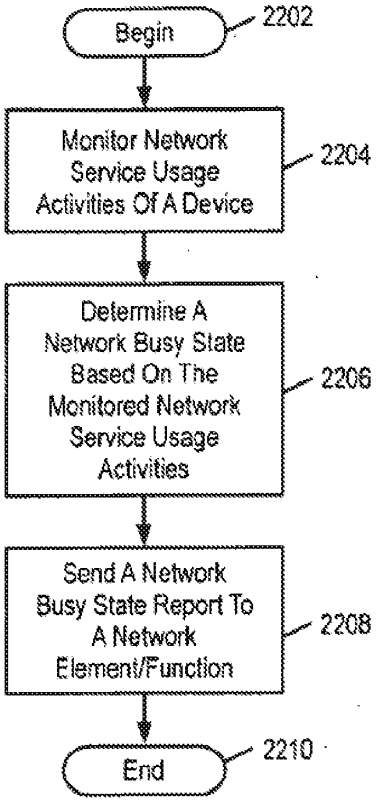

Begin
2202
Monitor Network Service Usage Activities Of A Device
2204
Determine A Network Busy State Based On The Monitored Network Service Usage Activities
2206
Send A Network Busy State Report To A Network Element/Function
2208
End
2210

FIG. 22

| | NBS 10% | NBS 25% | NBS 50% | NBS 75% | NBS 90% |
|---|---|---|---|---|---|
| Outlook | 6 | 5 | 4 | 3 | 2 |
| Skype | 7 | 6 | 2 | 1 | 0 |
| Safari | 5 | 4 | 3 | 2 | 1 |
| Pandora | 5 | 4 | 3 | 2 | 1 |
| FaceBook | 4 | 3 | 2 | 1 | 0 |
| iTunes | 7 | 6 | 3 | 1 | 0 |
| QuickTime | 8 | 6 | 4 | 1 | 0 |
| AV Software | 9 | 7 | 5 | 3 | 1 |
| Online Backup | 3 | 2 | 1 | 1 | 0 |
| OS Update | 2 | 1 | 0 | 0 | 0 |

FIG. 23

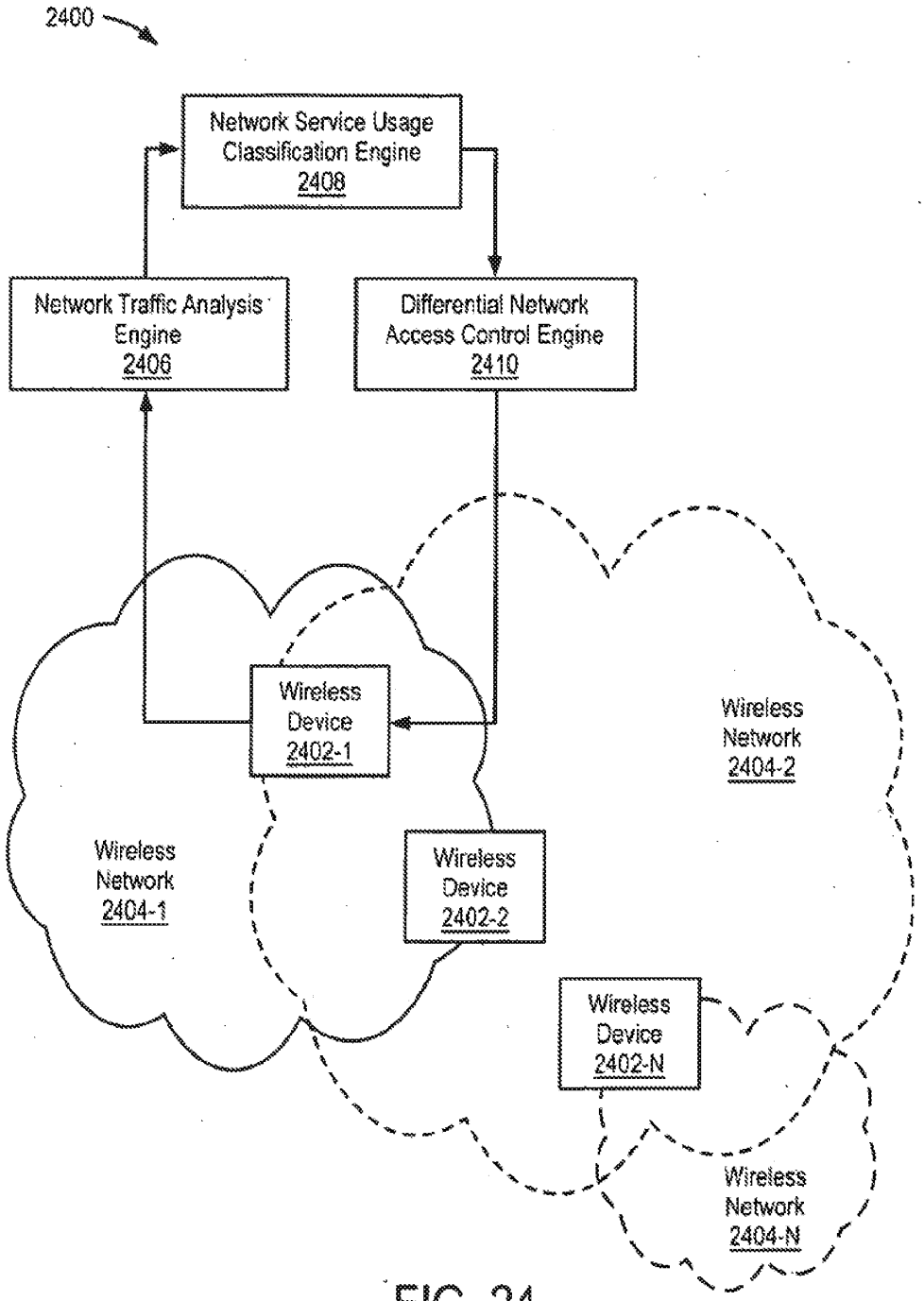

2400
Network Service Usage Classification Engine 2408
Network Traffic Analysis Engine 2406
Differential Network Access Control Engine 2410
Wireless Device 2402-1
Wireless Network 2404-1
Wireless Device 2402-2
Wireless Network 2404-2
Wireless Device 2402-N
Wireless Network 2404-N

FIG. 24

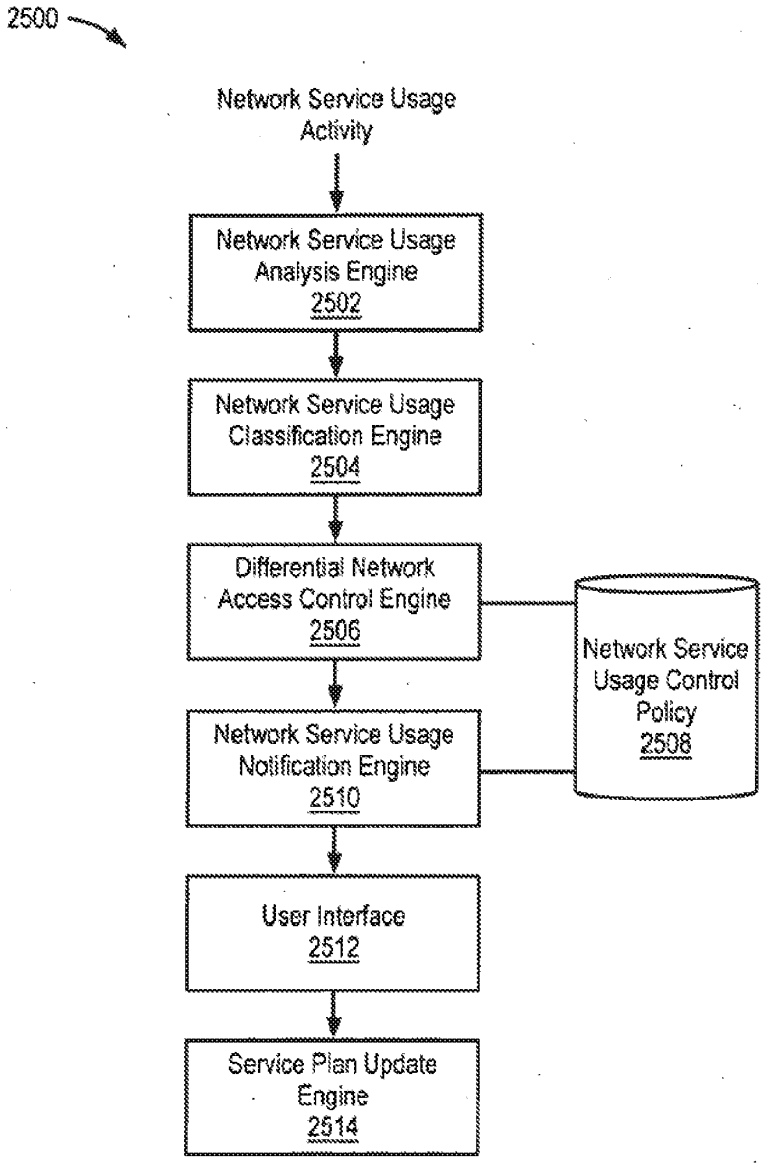

2500
Network Service Usage Activity
Network Service Usage Analysis Engine 2502
Network Service Usage Classification Engine 2504
Differential Network Access Control Engine 2506
Network Service Usage Control Policy 2508
Network Service Usage Notification Engine 2510
User Interface 2512
Service Plan Update Engine 2514

FIG. 25

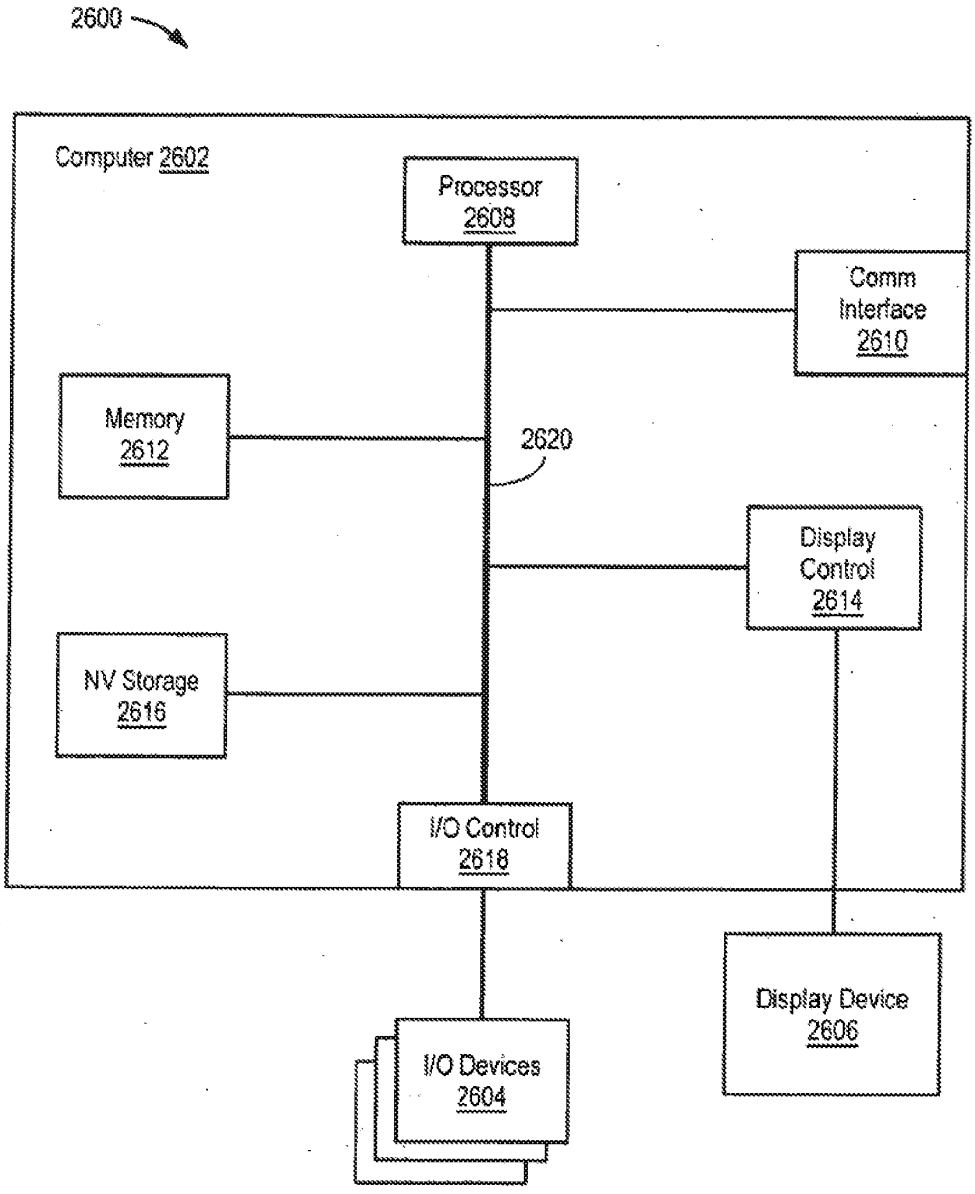

2600
Computer 2602
Processor 2608
Comm Interface 2610
Memory 2612
2620
Display Control 2614
NV Storage 2616
I/O Control 2618
Display Device 2606
I/O Devices 2604

FIG. 26

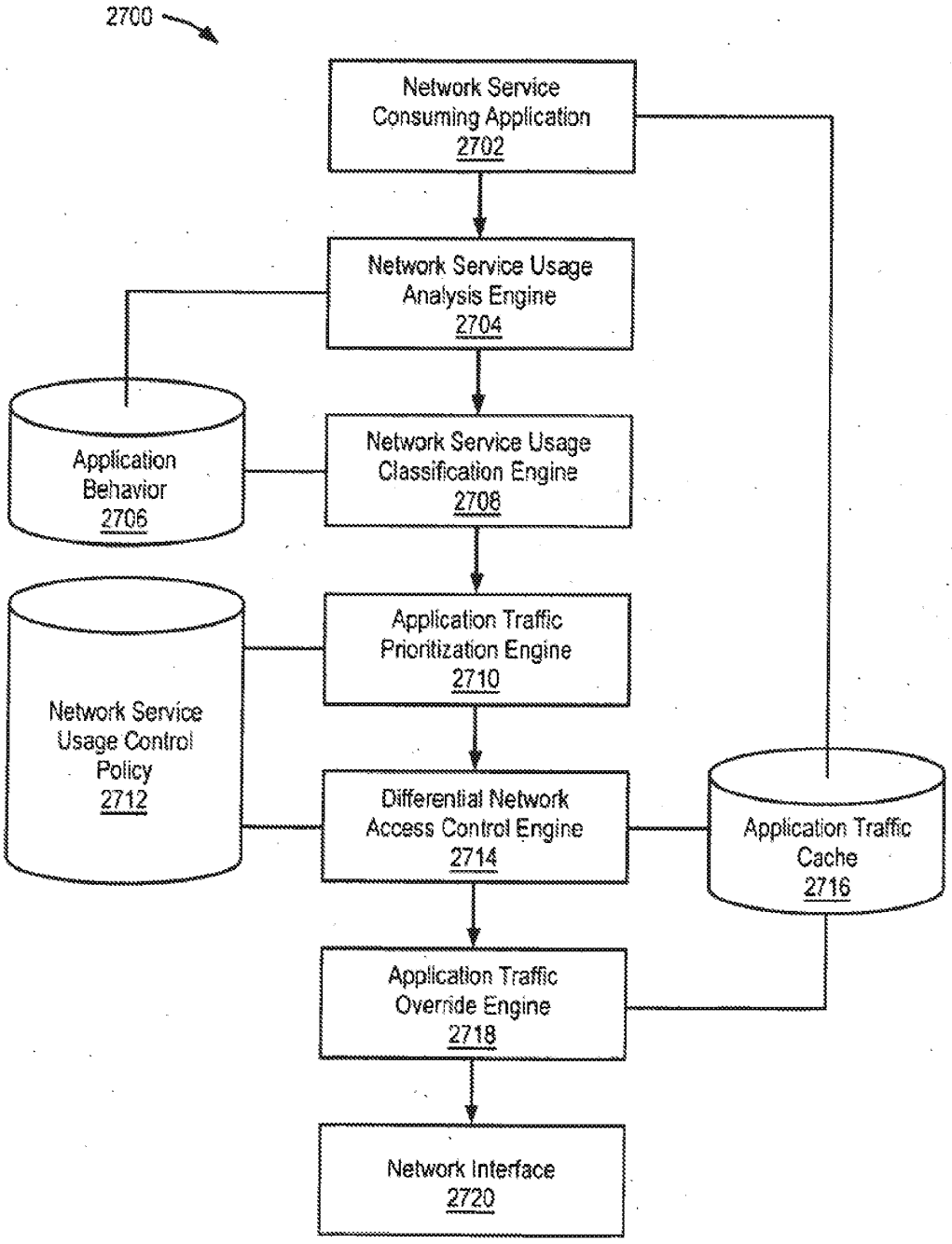

2700
Network Service Consuming Application 2702
Network Service Usage Analysis Engine 2704
Application Behavior 2706
Network Service Usage Classification Engine 2708
Application Traffic Prioritization Engine 2710
Network Service Usage Control Policy 2712
Differential Network Access Control Engine 2714
Application Traffic Cache 2716
Application Traffic Override Engine 2718
Network Interface 2720

FIG. 27

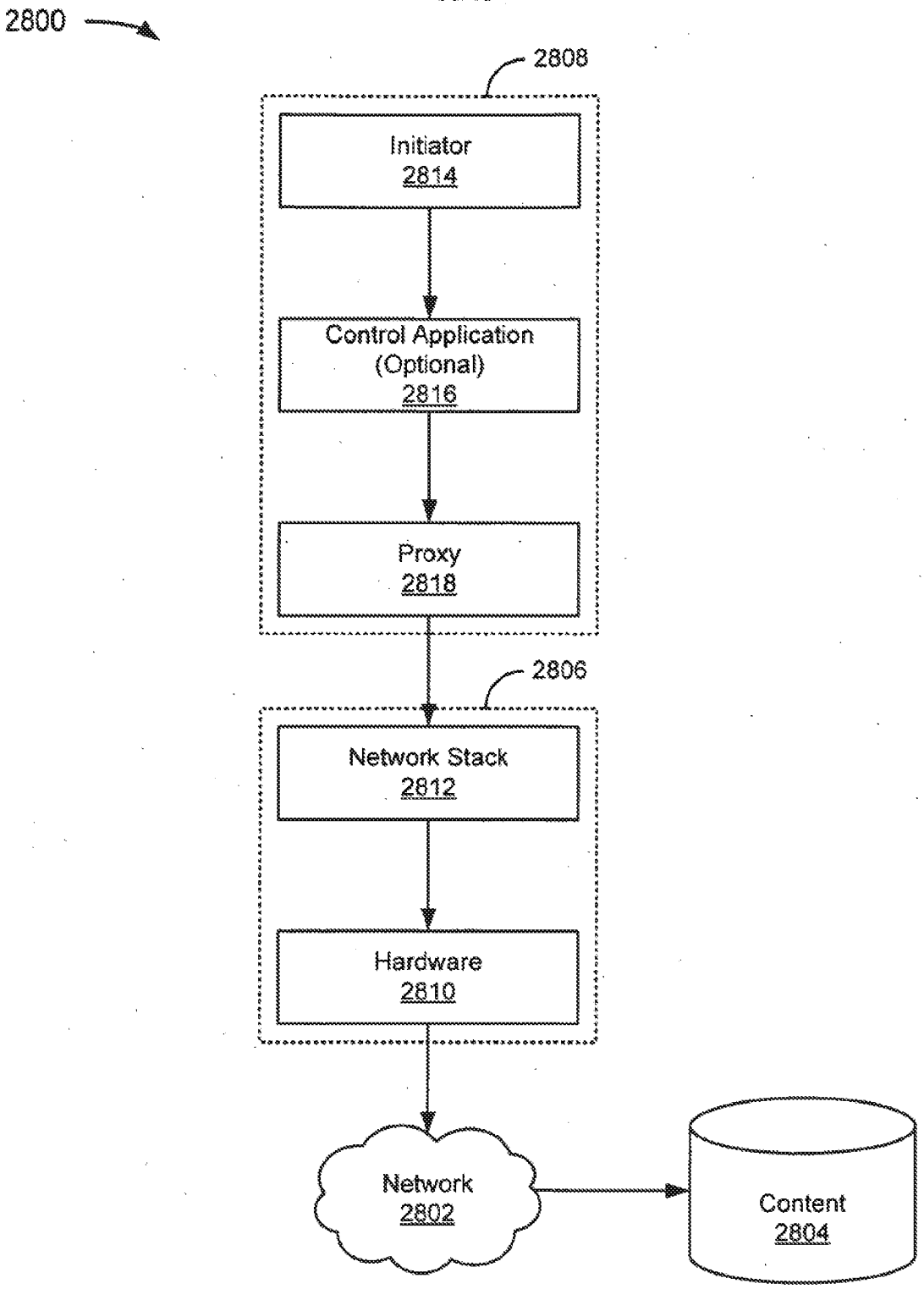

2800
2808
Initiator
2814
Control Application
(Optional)
2816
Proxy
2818
2806
Network Stack
2812
Hardware
2810
Network
2802
Content
2804

FIG. 28

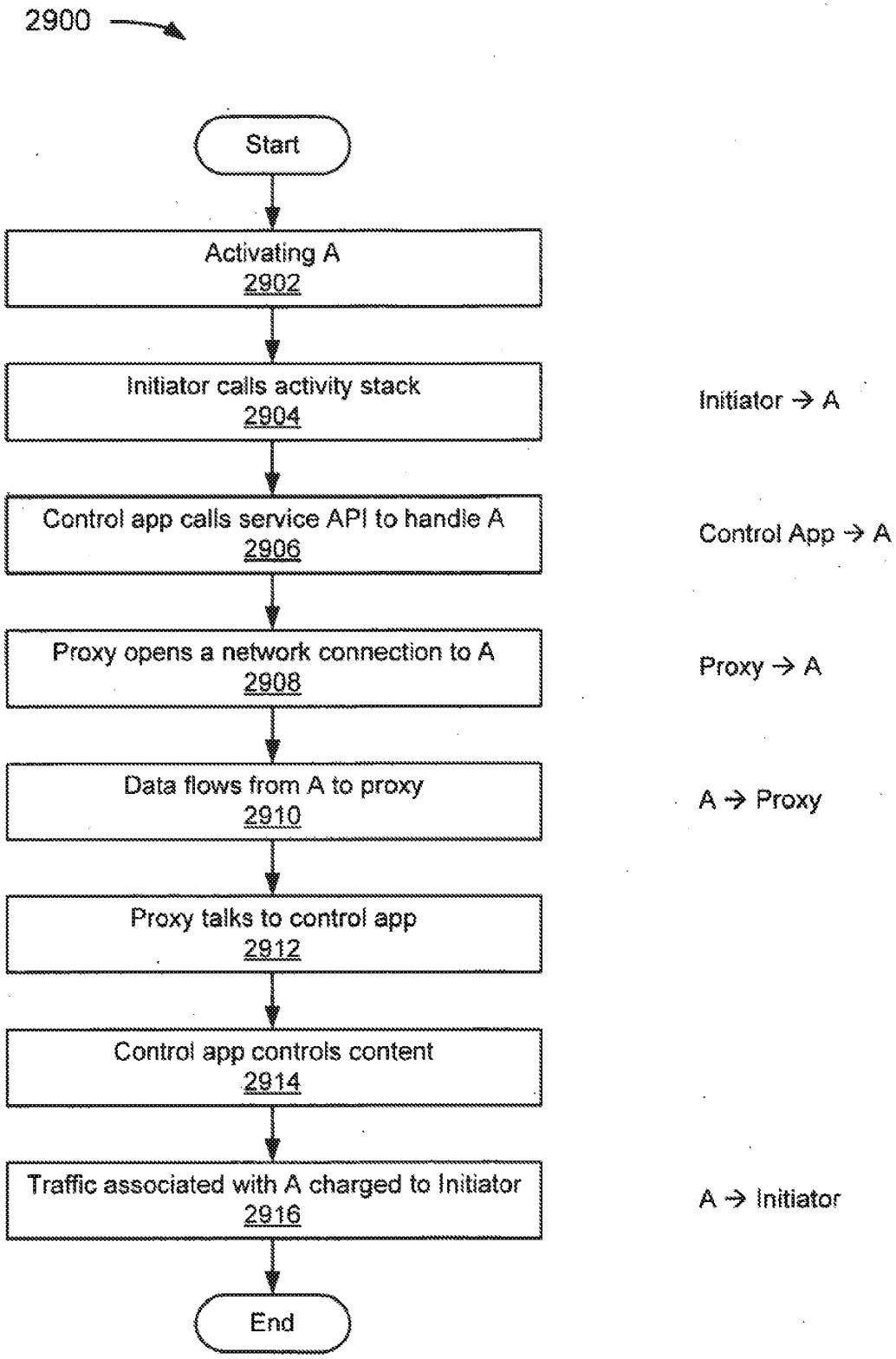

2900
Start
Activating A
2902
Initiator calls activity stack
2904
Initiator → A
Control app calls service API to handle A
2906
Control App → A
Proxy opens a network connection to A
2908
Proxy → A
Data flows from A to proxy
2910
A → Proxy
Proxy talks to control app
2912
Control app controls content
2914
Traffic associated with A charged to Initiator
2916
A → Initiator
End

FIG. 29

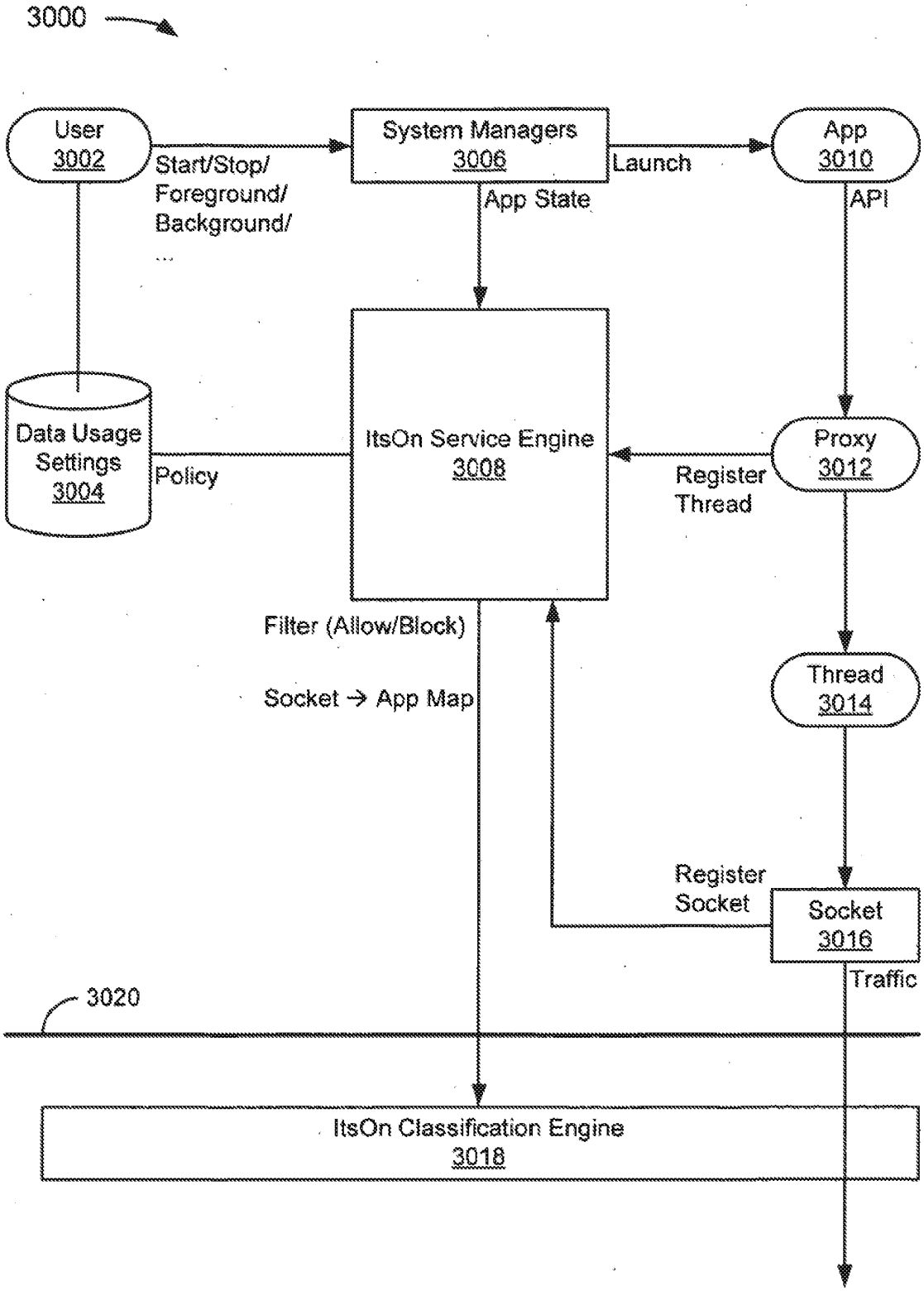

3000
User
3002
Start/Stop/
Foreground/
Background/
...
System Managers
3006
Launch
App
3010
App State
API
Data Usage
Settings
3004
Policy
ItsOn Service Engine
3008
Register
Thread
Proxy
3012
Filter (Allow/Block)
Socket → App Map
Thread
3014
Register
Socket
Socket
3016
Traffic
3020
ItsOn Classification Engine
3018

FIG. 30

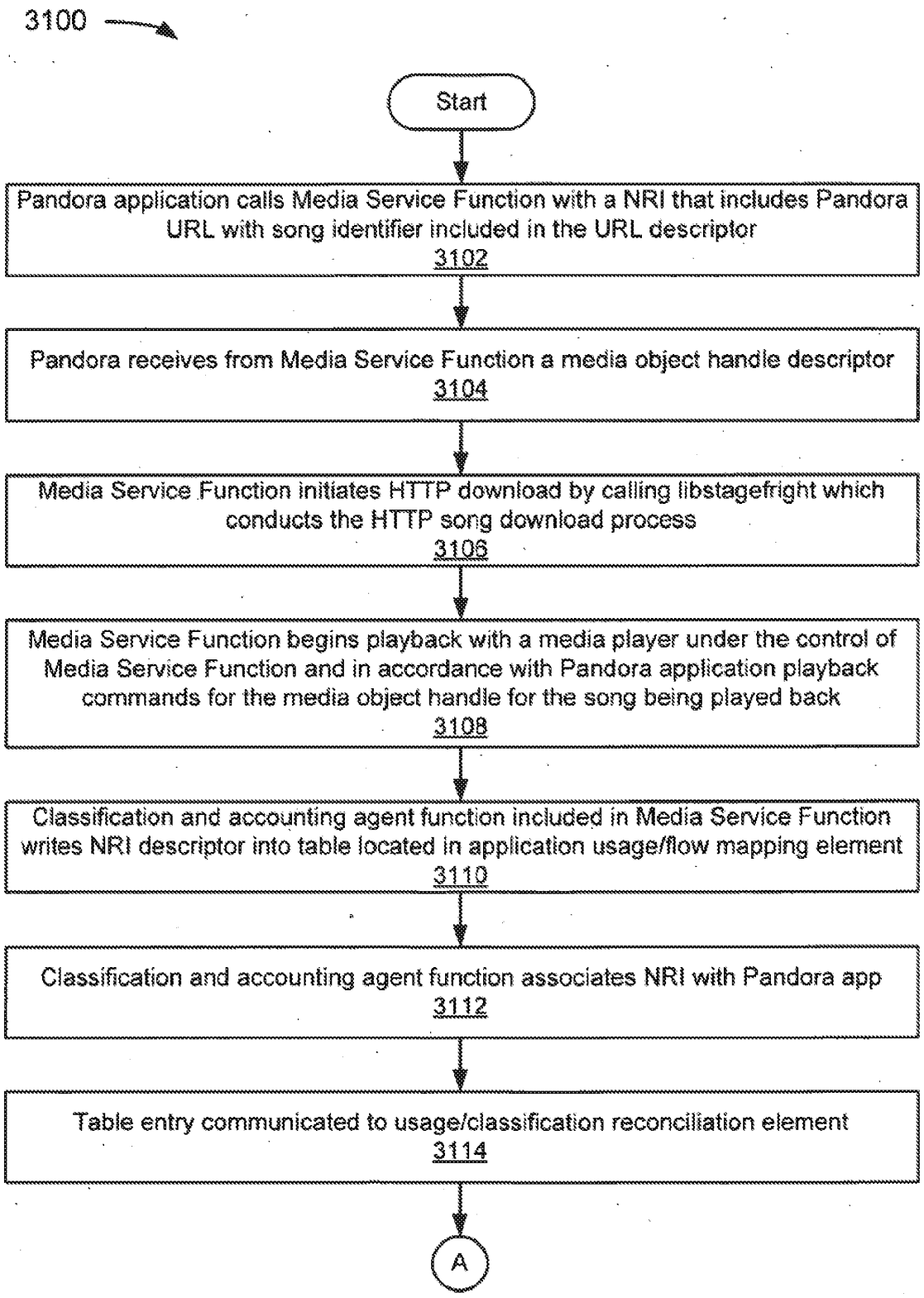

3100
Start
Pandora application calls Media Service Function with a NRI that includes Pandora URL with song identifier included in the URL descriptor
3102
Pandora receives from Media Service Function a media object handle descriptor
3104
Media Service Function initiates HTTP download by calling libstagefright which conducts the HTTP song download process
3106
Media Service Function begins playback with a media player under the control of Media Service Function and in accordance with Pandora application playback commands for the media object handle for the song being played back
3108
Classification and accounting agent function included in Media Service Function writes NRI descriptor into table located in application usage/flow mapping element
3110
Classification and accounting agent function associates NRI with Pandora app
3112
Table entry communicated to usage/classification reconciliation element
3114
A

FIG. 31A

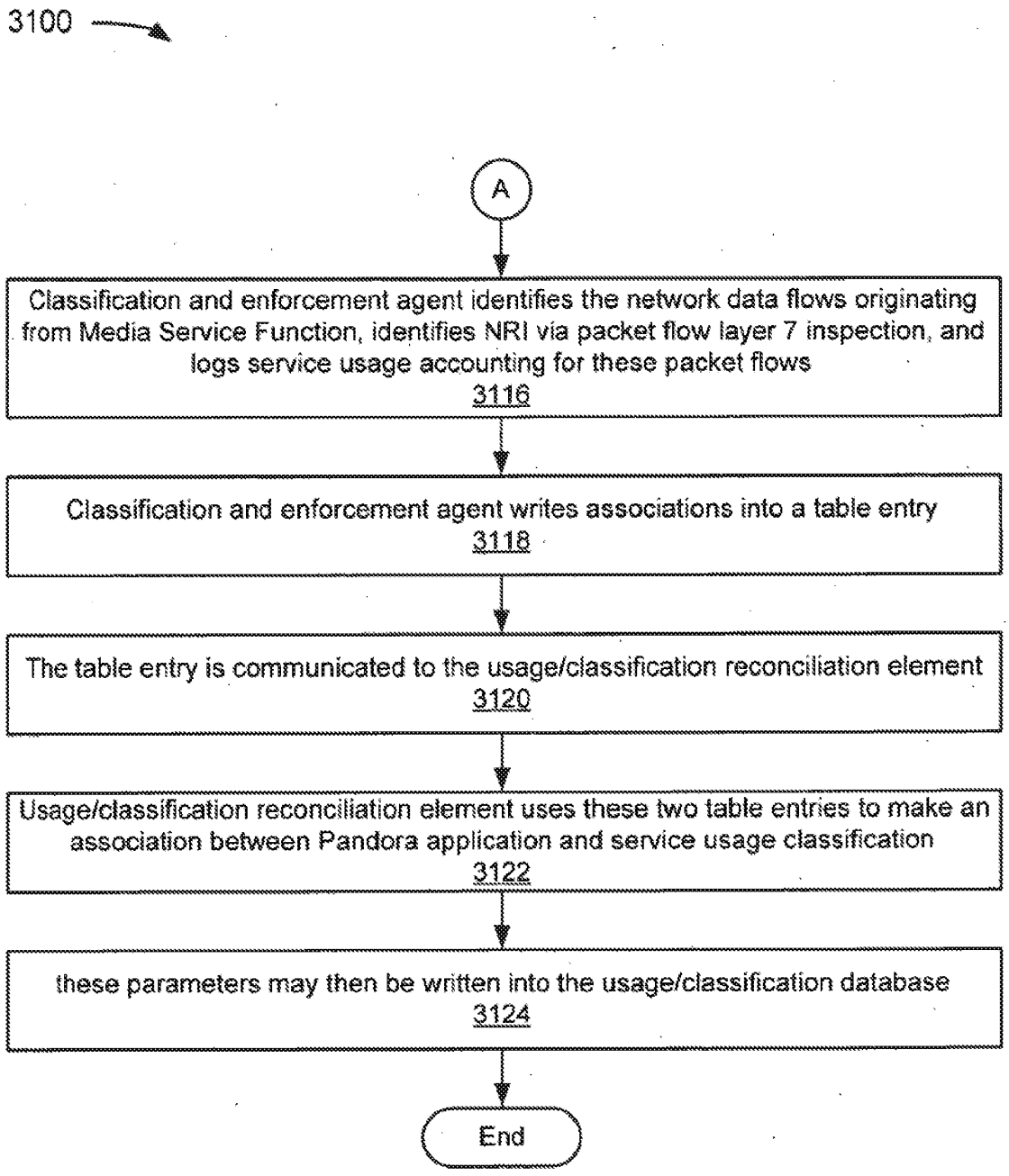

3100
A
Classification and enforcement agent identifies the network data flows originating from Media Service Function, identifies NRI via packet flow layer 7 inspection, and logs service usage accounting for these packet flows
3116
Classification and enforcement agent writes associations into a table entry
3118
The table entry is communicated to the usage/classification reconciliation element
3120
Usage/classification reconciliation element uses these two table entries to make an association between Pandora application and service usage classification
3122
these parameters may then be written into the usage/classification database
3124
End

FIG. 31B

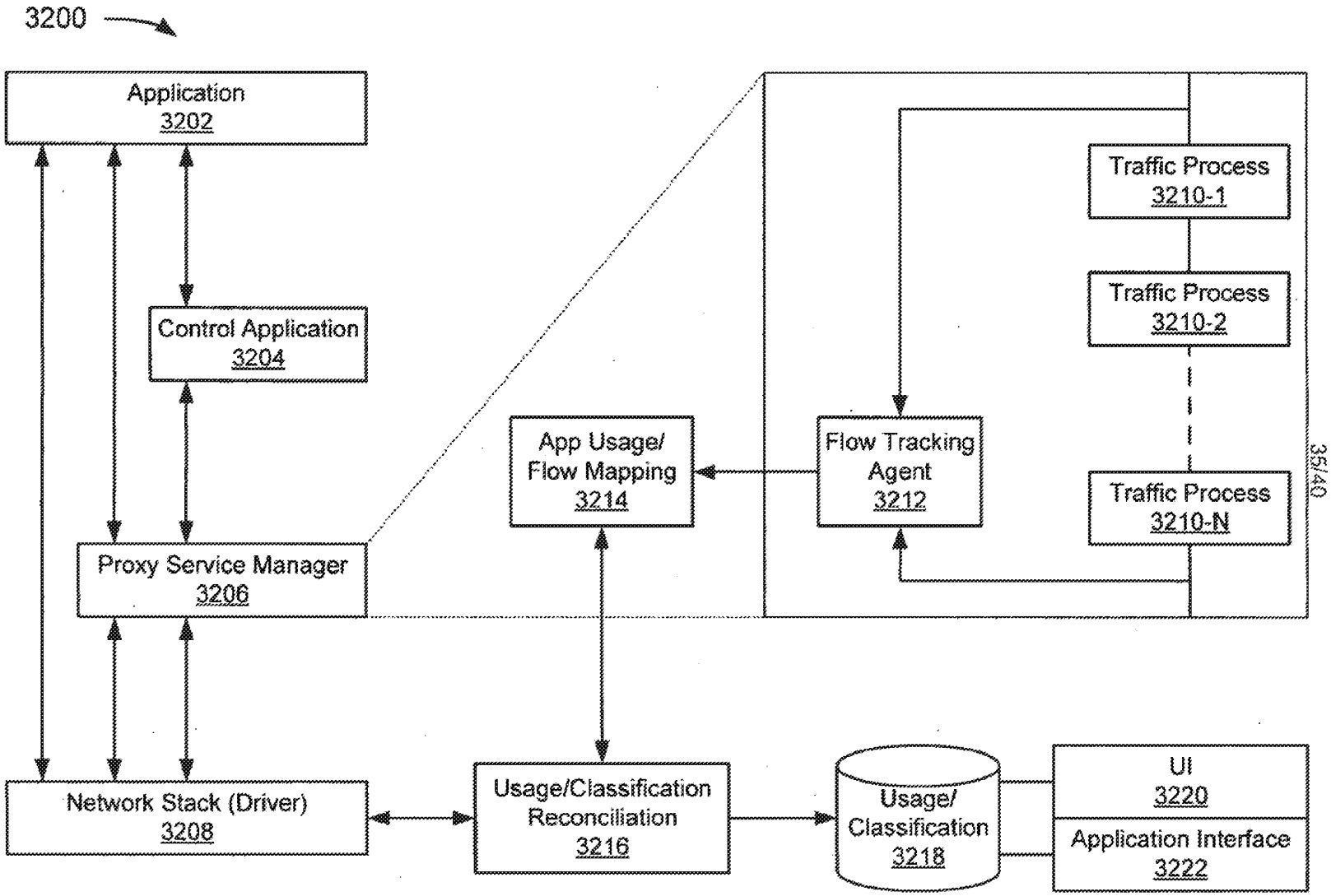

3200
Application
3202
Control Application
3204
Proxy Service Manager
3206
Network Stack (Driver)
3208
App Usage/
Flow Mapping
3214
Flow Tracking
Agent
3212
Traffic Process
3210-1
Traffic Process
3210-2
Traffic Process
3210-N
35/40
Usage/Classification
Reconciliation
3216
Usage/
Classification
3218
UI
3220
Application Interface
3222

FIG. 32

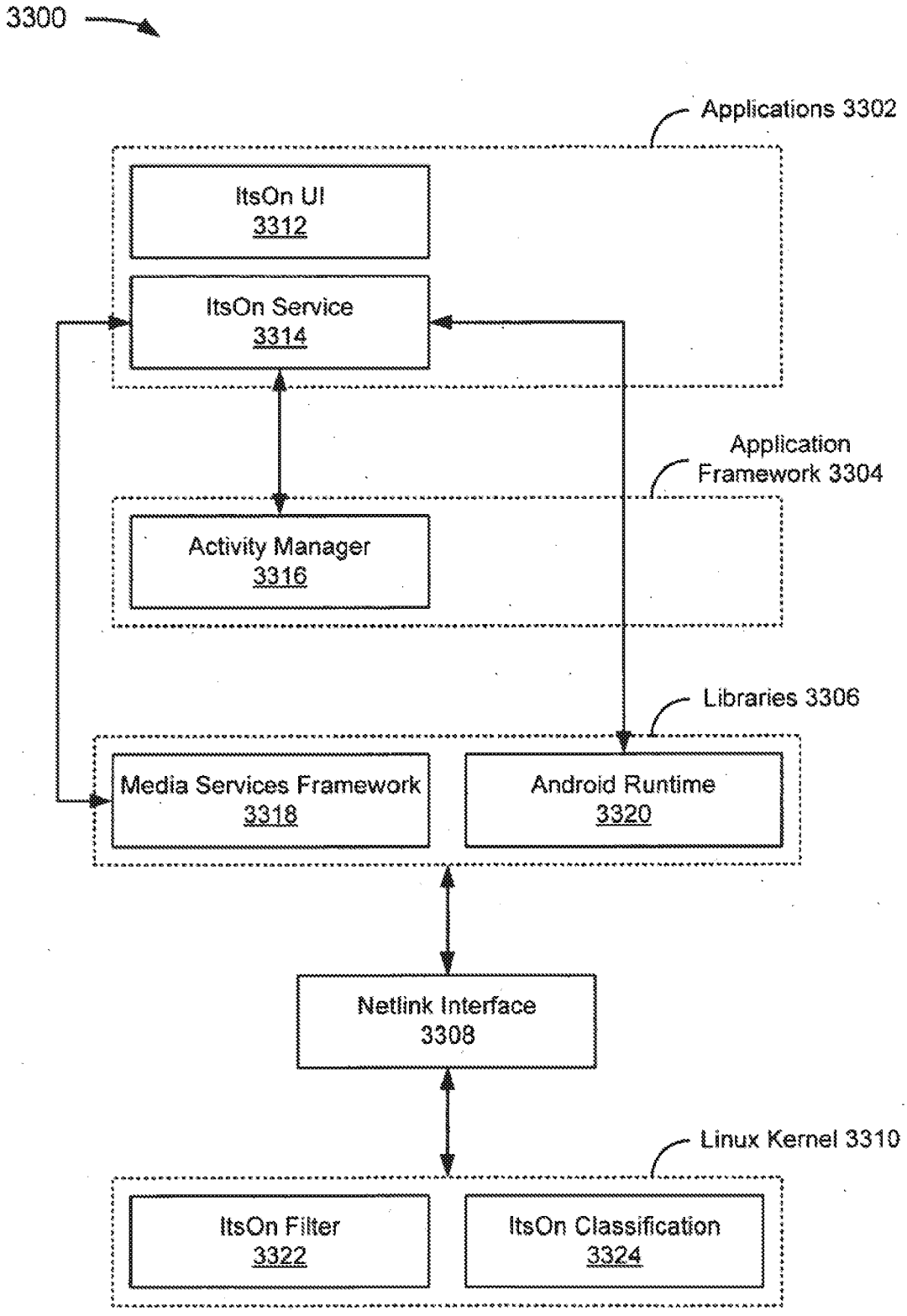

3300
Applications 3302
ItsOn UI
3312
ItsOn Service
3314
Application
Framework 3304
Activity Manager
3316
Libraries 3306
Media Services Framework
3318
Android Runtime
3320
Netlink Interface
3308
Linux Kernel 3310
ItsOn Filter
3322
ItsOn Classification
3324

FIG. 33

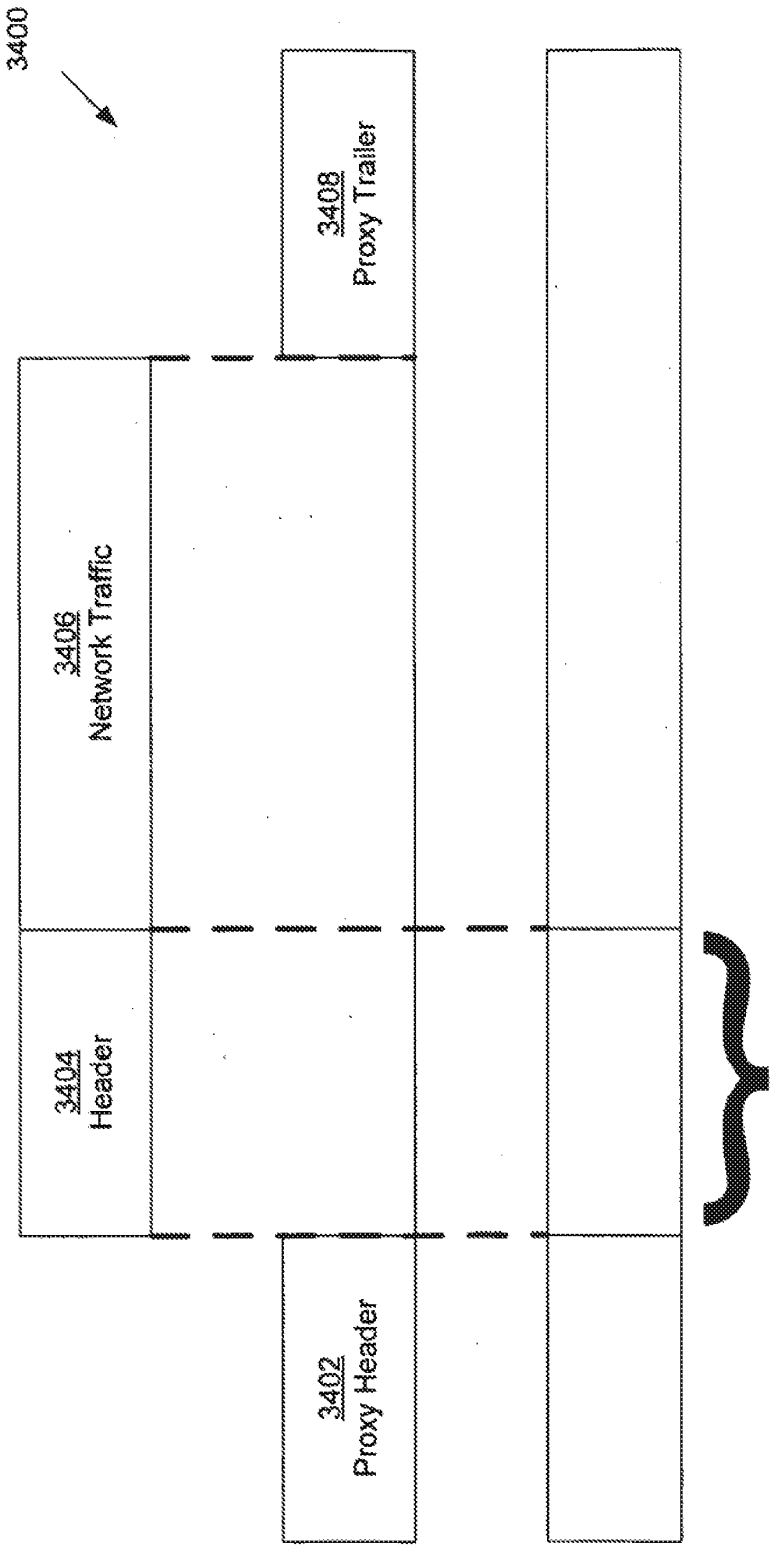

3400
3402
Proxy Header
3404
Header
3406
Network Traffic
3408
Proxy Trailer
Inspection Range of Proxy
Encapsulated Frame
3412

FIG. 34

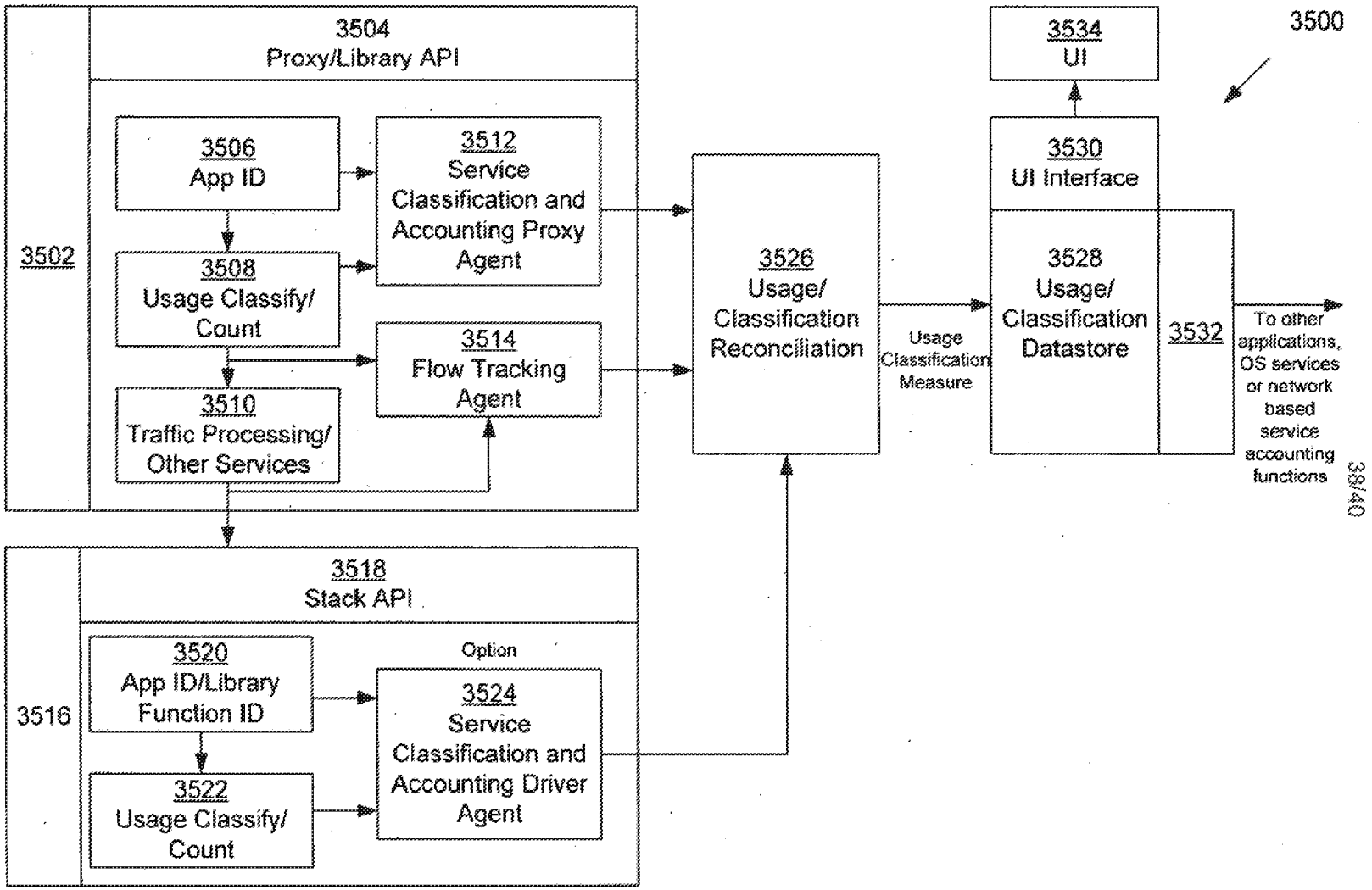

3504
Proxy/Library API
3506
App ID
3512
Service Classification and Accounting Proxy Agent
3502
3508
Usage Classify/ Count
3514
Flow Tracking Agent
3510
Traffic Processing/ Other Services
3518
Stack API
3516
3520
App ID/Library Function ID
Option
3524
Service Classification and Accounting Driver Agent
3522
Usage Classify/ Count
3526
Usage/ Classification Reconciliation
Usage Classification Measure
3534
UI
3500
3530
UI Interface
3528
Usage/ Classification Datastore
3532
To other applications, OS services or network based service accounting functions

FIG. 35

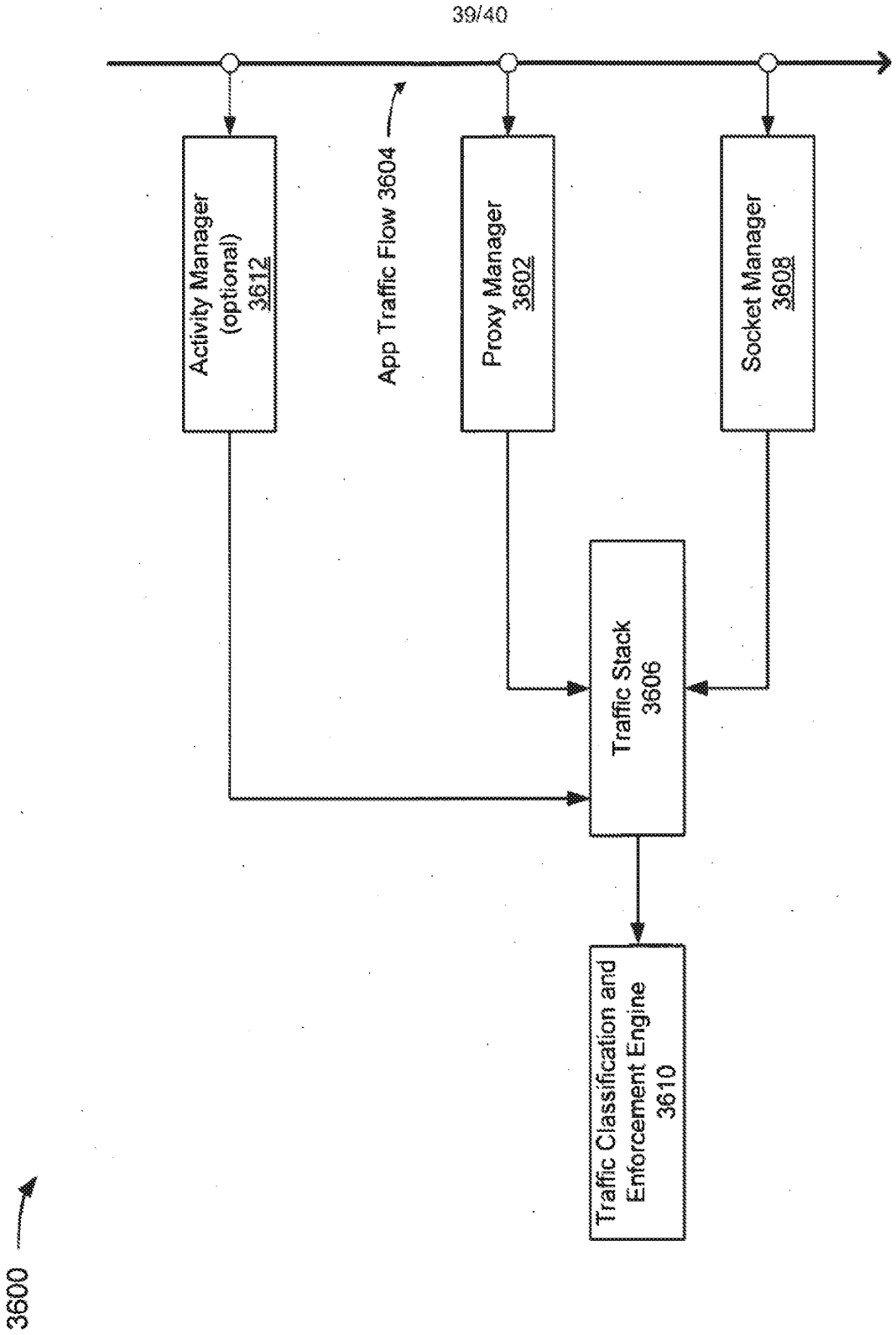

3600
Activity Manager (optional) 3612
App Traffic Flow 3604
Proxy Manager 3602
Socket Manager 3608
Traffic Stack 3606
Traffic Classification and Enforcement Engine 3610

FIG. 36

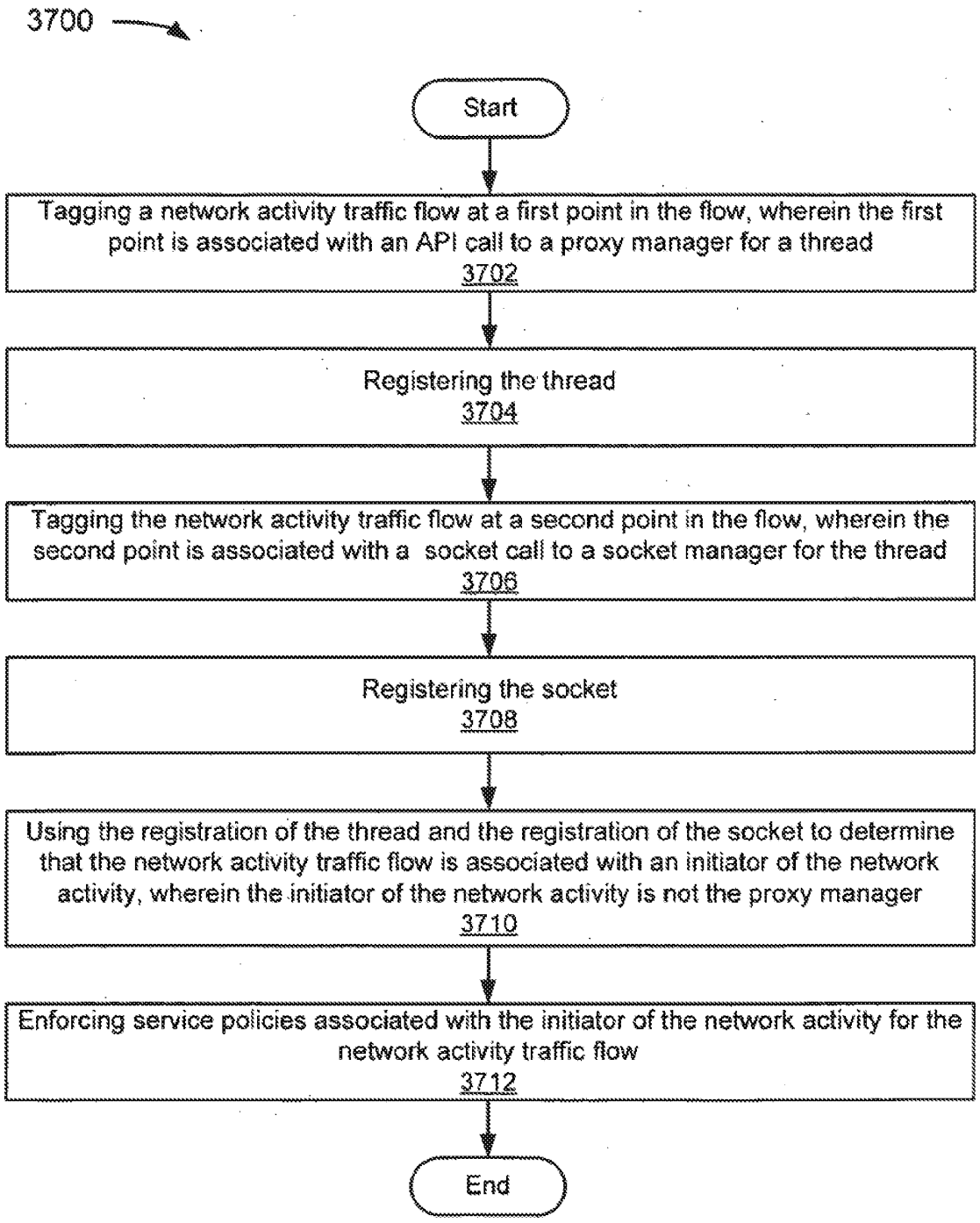

3700
Start
Tagging a network activity traffic flow at a first point in the flow, wherein the first point is associated with an API call to a proxy manager for a thread
3702
Registering the thread
3704
Tagging the network activity traffic flow at a second point in the flow, wherein the second point is associated with a socket call to a socket manager for the thread
3706
Registering the socket
3708
Using the registration of the thread and the registration of the socket to determine that the network activity traffic flow is associated with an initiator of the network activity, wherein the initiator of the network activity is not the proxy manager
3710
Enforcing service policies associated with the initiator of the network activity for the network activity traffic flow
3712
End

FIG. 37