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.
15/287,603	09/18/2018	10080250	RALEP037D1C1	1013

106963 7590 08/29/2018

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):

Headwater Research LLC, Tyler, TX;
Gregory G. Raleigh, Woodside, CA;
Alireza Raissinia, Saratoga, CA;
Jeffrey Green, Sunnyvale, 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.

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 07/23/2018
Headwater Research LLC
1011 Pruitt Place
Tyler, TEXAS 75703
UNITED STATES OF AMERICA

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)
July 23, 2018	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/287,603	10/06/2016	Gregory G. Raleigh	RALEP037D1C1	1013

TITLE OF INVENTION: ENTERPRISE ACCESS CONTROL AND ACCOUNTING ALLOCATION FOR ACCESS NETWORKS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$500	$0.00	$0.00	$500	10/23/2018

EXAMINER	ART UNIT	CLASS-SUBCLASS
RUDY, ANDREW J	3687	709-223000

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 5050876 (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 July 23, 2018

Typed or printed name James E. Harris Registration No. 40013

Electronic Patent Application Fee Transmittal

Application Number:	15287603
Filing Date:	06-Oct-2016
Title of Invention:	ENTERPRISE ACCESS CONTROL AND ACCOUNTING ALLOCATION FOR ACCESS NETWORKS
First Named Inventor/Applicant Name:	Gregory G. Raleigh
Filer:	James E. Harris/Ann Taylor
Attorney Docket Number:	RALEP037D1C1

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	500	500

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**500**

Electronic Acknowledgement Receipt	
EFS ID:	33254769
Application Number:	15287603
International Application Number:	
Confirmation Number:	1013
Title of Invention:	ENTERPRISE ACCESS CONTROL AND ACCOUNTING ALLOCATION FOR ACCESS NETWORKS
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:	RALEP037D1C1
Receipt Date:	23-JUL-2018
Filing Date:	06-OCT-2016
Time Stamp:	15:33:11
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$500
RAM confirmation Number	072418INTEFSW00002196505876
Deposit Account	505876
Authorized User	Ann Taylor
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.19 (Document supply fees) 37 CFR 1.20 (Post Issuance fees)	

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	Issue Fee Payment (PTO-85B)	P037D1C1_IssueFee.pdf	411281 586af9b84b1280daeebb67233c7a67b212c10707	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30123 cad6c17ebd6dc10a5017b03b98cde3c005f3376a	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	441404		

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 07/23/2018

Headwater Research LLC
1011 Pruitt Place
Tyler, TEXAS 75703
UNITED STATES OF AMERICA

EXAMINER
RUDY, ANDREW J

ART UNIT	PAPER NUMBER
3687	

DATE MAILED: 07/23/2018

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/287,603	10/06/2016	Gregory G. Raleigh	RALEP037D1C1	1013

TITLE OF INVENTION: ENTERPRISE ACCESS CONTROL AND ACCOUNTING ALLOCATION FOR ACCESS NETWORKS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$500	$0.00	$0.00	$500	10/23/2018

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 07/23/2018
Headwater Research LLC
1011 Pruitt Place
Tyler, TEXAS 75703
UNITED STATES OF AMERICA

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.
15/287,603	10/06/2016	Gregory G. Raleigh	RALEP037D1C1	1013

TITLE OF INVENTION: ENTERPRISE ACCESS CONTROL AND ACCOUNTING ALLOCATION FOR ACCESS NETWORKS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$500	$0.00	$0.00	$500	10/23/2018

EXAMINER	ART UNIT	CLASS-SUBCLASS
RUDY, ANDREW J	3687	709-223000

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 _____
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 (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

❑ 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 _____ Date _____

Typed or printed name _____ Registration No. _____

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.
15/287,603	10/06/2016	Gregory G. Raleigh	RALEP037D1C1	1013

106963 7590 07/23/2018

Headwater Research LLC
1011 Pruitt Place
Tyler, TEXAS 75703
UNITED STATES OF AMERICA

EXAMINER	
RUDY, ANDREW J	
ART UNIT	**PAPER NUMBER**
3687	

DATE MAILED: 07/23/2018

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.** 15/287,603	**Applicant(s)** Raleigh et al.	
	Examiner ANDREW J RUDY	**Art Unit** 3687	**AIA 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 the May 22, 2018 Amendment.
   ☐ 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 2-3 . 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 areply 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 _____.

/ANDREW JOSEPH RUDY/
Primary Examiner, Art Unit 3687

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

Drawings

2. Applicant's Drawings submitted October 6, 2016 are acceptable.

Allowable Subject Matter

3. Claims 2 and 3 are allowed.

4. The following is an examiner's statement of reasons for allowance: Claims 2 and 3 are allowed as all the cited prior art, either alone or in combination, does not disclose Applicant's inventive claim language.

Applicant's REMARKS regarding obviating the previous 35 USC 112 rejection are convincing. Thus, the 35 USC 112 rejection is withdrawn.

Claims 2 and have been reviewed in light of Alice Corporation Pty. Ltd. v. CLtweS Bank International, et al., 573 U. S. ___ (2014) and are not deemed invalidated by such. Applicant's May 22, 2018 REMARKS are convincing.

Claims 2 and 3 are determined to be directed to patent-eligible subject matter and the Examiner does not consider any of the pending claims to be directed to an abstract idea. Even if the Examiner were to identify an abstract idea for any claim, then under a further analysis under Alice all claims would still be found to be patent eligible

for the following reasons. The Examiner finds that when all of the elements of each claim are considered individually and as an ordered combination, each claim contains an inventive concept which is directed to an application, a particular application, or a special application, of the identified abstract idea. Further the Examiner finds that issuance of a patent for any claim would not preempt the identified abstract idea, or the field of the identified abstract idea.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

5. Applicant's Information Disclosure Statement (IDS) submitted May 22, 2018 has been reviewed. Note the attached IDS.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Andrew Joseph Rudy whose telephone number is 571-272-6789. The examiner can normally be reached on Monday thru Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Fahd A. Obeid can be reached on 571-270-3324. 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.

/ANDREW JOSEPH RUDY/
Primary Examiner
Art Unit 3687

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/287,603	Raleigh et al.
	Examiner	Art Unit
	ANDREW J RUDY	3687

CPC - Searched*		
Symbol	Date	Examiner
H04W 4/24; H04L 12/1457; H04M 15/8033; H04W 76/12; H04L 41/0823; H04L 67/34; H04L 12/4633	07/05/2018	AJR

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
709	203, 216-229	07/05/2018	AJR
455	414.1, 432.1, 456.1	07/05/2018	AJR

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Continuity data reviewed	07/05/2018	AJR
Inventor name search conducted.	07/05/2018	AJR

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
H04W	4/24; 76/12 20180201	07/09/2018	AJR
H04L	12/1457; 41/0823; 67/34;12/4633	07/09/2018	AJR
H04M	15/8033	07/09/2018	AJR

/ANDREW JOSEPH RUDY/ Primary Examiner, Art Unit 3687	

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	Examiner	**Art Unit**
	ANDREW JOSEPH RUDY	3687

CPC							
Symbol						**Type**	**Version**
H04W	/	76	/	12		F	2018-02-01
H04L	/	12	/	1457		I	2013-01-01
H04M	/	15	/	8033		I	2013-01-01
H04L	/	12	/	4633		I	2013-01-01
H04L	/	41	/	0823		I	2013-01-01
H04L	/	67	/	34		I	2013-01-01
H04W	/	4	/	24		A	2013-01-01

CPC Combination Sets								
Symbol					**Type**	**Set**	**Ranking**	**Version**
	/		/					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	2	
/ANDREW JOSEPH RUDY/ Primary Examiner, Art Unit 3687	09 July 2018	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	9

U.S. Patent and Trademark Office — Part of Paper No.: 20180709

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	15/287,603	Raleigh et al.
	Examiner	**Art Unit**
	ANDREW JOSEPH RUDY	3687

INTERNATIONAL CLASSIFICATION					
CLAIMED					
H04L	/	7	/	00	
H04W	/	76	/	12	

NON-CLAIMED					
	/		/		

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**
709	223

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					
455	414.1					

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 2	
/ANDREW JOSEPH RUDY/ Primary Examiner, Art Unit 3687 (Primary Examiner)	09 July 2018 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 9

U.S. Patent and Trademark Office — Part of Paper No.: 20180709

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	15/287,603	Raleigh et al.
	Examiner	**Art Unit**
	ANDREW JOSEPH RUDY	3687

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

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	2														
2	3														

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	2	
/ANDREW JOSEPH RUDY/ Primary Examiner, Art Unit 3687	09 July 2018	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	9

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

Application Number	15287603
Filing Date	2016-10-06
First Named Inventor	Gregory G. Raleigh
Art Unit	3687
Examiner Name	Rudy, Andrew J.
Attorney Docket Number	RALEP037D1C1

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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	5915226	A	1999-06-22	Martineau	
	2	6246870	B1	2001-06-12	Dent et al.	
	3	6535949	B1	2003-03-18	Parker, Kenneth W.	
	4	6591098	B1	2003-07-08	Shieh et al.	
	5	6603975	B1	2003-08-05	Inouchi et al.	
	6	6959202	B2	2005-10-25	Heinonen et al.	
	7	7031733	B2	2006-04-18	Alminana et al.	
	8	7120133	B1	2006-10-10	Joo et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.J.R./

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	9	7165040	B2	2007-01-16	Ehrman et al.	
	10	7315892	B2	2008-01-01	Freimuth et al.	
	11	7548875	B2	2009-06-16	Mikkelsen et al.	
	12	7584298	B2	2009-09-01	Klinker et al.	
	13	7607041	B2	2009-10-20	Kraemer et al.	
	14	7610057	B2	2009-10-27	Bahl et al.	
	15	7620383	B2	2009-11-17	Taglienti et al.	
	16	7627600	B2	2009-12-01	Citron et al.	
	17	7656271	B2	2010-02-02	Ehrman et al.	
	18	7668966	B2	2010-02-23	Klinker et al.	
	19	7681226	B2	2010-03-16	Kraemer et al.	

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	21	7693107	B2	2010-04-06	De Froment, Eric	
	22	7774412	B1	2010-08-10	Schnepel, Soenke	
	23	7797019	B2	2010-09-14	Friedmann	
	24	7805522	B2	2010-09-28	Schlüter et al.	
	25	7809372	B2	2010-10-05	Rajaniemi, Jaakko	
	26	7813746	B2	2010-10-12	Rajkotia, Purva R.	
	27	7835275	B1	2010-11-16	Swan et al.	
	28	7853656	B2	2010-12-14	Yach et al.	
	29	7882560	B2	2011-02-01	Kraemer et al.	
	30	7930553	B2	2011-04-19	Satarasinghe et al.	

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	31	7979889	B2	2011-07-12	Gladstone et al.	
	32	8024424	B2	2011-09-20	Freimuth et al.	
	33	8060017	B2	2011-11-15	Schlicht et al.	
	34	8090361	B2	2012-01-03	Hagan, Guy R.	
	35	8149748	B2	2012-04-03	Bata et al.	
	36	8234583	B2	2012-07-31	Sloo et al.	
	37	8306741	B2	2012-11-06	Tu, Ihung	
	38	8340625	B1	2012-12-25	Johnson et al.	
	39	8346923	B2	2013-01-01	Rowles et al.	
	40	8355570	B2	2013-01-15	Karsanbhai et al.	
	41	8392982	B2	2013-03-05	Harris et al.	

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	42	8401968	B1	2013-03-19	Schattauer et al.	
	43	8407472	B2	2013-03-26	Hao et al.	
	44	8413245	B2	2013-04-02	Kraemer et al.	
	45	8495743	B2	2013-07-23	Kraemer et al.	
	46	8504574	B2	2013-08-06	Dvorak et al.	
	47	8531995	B2	2013-09-10	Khan et al.	
	48	8549173	B1	2013-10-01	Wu et al.	
	49	8559369	B2	2013-10-15	Barkan	
	50	8594665	B2	2013-11-26	Anschutz, Thomas	
	51	8620257	B2	2013-12-31	Qiu et al.	
	52	8843849	B2	2014-09-23	Neil et al.	

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	53	8849297	B2	2014-09-30	Balasubramanian	
	54	8868727	B2	2014-10-21	Yumerefendi et al.	
	55	8891483	B2	2014-11-18	Connelly et al.	
	56	8929374	B2	2015-01-06	Tönsing et al.	
	57	9137286	B1	2015-09-15	Yuan	
	58	9286469	B2	2016-03-15	Kraemer et al.	
	59	9609459	B2	2017-03-28	Raleigh, Gregory G.	

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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	20040024756	A1	2004-02-05	Rickard, John Terrell	
	2	20060101507	A1	2006-05-11	Camenisch, Ja L.	

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	3	20070171856	A1	2007-07-26	Bruce et al.	
	4	20110004917	A1	2011-01-06	Saisa et al.	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2]	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	1098490	EP	A2	2001-05-09	Nortel Networks Ltd.		
	2	1942698	EP	A1	2008-07-09	Apple Inc.		
	3	2026514	EP	A1	2009-02-18	Nokia Siemens Networks		
	4	2007129180	WO	A2	2007-11-15	Nokia Corp.		
	5	2010128391	WO	A2	2010-11-11	Bridgewater Systems Corp.		

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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]

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.J.R./

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	1	Android Cupcake excerpts, The Android Open Source Project, Feb. 10, 2009	

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

EXAMINER SIGNATURE

Examiner Signature	/ANDREW JOSEPH RUDY/	Date Considered	07/09/2018

*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.

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	Raleigh et al.	Examiner:	Rudy, Andrew J.
Serial No.:	15/287,603	Art Unit:	3687
Filed:	October 6, 2016	Conf. No.:	1013
Title:	Enterprise Access Control and Accounting Allocation for Access Networks		

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

RESPONSE TO NON-FINAL OFFICE ACTION

In response to the Office Action dated November 22, 2017, the no-fee deadline for response being February 22, 2018, please consider the following response:

A Listing of the Claims begin on page 2.

Remarks begin on page 3.

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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	5	6603975	B1	2003-08-05	Inouchi et al.	
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	11	7548875	B2	2009-06-16	Mikkelsen et al.	
	12	7584298	B2	2009-09-01	Klinker et al.	
	13	7607041	B2	2009-10-20	Kraemer et al.	
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	16	7627600	B2	2009-12-01	Citron et al.	
	17	7656271	B2	2010-02-02	Ehrman et al.	
	18	7668966	B2	2010-02-23	Klinker et al.	
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	22	7774412	B1	2010-08-10	Schnepel, Soenke	
	23	7797019	B2	2010-09-14	Friedmann	
	24	7805522	B2	2010-09-28	Schlüter et al.	
	25	7809372	B2	2010-10-05	Rajaniemi, Jaakko	
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	27	7835275	B1	2010-11-16	Swan et al.	
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	38	8340625	B1	2012-12-25	Johnson et al.	
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	50	8594665	B2	2013-11-26	Anschutz, Thomas	
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	56	8929374	B2	2015-01-06	Tönsing et al.	
	57	9137286	B1	2015-09-15	Yuan	
	58	9286469	B2	2016-03-15	Kraemer et al.	
	59	9609459	B2	2017-03-28	Raleigh, Gregory G.	

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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	20040024756	A1	2004-02-05	Rickard, John Terrell	
	2	20060101507	A1	2006-05-11	Camenisch, Ja L.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15287603
	Filing Date	2016-10-06
	First Named Inventor	Gregory G. Raleigh
	Art Unit	3687
	Examiner Name	Rudy, Andrew J.
	Attorney Docket Number	RALEP037D1C1

	3	20070171856	A1	2007-07-26	Bruce et al.	
	4	20110004917	A1	2011-01-06	Saisa et al.	

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	1	1098490	EP	A2	2001-05-09	Nortel Networks Ltd.		
	2	1942698	EP	A1	2008-07-09	Apple Inc.		
	3	2026514	EP	A1	2009-02-18	Nokia Siemens Networks		
	4	2007129180	WO	A2	2007-11-15	Nokia Corp.		
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	1	Android Cupcake excerpts, The Android Open Source Project, Feb. 10, 2009	

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Name/Print	James E. Harris	Registration Number	40013

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(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 098 490 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
09.05.2001 Bulletin 2001/19

(51) Int Cl.[7]: **H04L 29/06**

(21) Application number: **00309735.9**

(22) Date of filing: **03.11.2000**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **05.11.1999 US 434628**

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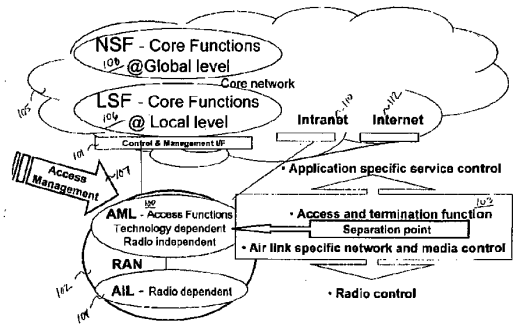
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(54) An architecture for an IP centric distributed network

(57) A method and system to for a communications network architecture for an Internet Protocol centric wireless network for a first user to communicate to a destination, the architecture comprising: a network service function layer within the wireless network. The network service function layer can include: a policy management server; an authorization server; a service accounting server; an authentication, authorization and accounting server; an unified directory within a directory server; a security gateway; and a mobility manager. The architecture also includes a local service function layer associated with the network service function layer. The local service function layer can include: an access accounting server; an authentication, authorization and accounting server; a security gateway; a policy enforcement server; a mobility manager; a network management server; and a wireless gateway. The architecture also includes an access management layer associated with the local service function layer. The access management layer can include: a location tracking server; a connection management server; a protocol server; an access management server; a policy enforcement server; a network management server; and a resource management server. The architecture also includes an access interface layer associated with the access management layer. The access interface layer can include: a channel management server; a policy enforcement server; an administration and maintenance server; and a radio frequency server.

FIGURE 1



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Description

FIELD OF THE INVENTION

[0001] The invention relates generally to computers and, more particularly, to an architecture for an Internet Protocol centric distributed network and a method and apparatus for such a network.

BACKGROUND OF THE INVENTION

[0002] Recently, wireless communication devices have become more and more popular as a method of communicating from one point to another. Cellular Radio is one, and probably the most popular, method of wireless communication. The original and still, most common Cellular Mobile Telephone System is a low-powered, duplex, radio/telephone which operates between 800 and 900 mHz for TDMA and 1800 and 1900 mHz for CDMA, using multiple transceiver sites linked up to a central computer for coordination. The geographic region served by a cellular system is subdivided into areas called cells. Each cell has a central base station and two sets of assigned transmission frequencies; one set is used by the base station, and the other by mobile telephones. To prevent radio interference, each cell uses frequencies different from those used by its surrounding cells, but cells sufficiently distant from each other can use the same frequencies. When a mobile telephone leaves one cell and enters another, the telephone call is transferred from one base station and set of transmission frequencies to the next using a computerized switching system. The first cellular telephone system began operation in Tokyo in 1979, and the first U.S. system began operation in 1983 in Chicago.

[0003] The earlier system have been focused on providing mostly voice services with some capability of providing data communications as well. However, recently, the need for a network designed with other services in mind other than just voice has arisen. The network should be able to provide access to different application layer protocols such as Session Initiation Protocol, H.323, and Internet Protocol to name a few.

SUMMARY OF THE INVENTION

[0004] In contrast to the prior art, the present invention provides a distributed IP centric system and method for wireless access to an internet protocol (IP) based network, wherein the system and method is independent from technology used in accessing the network. The system also uses the application layer to send messages between the access layer and the IP network. The access layer also includes distributed IP based functionality and the flexibility to be incorporated into distributed servers on a Local Area Network (LAN). The access layer also includes the capability to support establishing and maintaining the wireless link and mobility services to the mobile station through the access layers along with simultaneous IP access to public domain services. The access layer also handles connection management independent from the hardware used (such as ATM, Ethernet, etc.).

[0005] To this end, in one embodiment the method and system include a communications network architecture for an Internet Protocol centric wireless network for a first user to communicate to a destination, the architecture comprising: a network service function layer within the wireless network. The network service function layer can include: a policy management server; an authorization server; a service accounting server; an authentication, authorization and accounting server; an unified directory within a directory server; a security gateway; and a mobility manager. The architecture also includes a local service function layer associated with the network service function layer. The local service function layer can include: an access accounting server; an authentication, authorization and accounting server; a security gateway; a policy enforcement server; a mobility manager; a network management server; and a wireless access gateway. The architecture also includes an access management layer associated with the local service function layer. The access management layer can include: a location tracking server; a connection management server; a protocol server; an access management server; a policy enforcement server; a network management server; and a resource management server. The architecture also includes an access interface layer associated with the access management layer. The access interface layer can include: a channel management server; a policy enforcement server; an administration and maintenance server; and a radio frequency server.

[0006] Therefore, in accordance with the previous summary, objects, features and advantages of the present invention will become apparent to one skilled in the art from the subsequent description and the appended claims taken in conjunction with the accompanying drawings.

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BRIEF DESCRIPTION OF THE DRAWINGS

[0007]

Figure 1 is a diagram of separating wireless access from the Core Network;
Figure 2 is a diagram of the LSF/NSF (core) Layer functional service components;
Figure 3 is a diagram of the Radio Access Network Layer functional service components;
Figure 4 is a diagram of the Mobile Terminal Layer functional service components;
Figure 5 is a diagram of Protocol layers and interactions;
Figure 6 is a diagram of Service layer interfaces;
Figure 7 illustrates the connectivity of the Access Management Layer;
Figure 8 is a diagram of AML functional components;
Figure 9 is a diagram illustrating step 1 of the access session establishment procedure;
Figure 10 is a diagram illustrating step 2 of the access session establishment procedure;
Figure 11 is a diagram illustrating step 3 of the access session establishment procedure;
Figure 12 is a diagram illustrating step 4 of the access session establishment procedure;
Figure 13 is a diagram of the service session invocation procedure;
Figure 14 is a diagram of the functional component interaction sequence flow;
Figure 15 is a diagram of an overview of an access scenario at the AIL-AML;
Figure 16 is a diagram of an QoS change request;
Figure 17 is a diagram of use of default QoS to establish call/session;
Figure 18 is a diagram of a call/session invocation request;
Figure 19 is a diagram of power up registration;
Figure 20 is a diagram of the use of default parameters; and
Figure 21 is a diagram of an example implementation of the various layers of the architecture of the preferred embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0008] The present invention can be described with several examples given below. It is understood, however, that the examples below are not necessarily limitations to the present invention, but are used to describe typical embodiments of operation. Additionally, a list of abbreviations and a glossary will be listed first to facilitate a better understanding of the invention.

Abbreviations

[0009]

AAA	Authorization Authentication Accounting
AIL	Access Interface Layer
AML	Access Management Layer
ATM	Asynchronous Transfer Mode
CDMA	Code Division Multiplex Access
CN	Core Network
COA	Care Of Address
COPS	Common Open policy Service
dB	data Base
DHCP	Dynamic Host Configuration Protocol
DNS	Directory Name System
DEN	Directory Enabled Networking
DS	Directory Server
FR	Frame Relay
HDLC	High Level Data Link Control
IP	Internet Protocol
ITU	International Telecommunication Union
LAN	Local Area Network
LDAP	Lightweight Directory Access Protocol
LDP	Local Decision Point

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LSF	Local Serving Function
L1	Layer 1
L2	Layer 2
L3	Layer 3
MH	Mobile Host
MM	Mobility Manager
MPLS	Multi-protocol Label Switching
MS	Mobile Station
NGWN	Next Generation Wireless Network
NSF	Network Serving Function
OSI	Open System Interconnection
PDP	Policy Decision Point
PPP	Point to Point Protocol
PSTN	Public Switched Telephone Network
RADIUS	Remote Authentication Dial-In User Service
RAN	Radio Access Network
RF	Radio Frequency
RSVP	Resource Reservation Protocol
RTCP	Real Time Control Protocol
RTP	Real Time Protocol
QoS	Quality of Service
SDP	Session Description Protocol
SIP	Session Initiation Protocol
SMS	Short Message Service
SS	Session Server
TCP	Transmission Control Protocol
UAC	User Agent Client
UAS	User Agent Server
UDP	User Datagram Protocol
UMTS	Universal Mobile Telecommunication System
UWN	Unified Wireless Network
WAG	Wireless Access Gateway

Definition of terms

[0010] UWN: The Unified Wireless Networks is the IP centric core-network consisting of LSF and NSF network components. The UWN is assumed to be independent of air interface technology. The interfaces between system components of the UWN are based on the LAN/WAN technology and uses client server architecture.

[0011] 2G: The current wireless network components are referred to as the second-generation components. The 2G-network component uses industry-defined protocols and interfaces to communicate between the system and network components.

[0012] 3G: The future wireless network components evolved from the 2G components are referred to as the third generation components. In the description of the preferred embodiment it is assumed that the 3G will be backward compatible to the 2G. For an example, 3G mobile (voice mode) terminal is capable to act as 2G mobile (voice mode) in voice call support. In addition, 3G will be able to support new standards for making a multi-media call using newly defined standards. The gateway devices may be used to support 2G and 3G components.

[0013] NG: The future wireless network components that evolve from the 3G components are referred to as the Next Generation components. The NG components are assumed to take full advantage of the IP centric network infrastructure and eliminate the need of gateway devices. End devices will become smarter with the capability of communicating without the need for the gateway or mapping functions.

[0014] NSF: The NSF is one of the network components of the UWN architecture. It consists of several system components. These components may include legacy components through the necessary interfaces or their functional equivalent suitable to the IP centric environment. Some of these components are HLR, SCP, Unified Directory, AAA server, SN, IP Service Platform (provides value added applications to the client), etc. Network Serving Function (NSF) is the global home component of the UWN that owns the mobile user's subscription.

[0015] LSF: The LSF is one of the network components of the UWN architecture. It consists of several system components. Some of these components are CS, MM, CD, DHCP, DNS, Gateway devices, etc. The Local Serving function (LSF) is the serving component of the UWN that provides services to local and visiting wireless subscriber in that area.

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[0016] RAN: The Radio Access Network is the system component of the wireless network that provides radio control functions used in transmitting and receiving control and data information between mobiles and core network. The RAN itself is air technology dependent. However, it is evolving to provide independent functionality towards the IP centric core network. On this basis, RAN is assumed to have distinct radio interface and access management components. The radio management components provides the radio independent functionality towards the IP centric core network.

[0017] AML: The Access Management Layer is the service layer of the RAN that consists of radio management and access management components.

[0018] AIL: The Access Interface Layer is the service layer of the RAN that consists of air link interface handling components.

[0019] WAG: The Wireless Access Gateway is the entity that interfaces with the wireless access network such as 3G RAN and provides controlling capabilities to facilitate the RAN resources to meet users' requirements such as bandwidth management and also to interface with the intranet or Internet components.

[0020] WGW: The Wireless GateWay is the entity that interfaces and provides gateway functionality between the traditional wireless access such as BSC and the IP centric network. The WGW is assumed to provide merely tunneling capabilities to transport messages such as DTAP or BSMAP between IP centric network and the traditional 2G-access controller. This definition is not used in the description of the preferred embodiment. However, it is provided just to differentiate the meaning of WGW with the WAG described earlier.

[0021] UAC: User Agent Client is the first entity within the wireless network that assumes responsibility on behalf of the user to communicate with the core network or external network components. The UAC facilitates the activities in the ingress direction. Typically, the UAC is capable of communicating to the external servers directly. However, in some instances the UAC may convey such need to the UAC proxy.

[0022] UAS: User Agent Server is the entity that receives requests from the UAC or the UAC proxy. It facilitates the activity in the egress direction.

[0023] UAC proxy: User Agent Client Proxy takes responsibilities on behalf of the UACs to send appropriate requests to the server.

[0024] UAS proxy: User Agent Server proxy is the first entity within the wireless network that assumes the terminating responsibility on behalf of the receiving user. However, it has the ability to forward or redirect the call/session to other external components. The UAS-proxy facilitates the activities in the egress direction. Typically, the UAS proxy is capable of communicating to the terminating user directly. However, in most instances the UAS-proxy just conveys such information to the UAS that in turn communicates to the end user.

[0025] Ingress: This term is used for those activities that occur in direction from the mobile host to the network.

[0026] Egress:This term is used for those activities that occur in direction from the network to the mobile host.

[0027] Outgoing call/session: This term is used as defined by the bellcore documents. This term is used for the call/session activities that originated from the mobile host and progresses to other network through the serving network.

[0028] Incoming call/session:This term is used as defined by the Bellcore documents. This term is used for the call/session activity that originates from the external network and progresses to the mobile host through the serving network.

Introduction

[0029] The distributed IP centric Wireless Internet - NGWN architecture is centered around IP mobility management, call/session management, and network management. The scope of the description of the preferred embodiment is to explore call/session management services.

[0030] The call/session management services consist of three functions. These functions are: 1) establishing an access session between the mobile host and the serving network; 2) an invocation of a service session by the end user; and 3) facilitating network resources to establish point to point or point to multi-point virtual connection.

[0031] The establishment of an access session attaches the mobile host to the serving network. During the establishment, subscribers' are authenticated and granted either a specifically requested, or a default, bandwidth with the desired quality of service. Once the access session is established, the mobile host becomes IP capable and can reach, or be reached, any other devices. The access session remains active while the mobile host is attached to the serving network..

[0032] Once the access session is established, the user can invoke a service session. The user is provided with user capabilities and network preferences to use services from the serving network or externally accessed services. Although the user is provided with many choices of service invocation, the one of the main components is call/session control services. The management of call/session control is distributed to a set of appropriate servers (functions) within the access management and Local Service Function (LSF) network service layers. This distribution allows access relevant activities to be coupled with the access dependent service layers, and policy decision making activities coupled with the access independent layers. The services originated at the application level are configured with the appropriate application servers at the LSF service layer. In addition, call/session control services are part of the access management

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services that aids to facilitate in establishing point to point and point to multi-point virtual connections.

[0033] The main components of the Unified Wireless Networks (UWN) consist of IP mobility management components, call/session management components, network management control, and gateway devices that interface with other systems supporting different protocols. The network management control functionality is also important but dependent on the full definition on the other components. The gateway functionality is also required along with the other appropriate components of the UWN.

[0034] The description of the preferred embodiment focuses on the functional components of the call/session management services. These functional components are distributed in distinct network service layers based on their role. The network access and user service related functional components are distributed in the access management and service management layers respectively. Further; the service management layer is distributed into a local network service layer and a global network service layer.

[0035] Thus, realization of functional components and their appropriate separation into access and service layers have allowed separating network access and service management functions from the media transport. This enabled the end user to have choice of using serving network services or to use external Internet services. Detailed procedures to establish the access session and invoke the service session are discussed below.

Objectives/Requirements

[0036] The call/session management tasks are expected to achieve objectives for three basic functions. These functions are comprised of first, establishing, maintaining and terminating an *access session* between mobile host and the serving network. Second, providing network services to the mobile host that allows a mobile host to establish a *service session*. And third, facilitating transport resources of the serving network to establish a *transport session* based on the mobile hosts' need of bandwidth with a desired quality of service. The desired objectives to achieve these three functions are described below. Moreover, the call/session management functions are real time sensitive where access of decision making information and propagation delay through the network infrastructure plays an important and critical role. Additional objectives related to performance, capacity, and scalability are also identified for real time and other similar issues.

Access, Service, and Transport Session Objectives

[0037] These three basic functions of the call/session management services are identified and elaborated to distinctly depict the differences within the Wireless Internet.

Access Related Objectives

[0038] An establishment of an access session enables the mobile host to establish a point of presence at the local serving network. During access session establishment, subscriber management services are executed. These services include admission policy control decision, provisioning of default air link resources, and establishing the virtual packet channel that allows mobile hosts to interface with the external Internet network. The following paragraphs describe the access related objectives in detail.

[0039] Any access dependent requirements for subscriber management services should be identified. The subscriber management services include authentication, authorization, usage selection and usage constraints associated with subscriber.

[0040] User authentication and authorization are based on digital certificates/signatures, and is provided by an authentication server.

[0041] Usage selection and user constraints are based on the subscriber profile and network policy.

[0042] Provisioning the local serving functions with access and usage profile in order to provide allowed access and usage services to the mobile host.

[0043] Handling of flexible bandwidth provisioning and supporting requirements.

[0044] Handling of accounting requirements based on flat rate, per packet, time used, and/or Quality of Service provided.

[0045] Handling of data speed requirements of up to 144 kb/s for vehicular users, up to 384 kb/s for outdoor to indoor mobility, and up to 2 Mb/s for indoor and Pico cell environments. Handling of Quality of Service requirements.

Service Session Related Objectives

[0046] The service session enables an end user to use services provided by the serving network. Also, an end user can use the serving network services to dynamically change network transport resources. That will allow an end user

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to access globally available network services at the required bandwidth for a desired quality of service. The following paragraphs describe a few objectives.

[0047] Identify serving network services to facilitate use of access network application servers to provide services independent from the subscriber's home network.

[0048] Identify any interaction needed in providing global network services that are based on service level agreements between other networks (home or third party).

[0049] Identify serving networks' role in enabling end user to form a private network within the scope of serving the Wireless Internet.

[0050] Identify scheme for reporting network resource usage.

[0051] Establishing and managing voice, paging, Short Message Service (SMS), and circuit and packet data oriented services (e.g. multi-media conference, on-line subscription, etc.).

[0052] Service capabilities related to information and functionality such as dynamic negotiation of QoS, use of Intranet service and use of communication resources.

Transport Related Objectives

[0053] The transport session activities enable the mobile host to use the network's air and virtual packet channel path resources. The following paragraphs describe a few identified objectives.

[0054] Establishing bearer connection path for an air link and virtual packet channel using serving network's resources.

[0055] Facilitating Point to Point, Point to Multi-point and Multi-point to multi-point connection.

[0056] Facilitating use of underlying network infrastructure resources such as ATM, FR, or Ethernet.

[0057] Facilitating use of payload coding/decoding task identified by the payload mediation function of the local serving function.

Other Related Objectives

[0058] The following paragraphs describe a few more important objectives.

[0059] Performance objectives :

[0060] Minimum packet delay; ITU recommends roundtrip delay less than 300 ms.

[0061] Minimum packet loss, such that no noticeable degrade in voice quality and the performance of fax.

[0062] Maximum throughput via a virtual connection

[0063] Optimized bandwidth distribution

Challenges

[0064] An identification of the Call/Session management functions and objectives for the newly defined NGWN are relatively straightforward. However, the feasibility of such objectives to implement and achieve quality of traditional networks in the newly defined Wireless Internet is not an easy task;. it is a paradigm shift. It involves many unknowns and challenges. An attempt is made here to list such challenges in this section along with the solutions in subsequent sections.

[0065] Identify interfaces and signaling objectives between mobile host and network components. More precisely between:

[0066] Mobile host and network's access management layer (AML) functional components to establish access session.

[0067] Mobile host and network's local service layer functional (LSF) components to establish service session.

[0068] Mobile host and home network service layer functional components (NSF) to establish Virtual Home Environment.

[0069] Achieve distributed transparencies for applications.

[0070] Achieve optimized information caching significant to established clusters and domains.

[0071] Reduce dependencies for availability and reliability of network components due to network problems, server problems and faulty software.

[0072] Achieve scheme to reach neighboring domains directly avoiding hierarchical intervention.

[0073] Identify both connection oriented and transaction-oriented services.

[0074] Identify inter-working between non-IP access network and IP-based core network.

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Architectural Framework: Emphasizing Call/Session Management components

[0075] This section establishes context for the call/session management services. An architectural framework is illustrated mainly emphasizing the functional service layers and components. It starts with separation of functional boundaries and later decomposes functional components in detail. The interfaces and interactions between network entities and inter-working between functional service layer components is described below. However, in order to illustrate the separation of functional layers and the respective inter-working between layers, the description will not flow from figure 1 through figure 8 sequentially, but will refer to the figures out of order. However, the elements are numbered consistently throughout figures 1 through 8 so as to help the understanding of the description.

Architectural overview

[0076] The NGWN/Wireless Internet is an IP centric distributed Local Area Network (LAN) based architecture. The network components in this architecture are functionally separated as required to fulfill the need of wireless telecommunication and is also suitable to integrate with other data and telecommunication networks.

[0077] The NGWN architecture provides the separation of applications/services control that interacts with the end user and management of the physical infrastructure. Figure 1 identifies the separation of wireless access 102 from the core network 105 at the access management layer 107. Figures 2 through 4 illustrate the distributed architecture with suggested functional service components. The main focus of interest is on the functional service components at the LSF 106/NSF 108 network layer and the Radio Access Network Layer 102. Figure 2 identifies the core functional service components associated with the LSF 106/NSF 108 network layer. Figure 3 identifies the access interface and access management specific functional service components. As shown in figure 2, the WAG functional components 200, 202 provide the bridge function between the local service layer 106 and the access management service layer 100.

[0078] Now referring to figures 1 and 2, the WAG component 101 that is attached to the LSF network 106 represents the access gateway point for the technology dependent functional components. Multiple access gateway points 202 can be attached to the LSF network 106. This provides flexibility in network scalability. The detailed functionality of the WAG components is represented by the Access Management Layer components 100 and shown in figure 3. The LSF 106/NSF 108 service layer functional components on one side of the WAG provide the application specific controlling functions. The access side 104 of the WAG provides the technology dependent access functions.

[0079] The access points 200 and 202 shown in figure 2 as the Wireless Access Gateway, separate the network in two distinct layers. First, the LSF106 /NSF 108 network layer that consists of common core functional service components required for telecommunication network. Second, the Radio Access Network layer that is partitioned into Access Interface Layer (AIL) 104 and Access Management Layer (AML) 100 consists of access interface and access management specific functional service components. Through out the description of the preferred embodiment, an access point that is attached to the LSF 106/NSF 108 (core) network layer is referred for wireless access point. The separate access point is required because of the different air technologies used for wireless access. Likewise, any other technology such as a wireline telecommunication system or a LAN based system can be attached to the LSF/NSF network layer. For different types of access points attached to the core network, the appropriate corresponding controlling core functional service components can be added and configured into the network.

[0080] The LSF/NSF service layers provide the core network functions. Some of the core network functions are listed in Appendix B. Depending on the scalability requirement of the network, the functional service components within the LSF 106 and NSF 108 network layers can be distributed or consolidated based on the desired hierarchy.

[0081] The access management layer 100 as shown in figure 3 provides the controlling functionality relevant to access management and RF management activities. Please note that the RF management activities and access management activities are part of the Radio Access Network layer 102. However, only RF management activities are closely coupled with the AIL 104 and access management 100 activities are closely coupled with the core network. Thus, it is possible to separate the access management activities from the RAN layer. Another major activity is the connection management function. The RAN also provides other associated functions such as local decision making domain specific database, resource control for radio resources, transmission facilities associated with the connection management function, and network management activities. These functions are illustrated in more detail in figure 8. The RF management function of the AML interfaces with the AIL service components and service components within the AML. It performs functions such as channel management, resource management at the AIL level, and policy decision functionality with respect to the AIL needs. The access management functions of the AML interfaces with the core components towards the network side and service components within the AML. The major access management function includes the ingress and egress activities that take place through the access point. Figure 8 shows distributed access management functions. The 'Access' function 800 provides ingress activities, while 'Termination' 802 and 'Paging' 804 functions provide an egress activities. The layer 3 protocol signaling messages between the mobile host and the serving network received at the AIL are distributed to the pre-configured functional service components. The layer 3 protocol

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signaling accomplishes basic inter-working activities with the terminal device. Some of such activities include mobility management activities, location updating, radio resource selection, power control adjustments 806, and channel assignment and reassignments. Also, it may include network layer (L3) originated call control and supplementary services as traditionally used in legacy mobile systems. The AML components are pre-configured to communicate with the AIL components and tunnels appropriate signaling and data information.

The AIL components provide the radio access functions.

[0082] Now referring back to figure 1, the AML 100 is the dividing point 103 between the core network 105 and access dependent controlling functions 102 and 104. The components within the access management layer 100 take the role equivalent to the policy enforcement while the LSF 106/NSF 108 (core) service layer components provide the role equivalent to the policy decision. In order to expedite the policy decision and also to take advantage of the distributed infrastructure, the WAG (the access point attached to the LSF network) domain database is considered at the AML, which facilitates the policy and subscriber related default parameters and access related status information.

[0083] The functionality of various functional components in each service layer is out of the scope to describe in the description of the preferred embodiment. However, Appendix A provides a brief description for some of these components. The access management functional component as shown in figure 3 plays an important role in providing call/session management services. The distribution of access management component functionality along with other AML components is described in figure 8. The access management component performs ingress and egress activities. Logically, access management functions can be further distributed into access (origination) function for ingress activities and termination 802 and paging 804 functions for egress activities. These functions can be physically located in a single (access management) server 800. However, they can be distributed in different servers as they provide distinctly independent functionality. These functional service components are capable of sending/receiving application level messages (from/to user) as well as layer 3 protocol messages over IP (from/to AIL) that take place between the mobile host and the serving network. The detailed functions of these components are described later. However, a brief description is provided here to establish context.

[0084] The access management 800 of the AML takes the role of user agent in the network domain. Within the access management function 800, the access function takes the role of user agent client. With respect to the call/session management service perspective, this functional component handles ingress activities such as registration and origination. Similarly, the termination function 802 takes the role of user agent server and provides the proxy functions for egress activities. The paging function 804 is the further distribution of the egress activities that is associated with the users at the cell level 808. The location-tracking function (defined as handoff function later) handles handoff activities. The location-tracking function interfaces with the LSF service layer component - mobility manager for periodic location update, and inter system (WAG to WAG domain) and inter network domain controlling functions such as handoff.

Interfaces between network entities

[0085] The functional service components are distributed in appropriate network service layers as shown in figure 2 and figure 3 that interact with each other using various interfaces. Although the logical interface model is not shown in the figures, the lower layer (L1-L2) interfaces (shown in figure 5) are assumed to be Ethernet. The interface at the transport layer is either TCP or UDP that is based on the delay sensitivity and reliability requirement. The "other" in figure 5 indicates the support of application level framing (ALF) and support of timer associated with transport layer protocols in order to enhance transaction level capabilities such as controlling congestion and canceling transactions. Application layer protocols are text based and based on the currently being defined Internet protocols.

[0086] The logical interface model includes primary control and data path interfacing to the Wireless Internet. Unlike the LAN based application interfaces in most interfaces mentioned in this model, the air link interface is a specific interface. The mobile host interfaces at the serving network on the technology dependent air interface uses network layer protocol messaging. The radio access interface layer, as shown in figure 3, terminates the network layer air technology dependent messages. Based on the type of messages received at the access interface layer, they are distributed to the pre-configured functional components at the access management layer. Detailed procedures are explained later in the description of the preferred embodiment.

[0087] Although the details of the Mobile Terminal Layer are not discussed much in the description of the preferred embodiment, figure 4 shows an example of how the functionality of the mobile host can be separated into two layers: a wireless interface layer and a mobile application layer.

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Application inter-working

[0088] Figure 5 depicts the protocol layers and interactions between network entities. It establishes the main context for application interactions between various network components. It shows the protocol interfaces between OSI layers that inter-work to accommodate air interface and LAN based connectivity. The description of the preferred embodiment only focuses on activities that take place above the transport layer in case of LAN based architecture and at the network layer in case of air interface.

[0089] The following sections describe the interactions between mobile host and access network components, mobile host and local serving function components, and mobile host and home network components.

Interactions between mobile host and access network

[0090] The Access Management Layer and the Access Interface Layer are the part of the Radio Access Network. The AML service components provide the access dependent control functions. The technology dependent network layer (L3) protocol terminates at this point. The AML service components are logically distributed into different functions as shown in figure 8. A signaling distributor between AIL and AML distributes messages to the pre-configured functional components (servers). With respect to the call/session management services, the access, termination and paging functions play an important role. These components interface with the LSF service components in order to provide services to the AIL and the mobile host. The LSF service components interface with the NSF service components in order to provide services to the access management components.

[0091] The following interactions occur between the mobile host and the access management service layer:

[0092] The AML components interact with the network layer of the mobile host to establish an access session. (L3/IP between AIL and AML)

[0093] The AML components interact with the AIL components to bring the mobile host on the traffic channel.

[0094] The AML components interact through the connection management component to establish point to point protocol path that allows the mobile host to access any other IP capable devices.

[0095] The network preferred call/session control services are handled through the access management components.

[0096] Handoff, power control, and paging functions related handshakes with the mobile host are controlled by the AML components.

[0097] Interactions between mobile host and CN/LSF network service components

[0098] The LSF network service components provide specific services to the access management components during establishment of an access session and service session with the mobile host.

[0099] The subscriber management and policy decision services are provided during an access session establishment with the mobile host.

[0100] The policy decision services are provided during user session invocation.

[0101] Intranet services are provided by the LSF service components through the specialized application servers.

[0102] Interactions between mobile host and CN-NSF/Global network Service components

[0103] The NSF network service components provide services to the LSF network service components during establishment of an access session with the mobile host.

[0104] The subscriber management services are provided during an access session establishment with the mobile host.

[0105] Facilitate to publicly available server accesses.

[0106] Direct home network accesses.

[0107] Interactions between network service layers

Inter-working between service layer components

[0108] The access management layer components and the LSF/NSF service layer components are the main network components that play the significant role in controlling call/session management. The functional components within an access management layer are the edge components through which mobile users in a area accesses the core network for access establishment service, service session invocation service and intranet services or external network access services. The AML is comprised of many distributed functions. These functions are explored in subsequent sections including access (Origination: User Agent Client), termination (Termination: User Agent server), protocol servers (optionally at AML but not at LSF service layer), power control, resource control, handoff, paging, and connection management (Transport Network). The functions within LSF/NSF network service layer include service broker, session server, payload mediation, and AAA+ (accounting, authorization, and authentication) servers. The components are described in greater detail later.

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[0109] How these components interact with each other as well as with end user and establish an access session, service session and transport session is also described later in the text. The access function facilitate to establish an *access session* that interact with the mobility manager to provide the functionality and the context needed to grant and support the user in accessing NGWN - Wireless Intranet services. Typical access functions performed by the network domain include an establishment of an authentication, authorization, usage selection, and usage constraints. At the end of establishing access session, the serving network is configured and provisioned with the subscriber's profile to provide appropriate access role, and usage role to the end user. Further, appropriate access functions are instantiated within the access management layer that interacts with mobile host to facilitate service session invocation and monitoring usage functions of the network resources. These instantiated functions interact with the session and accounting servers during the service session. The access functions within the AML take the role of User Agent in the network domain.

[0110] The session server component of the LSF/NSF network service layer facilitates establishment and maintenance of a *service session*. It provides the functionality needed to satisfy end users' request for desired services. The functional components within the LSF/NSF network service layer provide services to the access management layer and to the end user in establishing functionality and context involved in the negotiations of parties, configuration and QoS to be associated to the execution of a service. These services are unlike the call model services that facilitate in establishing connection-less or connection oriented call/session.

[0111] The AML of a particular domain must establish an association with the session server of the LSF/NSF network service layer in order to provide call/session services to a mobile. It is possible for the AML to have association with multiple session servers. However, the AML must associate with a single session server to complete initiated transaction. It is also possible to have many transactions during call/session establishment. During each transaction the AML may use a different session server. This implies that the AML maintains call/session states.

[0112] The session server provides services such as address translation, location service, and bandwidth management and admission policy control. It interacts with the AML for instantiated access functions to provide desired call control and other session services to the mobile host.

[0113] The session server is capable of accessing any of the AML components. This enables the session server to update the domain specific local database within the AML, monitor resources and achieve flexibility (optional) to manage connections for traffic. Updating local domain database provides necessary intelligence to the AML components to perform default capabilities quickly and efficiently. Also, the session server uses services from home (global) network components (NSF) for the purpose of authentication, authorization, accounting, policy related decisions, and globally provided services. The session server performs the function of redirect server in terms of SIP context (SIP Session Initiation Protocol - RFC 2543) or similar to gatekeeper function in terms of H.323 context for the call/session control services.

[0114] The connection management component of the AML provides the function of establishing *transport session* that establishes an end-to-end virtual connection, and handles multi-point and multi-media connections. It interacts with the session and accounting servers for policy and usage monitoring and reporting functions.

Call/Session management specific: components, services, and procedures

[0115] This section describes call/session management relevant functional service components within each network service layer and services and procedures that establish access session and transport sessions. The service components within an access management layer of the RAN layer and service components within the local service layer of the LSF/NSF network services layer plays an important role in providing call/session management services.

Access Management Layer (AML) components

[0116] The AML functional component position is between the radio access interface layer and the core network components as shown in figure 1 and figure 7. The AML component performs controlling and policy enforcement functions. It controls activities that take place at the access interface layer. Also, it controls interface activities associated with the user during access session establishment and service session invocation. It controls connection management activities that establish and monitor the point to point and point to multi-point virtual packet channels.

[0117] The network and user specific preferences are executed here based on the policy decision provided by the LSF/NSF network layer service components. The local domain database is updated with limited relevant information during access session establishment and service session invocation that expedites real time critical policy decision execution. For an example, an origination request arriving at the access management server examines the requested bandwidth with the allowed default permission through the local domain database. If the requested bandwidth matches with the allowed default, an access management server facilitates the requested bandwidth through the resource control function of the AML. If the requested bandwidth is other than default, an access management server may consult

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with the session server to take further action.

[0118] These functions can be physically distributed in different servers within the AML as network capacity demands. The AML functions (i.e. components) are pre-configured with the local service layer components to provide services to the mobile host during access session establishment. Additional components are instantiated and configured at the end of access session establishment. This is done based on the capabilities granted to the users and network capabilities to provide additional services.

[0119] Figure 6 illustrates how some of the components within each layer interfaces to some of the other components and is only meant to illustrate an example of the components described in detail throughout the description of the preferred embodiment.

[0120] Figure 7 illustrates the respective position of AML in Wireless Internet. Figure 8 illustrates the functional components within the AML. The functional components within the AML are pre-configured with a signaling router that interfaces between AIL and AML. The signaling packet to/from the radio access interface layer arbitrates at the signaling distribution function of the AML and distributes to the pre-configured AML components based on the type of signaling (e.g. related to call/session processing, mobility management, supplementary services, radio resource, etc.). An access function plays an important role in ingress direction while termination and the paging functions play an important role in egress direction. The access function takes the role of user agent on behalf of the end user. An access function involves in initial dialog with the mobile host. At network layer, the mobile host communicates with the access function using network layer messages. Intelligence at the access function uses local domain database in performing default services. For higher-level policy decisions, it accesses the session server at the LSF network service layer.

Activities of the AML components are described below:

[0121] **Access function** - Access function takes care of ingress related call/session management activities. These activities include registration and origination. An access function is the first signaling termination point with respect to ingress call establishment. It executes the policy enforcement functions. The access function of the AML takes the role of a user agent in a serving network. It interfaces with the mobile host to provide access session establishment service. During initial registration, it interacts with the mobility manager of the LSF network layer component that facilitates the subscriber management services. Upon successful completion of the subscriber management services through the mobility manager, the local domain database is updated with user and network preferences. The local domain database provides the local decision point functions. This expedites the domain specific activities during service session invocation and through out the active access session.

[0122] Further, an access function facilitates the establishment of a traffic path (establish PPP link) between the mobile host and the connection management component. The purpose of this action is to establish an access session between the mobile host and the serving network. The access function of the AML does this in two steps. First, the access function interacts with the RF management (resource control as shown in figure 8) component to bring the mobile on a traffic channel. Second, the access function interacts with the connection management component through which the PPP protocol messages handshake to establish IP address service point at the mobile host. The mobile host can negotiate the choice of IP address to be used; either network provided or mobile provided. This establishes the transparencies between the mobile host and the serving network. The access function informs the session server of the LSF network layer about the completion of the access session.

[0123] At this point, the session server has direct addressing capability to the mobile host to provide user capabilities and network preferences. Based on the usage and preferences granted to the mobile host, an appropriate service session manager function is instantiated within the access management layer domain. The user application interacts with the service session manager for service invocation and network service requests.

[0124] The access function takes the role of either user agent client or user agent client proxy depending on the need that is based on the capability of the mobile host. Please note that access function implies that the activities may be provided by an instantiated session server manager or handed over to the appropriate protocol servers. When the mobile host is capable to control call/session-handling activities, the mobile host takes the role of user agent client. The access function provides the role of user client proxy if requested. The mobile host has choice not to use access function as client proxy and may contact any desired client proxy or directly to the end user agent server. The mobile host keeps track of state machine. If the mobile host requests to the access function to aid in further call/session-handling activities, the access function takes the role of user agent client proxy. In this case, the access function is taking role of client proxy may interacts with the session server that provides the role of redirect server. Also, the access function can play role in two possible modes. First, an idle mode in which it provides call/session-handling transaction services when requested but do not keep track of call/session state machines. Second, an active mode, in which access function provides call/session-handling transaction services and keep track of call/session state machine.

[0125] When the mobile host is not capable of handling call/session activities, the access function receives request from the mobile host. The access function takes the role of user agent client, interacts with the session server for

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admission control and policy decision if required. The access function performs the outgoing call/session activities. The access function keeps track of state machine.

[0126] Termination and paging function - Termination function handles egress activities related to the incoming service session (call control activities) requests. Why do we need the termination function? In an IP environment, with the fact that each IP capable mobile host is addressed by a specific IP address, an external caller when trying to reach a mobile host in a Wireless Internet, it can reach directly without any intervention from the wireless access. However, this is only true when the mobile host is attached to the serving system using its permanent IP address. Because of the transient characteristics of the mobile host it is more suitable to assign a domain specific IP address within the Wireless Internet. In this case, once the domain specific address is made globally available by linking with the mobile host's home then the external caller only needs to find domain specific termination-proxy server. The termination-proxy server associates the current location of the callee within that domain with the current paging server (user agent server).

[0127] Thus, the termination function acts as a user agent proxy server for the user agent servers associated within the AML (notice cloud shown in figure 8). The termination function provides the first signaling termination point with respect to egress call establishment. It executes the policy enforcement functions. The local domain database provides the local decision point functions. This expedites the domain specific activities during termination service session establishment. The termination function interacts with domain database to get information for handling incoming request. If the end-user is not recognized, it interacts with the session server of the LSF component to take further action. In terms of SIP context (SIP RFC 2543), the session server performs function similar to the redirect server. Similarly, in H.323 context, the session server performs function similar to the gatekeeper. The termination function uses services from the session server and mobility server of the core network for various services that may include authentication during termination, current location information and policy-related decision.

[0128] If the end-user is recognized (i.e. registered within this domain) and the requested service is allowed, the termination function directs the request to the appropriate paging function (user agent server) to page the end-user or activate the traffic path from either standby or dormant mode. The paging functions (user agent servers) are associated with the unique cells within the access management domain serving area. The paging functional component keeps track of the call/session state machine as it is acting as a user agent server on behalf of the mobile host.

[0129] The termination and paging function interacts with the RF management server (resource manager) to establish a radio link connection. As mobile host is attached to the serving network, a domain specific IP address is already assigned. So in terms of SIP context (SIP RFC 2543), this IP address is returned in the contact header when returning response to the INVITE message. The termination or paging function interacts with the connection management function to establish a transport session.

[0130] Protocol servers (or functions) - The access management functions are closely coupled with the protocol servers or functions. The protocol functions are the different code points within the system specific to the type of protocol (such as SIP, H.225, H.245, RSVP, MPLS, etc.) used for the specific activities (such as session establishment, quality of service request, secure virtual path establishment, mobility specific, etc.). These functions can be part of the access management functions and instantiated for each service session invoked. Or, these functions can be separated in different servers and access management functions can hand over the specific requests to these servers as needed. The role of these servers varies depending on the type of protocols. For an example, in SIP context, such server provides functional role as proxy server. Similarly, in H.323 context, such server provides functional role as H.323 gateway.

[0131] The location of these protocol functions or servers is not appropriate at the LSF network layer as they are closely coupled with the access management activities. For the simplest network hierarchy, these functions or servers can be associated with one WAG (access point) domain. As network scalability increases, i.e., additional access points are added, other access points can access these servers established at a single geographically convenient location. Alternatively, it is possible to locate these protocol servers along with other Intranet application servers.

[0132] Once access management hand over request to the appropriate protocol servers, these servers create direct links with the end user and takes the responsibility to interact with the connection management functions to establish appropriate transport session.

[0133] Connection management function - The connection management function is the part of the AML component. It provides the third and final phase of the call/session management services that facilitates in establishing transport session. It receives transport session establishment request from the access (user agent client) function or instantiated session service manager during the outgoing service session establishment. Similarly, the termination (UAS proxy server) and/or paging function (user agent server) requests transport session establishment during incoming service session establishment. Based on the request, the connection management function facilitates to establish the point to point or point to multi-point virtual packet channel. The connection management function monitors and records usage activities. Like session service manager, the connection session manager is instantiated for each transport session establishment. The connection session manager for the transport session takes care of providing required quality of service and use of appropriate network infrastructure as described earlier.

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[0134] **Configuration Manager** - the configuration management function at the AML service layer facilitates reconfiguration of AML service layer components. It also facilitates location tracking (handoff) with addresses of neighboring location tracking components that are used for handoff activities during movement from one AML to another AML.

[0135] **LSF/NSF network service layer components** - There are many functional components that are involved in providing call/session management services. However, only some of these are significant for the purpose of the description of the preferred embodiment and described here.

[0136] **Session server** - The session server is one of the call/session management service components at the local service layer. The primary function of the session server is to interact with the AML service components to provide call/session management services. More precisely, it interacts with the access function and the termination function within the access management server of the AML service layer. Also, it interacts with the connection management function at the AML for usage monitoring and recording purpose. Once the access session is established between the mobile host and the serving access network, the access function interacts with the session server. At this time, the session server may configure the mobile host with available network preferences and users granted capabilities. Also, the session server provides important IP addresses to the mobile host (possibly using html) that can provide value-added services. The call control services are some of the many other services the mobile host can invoke. The session server at the LSF service layer along with access and termination functions at the AML service layer provides most of the call/session control services. The typical functions facilitated by the session server includes address resolution, call/session admission control, policy control decisions and access accounting control.

[0137] Other issues such as address translation and finding terminating proxy servers are not explored here. However, it is important to mention that the session server is assumed to perform functions similar to the redirect server identified within the SIP component definition (SIP RFC 2543). An identification of functionality for admission policy control and bandwidth management is the challenge with respect to the 3rd generation infrastructure. In addition to these, the role of session server in providing location-based applications and its interactions with the mobility manager server is also a challenge. These issues are differed at this time.

[0138] **Database management (directory services)** - The call/session functions related to a subscriber are typically based on the subscriber's profile. Such information in wireless network is typically centrally located at the subscriber's home NSF layer or at global level. In order to take advantage of the distributed network, subscriber's profile and related information need to be distributed in appropriate domains. Such distribution should be to a level where access point dependent components (e.g. session server, MM server) and radio dependent components (e.g. functional components within the AML) can take necessary decision independently. Such distribution will expedite the call/session processing and reduce the lengthy delay involved in accessing centrally located database and hence improve performance.

[0139] **Call/Session management services** - The ultimate objective of the Wireless Internet is to provide the end user an access through the network, provide choice of user desired services (Intranet or external Internet, etc.), and finally, the control and monitor capability for network resources used. The call/session management services facilitate these objectives. Three basic functions were briefly identified earlier. These functions are listed in the following paragraphs again.

Establishing an access session between the mobile host and the serving network

[0140] The establishment of an access session facilitates the mobile host to attach to the serving network. During the establishment, subscribers' are authenticated and granted for requested or default bandwidth with desired quality of service. The local decision point within the access management layer is updated and appropriate service components get configured. Once the access session is established, the mobile host becomes IP capable enabling access to/from any other device. The access session remains active at all times as long as the mobile host remains attached to the serving network.

An invocation of a service session by the end user

[0141] The user can invoke a service session. The call/session control service is one of many services that the user can invoke. The session server at the LSF service layer facilitates the call/session management control activities. At this point network becomes capable of providing basic call/session control services. However, the network is also capable of providing simple to complex services.

[0142] The user is provided with user capabilities and network preferences to use desired services from the serving network or access external services. Based on the user capabilities and network preferences with respect to the type of user, the network configures itself to respond to the user service invocation.

[0143] For example, in the management of basic call/session control services, the session server manager is instantiated at the access management layer that provides the user interface for call/session control services. While at the LSF service layer, instance of a session can be created at the accounting server to handle accounting activities for

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any service session. Similarly, for any other service, the appropriate session manager can be instantiated to respond to that specific desired service. The application servers are configured at the LSF service layer.

[0144] This allows the ability to keep access relevant activities coupled with the access dependent service layers, and policy decision making activities at the access independent layers. Also, this allows flexibility to provide mixture of independent services and add new services.

Facilitating network resources to establish point to point or point to multi-point virtual connection

[0145] Distinction between the call/session control services and other applications/services is emphasized throughout the specification for clarification purposes. The call/session control services are the part of the access management services that facilitate establishing point to point and point to multi-point virtual connections.

[0146] **Access session establishment** - The mobile host establishes point of attachment with the serving network. The mobile hosts on power up or during idle state periodically sends registration or location update request to the serving network. The access interface layer components facilitate an air link communication with the mobile host. Upon receiving registration request, AIL distributes it to an access management server component within the AML. The access management server consists of many functions. They are identified in figure 8. They are access, termination and paging functions. These functions have independent functional role and can be separated in different servers if network capacity demands. In this section when access management server is referenced implies an access function of the access management server. The AIL distributes signaling information to the appropriate servers depending on the type of signaling. Optionally, such distribution can be implemented at the AML.

[0147] Now referring to figure 9, the access management layer processes the registration request 900. The domain database 902 within the AML provides the local decision point to the AML components to make primary decisions. The access management server 904 checks with the domain database 902. If the mobile host 906 is already registered, mobile host's current location is updated. If the mobile host 906 is not active within this domain, the access management server sends REGISTER request to the LSF service layer component - mobility manager 908. A SIP message, REGISTER is shown for examples that access management server sends to the mobility manager 908. It includes MIN or "user at domain" location information that identifies cell information.

[0148] Although the activities performed by the mobility manager 908 will not be described in great detail, a brief outcome of this activity is described here. This is the first step in establishing an access session between the mobile host and the serving network. The mobility manager 908 receives the REGISTER message. This indicates that the subscriber needs to be authenticated for access and authorized for the requested services. The mobility manager performs this task with the help of other LSF service layer components such as AAA+, directory services, DHCP, and policy server. If the mobile host is active within the regional serving domain, the LSF service layer components provide the service functions. I.e., an authentication is done through the local AAA server, an IP address assignment through the DHCP that is suitable to the AML domain, and subscriber's default profile is updated at the AML domain database as well as at the regional domain.

[0149] Once the authentication and authorization process is complete, it is assumed that the RAN is authorized to provide access to the mobile host. Now referring to figure 10, first, the access management server 904 interacts with the RF management server 1000. The access management server 904 instructs the RF management server 1000 to assign a traffic channel. The RF management server 1000 interacts with the access interface layer components and facilitates the sending of appropriate air link messages to the mobile host. The RF management server 1000 notifies the access management server 904 once the mobile host 906 establishes the traffic channel. At this time, data link connectivity is achieved between the mobile host and AIL. Second step is to establish PPP connection between the layer 2 of the mobile host and the connection management server 1002.

[0150] The access management server 904 then starts to interact with the connection management server 1002. First, it establishes the co-relation between traffic channel and assigned IP address at the connection management server 1002. Now referring to figure 11, the access management server 1002 handshakes configure/response layer 2 PPP connection messages with the layer 2 of the mobile host through the assigned IP address at the connection management server 1002. At the mobile host 906, layer 2 establishes an IP address service point link with the layer 3 (IP layer). During this handshake, the mobile host 906 accepts the network assigned IP address or provides a desired permanent IP address instead. In case of the latter, the access management server 904 reconfigures the connection management with a new IP address and also updates the appropriate hierarchical databases.

[0151] At this point, an access session is established between the mobile host 906 and the session server 1200 at the serving network as illustrated in figure 12. The application layer at the mobile host 906 becomes IP capable and can access any IP addressable device. The air link at the layer 2 is in the active mode. This link remains active for a pre-determined time that is based on the MAC layer specification. With no activity on air link, active status of this link changes to standby mode, and later goes to the dormant mode and then the traffic channel gets released. However, the established access session at the access management service layer remains active. This access session remains

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active until association of the mobile host is removed or deleted at the access management layer. When any data activity happens, either from the mobile host or from the access network, the air link turns from dormant mode to the active mode.

Invocation of service session

[0152] Now turning to figure 13, once the mobile host 906 establishes point of attachment at the session server 1200 within the serving network, the mobile host 906 becomes capable to invoke any services. The mobile host 906 can access any IP addressable device. The serving network can help provide locally or globally available services. The serving network becomes smarter and configured to provide services to the user. The default parameters are configured at the local decision points at appropriate domain levels.

[0153] At this time the network is capable to provide basic services. However, the network is capable and flexible enough to provide more complex services. A brief discussion is provided here for reference and will be explored later.

[0154] The serving network provides user capabilities and network preferences to the user. The user capabilities were determined during access session establishment as a result of executing subscriber management services. The network preferences based on network capabilities are pushed to the mobile client 906. Such preferences may include a choice of invoking different type of call/session control services (voice, data, multi-media, etc.) or value added services (Intranet services, location-based services, etc.). More over, the serving network can provide a choice to the mobile host of using the serving network as an ISP provider, or for other possible options. Some of these options are illustrated on screens 1300 and 1302 in figure 13.

Establishment of transport session

[0155] Based on the type of service session invoked, the service session manager (please refer to discussion on service session manager) notifies the connection management function to establish a virtual packet channel path. The connection session manager is instantiated by the connection management function that establishes appropriate network resources to establish requested transport session. The connection management function isolates activities from the call/session control activities. For example, it hides the underlying network topology and supports the inter-working between network layers. Based on the quality of service requirement (which is discussed below), the connection management function facilitates establishment of a path ranging from no packet control to fully dedicated virtual packet channel path. It may use different techniques to achieve the required quality of service. These techniques may include use of MPLS, RTP/RTCP, RSVP as well as other schemes. The quality of service requirements may include the following: bandwidth reservation for a data path (possible use of RSVP); end-to-end latency guarantees through the optimized IP network (possible use of MPLS); network infrastructure selection such as IP or ATM backbone (Layer 1 & 2 selection); protocol selection such as MPLS, RTP/RTCP, RSVP (based on quality of service requirements); and acceptability of loss of data (possibly establish limits on acceptable vs. unacceptable loss based on type of transport session established, such as voice, audio, video, etc.)

Call/Session procedures

[0156] The call flow procedure described here uses several scenarios to outline involvement of access function. However, certain assumptions are identified in the following paragraphs.

[0157] The Mobile host should be IP capable. For example, once the mobile host is attached to a wireless access system, the mobile host can reach any IP addressable device, server or end-user directly and transparently through the network. Also, any external user or device can reach the mobile host transparently through the network.

[0158] The mobile host can seek network services for call/session establishment or dynamic change in resource allocation using standard application protocol such as SIP or RSVP.

[0159] The RAN is IP capable. Particularly, the service components within the RAN; AIL and AML are IP capable. The PPP link is established between the mobile host and connection management component of the AML. The router between the AIL and AML will arbitrate the signaling and traffic packets before forwarding to the pre-configured IP devices of the AML components. This arbitration can be done at the AIL or at the AML depending on the choice of implementation.

[0160] The functions of the AML components are distributed based on the required function. Such functions include access, termination, handoff (location tracking), paging, power control, RF management (resource control), configuration management, and connection management. Also, local domain database for local aspects is used. It provides subscriber dependant data and local policy decision parameters for system dependant data. Alternative to these local aspects, global aspect entities such as AAA+ server and Policy Decision Point (PDP) can be accessed from the core network respectively.

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[0161] The AML components require assuming responsibility for the end-user as a User Agent Client and User Agent Server in an ingress and egress direction respectively.

[0162] The AML component interfaces with the core network when necessary. The core network components provide either redirect server function or value added service function to the access function.

Call/session general overview

[0163] The AML service components and the session server are the main network components that play a significant role in call/session management. The AML components are the edge components through which a mobile host in an area accesses the core network for Intranet services or external network for third-party network services or publicly available Internet services.

[0164] Thus, the AML components provide the access function. The access function establishes the functionality and the context needed to grant and support the user in accessing NGWN - Wireless Internet services. The functionality of access management server component within the AML takes the role of user agent in the network domain. Please refer to discussion on each service component.

[0165] The session server provides the call/session service function. The session server provides services to the user agent in establishing functionality and context involved in the negotiations of parties, selection of functional protocol components, configuration and QoS to be associated to the execution of a service. These services are unlike the call model services that facilitate in establishing connection-less or connection oriented call/session. Thus, the session server receives a request from the user agent and satisfies the service need. Upon access initiation or registration, the access management server component of the AML takes the role of user agent on behalf of the mobile host and interacts with the session server in establishing the requested need or service. Upon establishment of an access, appropriate network configuration takes place to serve the mobile host for its default services and network capabilities. In the process, the session service manager is instantiated that interfaces with the mobile host that satisfy the service request such as dynamic change in QoS. Please refer to the section discussing the session server.

[0166] The architecture vision is such that service requests will be facilitated appropriately by the AML components. The service session manager and transport session manager is instantiated by the access management server during access session establishment. These components provide the interface point and satisfy the end users' need and requests.

[0167] Upon terminal registration (e.g. at power up), the mobile host gets control of the radio channel and engage with a specific serving RAN in an area. The mobile hosts send registration messages to the RAN that appears at the associated access management service components. For an example, in case of a CDMA technology, a network layer IS-95 origination message is received from the mobile host to the network access interface. The AIL sends this message to the associated AML using HDLC protocol or simply in IP packets using Ethernet. The signaling IP packets are received at the edge router between AIL and AML. This router arbitrates the type of message and distributes to the appropriate AML components such as access management server, power control server, or handoff server. It is assumed that the IP security is established between AIL and associated AML, and also between identified network layers. The signaling arbitrator is configured with the appropriate IP addresses of the AML components and core network components. Thus, access related messages will be forwarded to the access management server, handoff and mobility related messages will be forwarded to the handoff server, while power control related messages to the power control server, and so on. The data packets will be distributed to the connection management server.

Exemplary Functional Component Interaction Sequence Flow

[0168] Although the functions of related service components and their interactions are described earlier, figure 14 provides functional component interaction sequence flow. The following paragraphs describe a general overview for these sequences.

[0169] Sequence 1 is described as when the network layer (L3) of the mobile host sends the registration request (e. g. at the power up) to establish a point of presence at the serving network. The access function of the AML service layer receives this request.

[0170] Sequence 2 comes into play when the access function at the AML service layer communicates with the mobility manager at the LSF service layer. The mobility manager performs several functions for which it may communicates with other functional components at the LSF service layer and/or with NSF service layer in order to provide subscriber management services. In this process the mobility manager may communicate back to the mobile host through the AML service layer to authenticate the mobile host.

[0171] Sequence 3 gets traversed when registration is completed, the mobility manager facilitates to download information such as a subset of user specific default parameters and allowed service options to the AML domain database. Such information provides local decision point to expedite future service invocation procedures if necessary.

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[0172] The access function at the AML service layer communicates with the RF management server in sequence step 4. For simplicity, the RF management server is not shown in this figure. The RF management server performs procedure to assign traffic channel.

[0173] Sequence 5 designates informing the access function upon completion of traffic channel assignment.

[0174] The access function of the AML service layer communicates with the connection management server in sequence 6. It facilitates to establish relation between traffic channel and assigned IP address. Then, the access function negotiate with the mobile host at the layer 2 through the connection management server of the AML service layer to establish PPP connection and IP address selection. The mobile host may accept the network provided IP address or mobile host may provide its permanent IP address to use.

[0175] The mobile host communicates back to the access function of the AML service layer in sequence 7 indicating accepted IP address assignment. The access function facilitates the necessary changes relative to the selected IP address at the AML domain and/or at the LSF service layer database.

[0176] Upon establishing PPP link between the mobile host and the connection management server, the access function at the AML service layer communicates to the session server in sequence 8 to download necessary information to the mobile host.

[0177] The session server downloads necessary information to the mobile host in sequence 9. The information includes: end user's capabilities that derived as a result of providing subscriber management services during access session establishment, and network preferred preferences for which network is configured to provide optimum service. Also, the session server communicates with the connection management to provision default bandwidth and required quality of service requirement corresponding to the end user.

[0178] The sequence 10 indicates the service invocation by the mobile host. The sequence 10' (10 prime) indicates an service invocation (e.g. origination) form the network layer of the mobile host. In this case, with respect to SIP, the access function at the AML service layer provides the function similar to the user agent client (UAC). The sequence 10 indicates an service invocation from the application layer of the mobile host. In this case, with respect to SIP, the mobile host application layer provides the function similar to the UAC. Based on the end user invocation of specific use of service, the mobile host has multiple options: it can reach directly to the callee (destination end user, i.e., e.g. user agent server in SIP context); it can reach to the other domain network. In SIP context, it can reach to a user agent server proxy that can terminate to the appropriate user agent server; or it can reach to the serving network's provided appropriate protocol server. In SIP context, it can reach to the user agent client proxy. The user agent client proxy can facilitate the further action to provide necessary resources and forward service session establishment request to the callee.

[0179] If the user chooses to use network provided appropriate protocol servers, then the appropriate protocol server receives the service session invocation request in sequence 10A and 10'A. The protocol server communicates with the session server that arbitrates to the appropriate controlling entity. For an example, in SIP context, the user agent client proxy will communicate with the Redirect server. Likewise, in H.323 context, the H.323 gateway will communicate with the gatekeeper (GK). The other GW performs similar functionality provided by the user agent client proxy in SIP context or H.323 gateway in H.323 context. Such gateways may include PSTN gateway, and similar others.

[0180] Sequence 10B, 10' B is the response from the session server. The session server provides information that required to appropriately forward the service session request to the callee or to the destination.

[0181] Sequence 10C, 10' C indicates when the session server at the LSF service layer or the access function at the AML service layer communicates with the connection management server to allocate allowed bandwidth and provide selected quality of service for the transport session. Such allocation will be committed upon completion of the signaling negotiation between end parties.

[0182] Sequence 10D, 10'D is the forwarding request go out to the appropriate destination.

[0183] Sequence 11 designates when the forwarding request arrives at the user agent server proxy in SIP context, or at the H.323 gateway in H.323 context, then, such entities performs necessary functions to validate for admission control, identifying location of the end user and forwards request to the end user. Similarly, the other gateway will provide the same functions.

Protocol choices

[0184] The list of network preferred protocol preferences could be provided to the mobile host during access session establishment. The access management functions at the AML and the session server at the LSF network layer facilitate the end user with varieties of options based on the type of user's capability, subscribed options, and network preferred protocol preferences. Based on the choice of user invocation, appropriate protocol servers are accessed to establish service session. If the end user is not capable of selecting protocol options, the end user can access the access management functions. This is also a traditional way of handling request from the mobile host. The access management functions interact with the session server to determine the appropriate protocol function and facilitate the selected

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capability components that can establish the service session. The request is hand over to the appropriate server to establish service session.

[0185] This scheme provides the support of any protocol. For an example, the SIP (SIP RFC 2543) and H.225 (H. 225 - Call Signaling Protocols and Media Stream Packetization for Packet Based Multimedia Communications Systems) & H.245 (H.245 - Control Protocol for Multimedia Communication) protocol stack can be supported independently and transparently. Also, legacy protocols can be supported in the same fashion.

Wireless access scenarios

[0186] Two paths are illustrated in figure 15. The first facilitates control of the air 1500 and the virtual packet channel path 1502. The second facilitates signaling interactions 1504 with the core network to establish session and allocation of local resources. The two distinct channels through which traffic data flows are identified in the following paragraphs.

One through the air link and another through the virtual packet channel

[0187] The virtual packet channel 1502 can be established through all the routers along the data path using RSVP (following PATH - RESV signaling sequence between routers). Thus, the control of the virtual link and dynamic bandwidth changes can be obtained by using RSVP processed at each router along the data path. However, the control of the air link is not trivial. This is because of two reasons. First, the data transformation at the connection management 1506 does not distinguish data from signaling and thus, does not process the signaling protocol. The RSVP signaling is merely transported through the wireless access point to the end terminal. Thus, it becomes the end terminal's responsibility to interact with the access point to allocate or modify the bandwidth necessary for the air path. This leads to the second point where bandwidth adjustment requires a unique signaling handshake between the IP Mobile host 1508 and the AIL-AML interface 1510.

Control of session establishment and resource allocation

[0188] Within the wireless access point, the client agent for the end user performs several functions. Some of these functions include interactions with the core network 1512. The user agent (client 1514 or server 1516) performs the role of policy enforcement while the core network 1512 performs the role of policymaking decisions. Depending on the implementation choice, interactions related to the policy may be performed locally or at the core network 1512. It may be practical to distribute default parameters and the subscribers' allowed resource allocation at the time of registration to the local domain database. In this case the policy enforcement function that is a part of the user agent (access management server), performs decisions based on the local decision point (LDP) 1518.

[0189] IP capable end terminals 1520 can communicate with each other transparently. However, the wireless access point plays an important role in establishing the air link path. An intervention at the wireless access point can occur several times during the communication. These scenarios are identified in the following paragraphs.

Scenario 1

[0190] As shown in figure 16, the IP capable end terminals 1508, 1520 are in active state. Assume terminal A 1508 is attached to the wireless access side. Terminal B 1520 is somewhere else on the Internet. Terminal B 1520 sends an INVITE message directly to the terminal A 1508 using the currently used call ID to modify an active call/session with different quality of service parameters than what is included in the SDP. Terminal A 1508 needs to send a request 1600 to the access system to modify the established air link 1500.

Scenario 2

[0191] Figure 17 shows the case of a termination. When the distant client 1520 sends a message 1700, for example, an INVITE message, to the AML 1510, the message ends up at the user agent proxy server. The policy enforcement points and call admission control functions take place at the user agent proxy server. The user agent proxy server may need to access the subscriber related or the system level policy decision database. Such databases can be located locally or at some central location. The subscriber dependent database can be accessed through the local database 1518 (domain dB) for validity, profile check and current cell location if available or may be accessed through AAA server centrally located within the core network. Similarly, system level policy decisions such as allocation of subscriber requested bandwidth with respect to the availability can be checked by the proxy server by accessing local policy decision database or globally located database.

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Scenario 3

[0192] Figure 18 shows the call/session invocation request scenario. Though an IP mobile host 1508 is capable of establishing a call/session with another external device 1520 transparently without interaction of AML 1510, it is possible that in many cases the IP mobile host 1508 may request the AML 1510 to establish such a call/session. An example of such cases may include where a mobile host 1508 wants to establish a multicast call/session; it that case, it would request the AML 1510 to establish such a session. This is important mainly due to the bandwidth limitation of the air link 1500. The AML 1510 would facilitate the multicast of packets to as many sessions as needed. Another example is where trigger based services are incorporated that allow mobiles to invoke pre-established value added services offered by a local service provider or a local Intranet.

Scenario 4

[0193] Figure 19 shows the power up registration scenario. The power up is one case when the AML 1510 is accessed to establish an air link 1500 and establish access session. Once the air link 1500 is established, the mobile host 1508 can stay in active or dormant state. In any of these cases, the subscribers' profile is kept in a local database (domain dB) 1518. QoS policy and policy enforcement points are distributed in the access (user agent client) function for ingress and terminating user agent proxy for egress activities. Depending on the QoS requested, that include bandwidth requirements at the default level.

Scenario 5

[0194] Figure 20 shows the scenario where default parameters are used and no intervention is required. That means the mobile user 1508 can establish a session with an external user 1520 using default QoS parameters provisioned during access session establishment. In egress, the user agent proxy server will use default parameters to establish call/session with the user 1508 within the domain of AML 1510.

[0195] Figure 21 illustrates an example implementation of the architecture of the preferred embodiment. As shown, one access management layer 2100 can have one or more access interface layers 2102 and one local service function layer 2104 can have one or more access management layer 2100. In addition, local service function layer 2106 is also depicted with one or more access management layers 2108, which in turn have one or more access interface layers 2110. Additionally, the local service function layers 2104 and 2106 are shown to be connected to a network service function layer 2112 through either a LSF firewall 2114, the public Internet 2116 and a NSF firewall 2118, or through a private link 2120. The LSFs 2104, 2106 would use the private link 2120 if the NSF belonged to the same service provider and would use the firewalls 2114, 2118 if the NSF belonged to a different service provider.

[0196] Moreover, NSF 2122 is connected to NSF 2112 through a private link 2124, through a service level agreement link 2126 or through another NSF firewall 2128, the public Internet 2116 and the original NSF firewall 2118. Similarly to the LSF/NSF connections, the two NSFs 2112, 2122 would use the private link 2124 if the two NSFs belonged to the same service provider, the service level agreement link 2126 if the two NSFs had a service level agreement and the firewalls 2128, 2118 if the two NSFs belonged to two different service providers.

[0197] In addition, LSFs 2130, 2132, private link 2134, LSF firewall 2136, access management layers 2138, 2142, and access interface layers 2140, 2144 are depicted in the same format as the other components on the right side of figure 21 for simplicity purposes. However, the network could be arranged in countless ways and still withhold the relationships described above.

Conclusion

[0198] It is understood that several modifications, changes and substitutions are intended in the foregoing disclosure and in some instances some features of the invention will be employed without a corresponding use of other features. Accordingly, it is appropriate that the appended claims be construed broadly and in a manner consistent with the scope of the invention.

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Appendix A: Service layer functional components

This section elaborates some of the functional components that are distributed in network service layers. The definitions given here are of generic. However, relevant details to the call/session management services are described in the specification.

Policy management & Policy enforce server - The policy management server defines business and service concerns, and more precisely, policies for users and network devices. It distributes policies to the network devices to enforce the policies defined by the network administrator. It provides policy decisions to control network behavior provided to the user. The policy enforcers are respectively at the lower layer to the policy management at appropriate network devices. These devices communicate with the policy management server using COPS protocol. The policy relevant information can be distributed at the appropriate hierarchy network layer in order to expedite the real time critical decisions.

Authentication server - The authentication server is the core network component. The mobility manager facilitates the authentication process for the mobile host. The authentication server is reachable through the AAA+ server that provides the common protocol for Authentication, Authorization, and Accounting activities. The authentication function is provided based on the digital certificates/signatures.

Directory server - The directory server stores the user service profile and policy in a database. The directory server communicates with other network components such as policy management server using LDAP protocol. The directory server uses Directory Enabled Networking (DEN) scheme. The DEN scheme takes an advantage of information already stored in directories.

DHCP - In an IP centric NGWN – Wireless Internet, a mobile host must be initially assigned a specific IP address that is appropriate to the network domain to which the mobile host is attached. If the mobile host moves to a new network domain, a new IP address must be assigned. The Dynamic Host Configuration Protocol provides such mechanism through which an IP address is allocated to the attached mobile host. The mobility manager component of the LSF service layer facilitates this procedure.

DNS – NAI DNS - The Domain Name System is the software that allows name to

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number mapping. The name richweb is the 47.161.113.52 and vice versa. This is achieved through the DNS. The DNS is a hicrarchy. There are small number of root domain name servers that are responsible for tracking the top-level domains and who is under them. The root domain servers between them know about all the people who have name servers that are authoritative for domains under the root. In the NGWN – Wireless Internet the DNS hierarchy is established based on the user's current location.

Mobility Manager - The mobility manager functional component is the part of the core network component. It facilitates to provide subscribers' management services during the access session establishment between the mobile host and the serving network. It also facilitates the inter-domain handoff activities.

Access Accounting server - The access accounting server is the core network component. The session server that facilitates to configure service session invocation, that also facilitates the instance for that service session at the accounting server to record the usage activities. The access accounting server is reachable through the AAA+ server that provides the common protocol for Authentication, Authorization, and Accounting activities.

AAA+ - The AAA+ server provides the common protocol access to the network clients to access Authentication, Authorization, and Accounting servers. Currently, the DIAMETER and RADIUS protocols are under evaluation for the AAA+ server access.

Network management - The network management functions at the different network layer hierarchy provide appropriate management functions. The management functions take care of business and service oriented concerns. Ideally these functions can be distributed to the core network for business decision (policy management) and service session related activities and at the AML for the network resources and transport session related activities. These functions include fault management, configuration management, accounting management performance management, and security management.

Call Server - The call server is the core network component. It takes the role of media gateway controller. It controls signaling gateway and media gateway components that interface with the PSTN.

Session server - Please refer to text above describing session server.

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Location tracking - The location tracking is the part of the access management layer component. It keeps track of the mobile host's location movement activities in the WAG domain. It facilitates the handoff activities between cells within the WAG domain. Also, it facilitates in inter-WAG domain handoff activities. The neighboring WAG domain information can be exchanged directly. It interacts with resource manager for the purpose of maintaining radio link and Care Of Address (COA) relationship. Also it interacts with the domain database server to update the end-user's location.

Power Control function - Power control function handles all power control related activities. It performs the necessary algorithm to manipulate special situations, which may occur due to interference or adjustment during the start of a call. It interacts with resource manager for the purpose of maintaining power level of the radio link.

Connection management server - The connection management server handles activities to establish virtual packet channel through the serving network. It gets instructions from the access management server. For each service session created, a transport session manager is also instantiated. The transport session keeps track of usage activities based on the instruction provided either per packet, per byte, time in active session, or flat time. It facilitates to establish point to point or point to multi-point transport session.

Access management server - Please refer to text above for access and termination-paging function.

RF management - The RF management server is the access management layer component. It facilitates the controlling function for the radio dependent activities. It interfaces with the access management layer components. Also, it interfaces with the access interface layer components.

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Appendix B: Core network functions

The LSF/NSF network layer consists of core functional service components required for telecommunication network. This section identifies the major core network functionality expected from the LSF/NSF network layer functional service components shown in Figure 2. Some of the core network functions are described in the following paragraphs.

Serving domain specific address assignment.

Policy decision based on subscriber's profile, assigned network preferences, and available network resources.

Network management control function.

Subscriber management services during access session establishment that at least include authentication and authorization.

Providing subscriber's capabilities and network preferences in serving end user.

Configuring appropriate application servers or facilitating functional service components based on the subscriber's default services or invoked services.

Usage data collection and accumulation of network resources and recording.

Handoff activities to support continuous mobility between multiple access points.

Claims

1. A method for a first user to communicate in an Internet Protocol (IP) centric distributed network with a plurality of service layers providing a plurality of functions associated with each of the service layers, the method comprising:

   accessing the network to establish a point of presence at an access management layer and a core portion of the network and to designate a default amount of bandwidth and a plurality of default setup parameters;
   invoking service through a session server on the network to establish an amount of network resources requested by the first user; and
   establishing a transport session to create and manage a connection from the first user to a destination address.

2. The method of claim 1 wherein the plurality of service layers includes a network service function layer.

3. The method of claim 1 wherein the plurality of service layers includes a local service function layer.

4. The method of claim 1 wherein the plurality of service layers includes an access service function layer.

5. The method of claim 3 wherein the local service function layer is independent of a specific access technology used for the first user to communicate to the network.

6. The method of claim 4 wherein the access service function layer accommodates a plurality of technologies used for the first user to communicate to the network.

7. The method of claim 1 wherein the invocating service through the session server includes providing a list of a

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plurality of functions available to the first user.

8. The method of claim 7 wherein the plurality of functions available to the first user are based on capabilities of the first user and a plurality of network preferences.

9. The method of claim 8 wherein the session server also provides addressing of any appropriate server to contact for each of the plurality of functions available to the first user.

10. The method of claim 7 wherein the session server contacts an accounting server through an Authorizing, Authentication and Accounting server and initiates an appropriate record of resources committed to the first user.

11. The method of claim 10 wherein the accounting server sends information to an accounting accumulator at the network service layer.

12. The method of claim 10 wherein the session server instructs a connection management server to record usage information according to resources used by the first user.

13. The method of claim 12 wherein the usage information includes at least one of the group consisting of: time used by first user, packets used by first user, flat rate for each access by first user or bytes used by first user.

14. The method of claim 2 wherein the network service layer includes a mobility manager that provides handoff services to the first user when the first user leaves the local service function layer for another local service function layer.

15. The method of claim 3 wherein the local service layer includes a mobility manager that provides handoff services to the first user when the first user leaves an access management layer for another access management layer.

16. The method of claim 3 wherein the access management layer includes a location tracking server that provides handoff services to the first user when the first user leaves a first cell in a first access interface layer for another cell in another access interface layer.

17. The method of claim 1 wherein a session server reserves any quality of service parameters and an amount of bandwidth requested by the first user.

18. The method of claim 1 wherein an access and termination function at an access management layer reserves any quality of service parameters and an amount of bandwidth requested by the first user.

19. The method of claim 1 further including sending communications from an application layer at the first user wherein an user agent client resides at the first user.

20. The method of claim 1 further including sending communications from a layer 3 at the first user wherein an user agent client resides at an access management layer of the access layer.

21. The method of claim 1 further including an user agent server associated for each of a plurality of access interface layer of the access layer.

22. The method of claim 1 further including an user agent server that acts as a gateway by converting incoming protocols of incoming communications to a protocol understood by the first user.

23. The method of claim 1 further including an user agent server that delivers incoming protocols of incoming communications to the first user when the incoming protocol is understood by the first user.

24. The method of claim 1 wherein the session server further provides admission control functions and address resolution to an user agent client and an user agent client proxy at a SIP protocol server.

25. The method of claim 1 wherein the session server further provides admission control functions and address resolution to a H.323 terminal and a H.323 gateway at a H.225 protocol server.

26. The method of claim 1 wherein the network includes a connection management server that can transport commu-

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nications on a plurality of backbone infrastructures.

27. The method of claim 1 wherein the network includes a connection management server that can transport communications on a point to point basis.

28. The method of claim 1 wherein the network includes a connection management server that can transport communications on a point to multi-point basis.

29. The method of claim 1 further including providing the requested amount of network resources by utilizing a connection management server that utilizes a plurality of protocols to deliver a requested quality of service for latency.

30. The method of claim 1 further including providing the requested amount of network resources by utilizing a connection management server that utilizes a plurality of protocols to deliver a requested bandwidth.

31. The method of claim 1 further including deciding policy parameters at a core network level.

32. The method of claim 31 further including enforcing policy parameters at an access management level.

33. The method of claim 1 wherein a plurality of access management layer components interact with a network layer of the first user to establish an access session.

34. The method of claim 1 wherein a plurality of access management layer components interact with a plurality of components to bring the mobile host on the traffic channel.

35. The method of claim 1 wherein a plurality of access management layer components interact through a connection management component to establish point to point protocol path that allows the first user to access any other IP capable device through a serving network.

36. The method of claim 1 wherein a plurality of network preferred call/session control services are handled through a plurality of access management components.

37. The method of claim 1 wherein handoff, power control, and paging functions related handshakes with the first user are controlled by a plurality of access management components.

38. The method of claim 1 wherein the first user interacts with a plurality of protocol servers and access management service layer components.

39. The method of claim 38 wherein the plurality of protocol servers and access management service layer components interact with a plurality of components at the local service function layer.

40. The method of claim 1 wherein a plurality of components at a local service function layer provide specific services to a plurality of access management components during establishment of an access session and service session with the first user.

41. The method of claim 1 wherein the accessing includes providing subscriber management and policy decision services for the first user.

42. The method of claim 1 wherein policy decision services are provided for the first user during user session invocation.

43. The method of claim 1 wherein Intranet services are provided to the first user by a local service function layer through specialized application servers.

44. The method of claim 1 wherein the first user interacts with a plurality of global network service components

45. The method of claim 1 wherein the accessing further includes a network service function layer providing services to a local service function layer.

46. The method of claim 1 further including providing subscriber management services during an access session

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establishment for the first user.

47. The method of claim 1 further including facilitating publicly available services.

48. The method of claim 1 further including facilitating direct home network accesses.

49. A communications network architecture for an Internet Protocol centric wireless network for a first user to communicate to a destination, the network comprising:

a plurality of network service function layers within the wireless network;
a first set of a plurality of local service function layers associated with one of the plurality of network service function layers within the wireless network;
a first set of a plurality of access service function layers associated with one of the plurality of local service function layers; and
a second set of a plurality of access service function layers associated with a second of the plurality of local service function layers.

50. The communications network of claim 49 wherein at least two of the plurality of network service function layers belong to a first wireless network service provider and are connected through a private link.

51. The communications network of claim 49 wherein at least two of the plurality of network service function layers belong to two different wireless network service providers and are connected through a private link governed by a service level agreement.

52. The communications network of claim 49 wherein at least two of the plurality of network service function layers belong to two different wireless network service providers and are connected through a public link.

53. The communications network of claim 49 wherein the network service function layer includes a mobility manager that manages a handoff when the first user leaves one of the plurality of access service function layers and enters another of the plurality of access service function layers.

54. The communications network of claim 49 wherein at least one of the plurality of network service function layers and at least one of the local service function layers reside in a single entity.

55. The communications network of claim 49 wherein the first set of the plurality of local service layers includes a session server

56. The communications network of claim 55 wherein the session server provides a list of a plurality of functions available to the first user.

57. The communications network of claim 56 wherein the plurality of functions available to the first user are based on capabilities of the first user and a plurality of network preferences.

58. The communications network of claim 56 wherein the session server provides addressing of any appropriate server to contact for each of the plurality of functions available to the first user.

59. The communications network of claim 56 wherein the session server contacts an accounting server through an Authorizing, Authentication and Accounting server and initiates a record of resources committed to the first user.

60. The communications network of claim 59 wherein the accounting server sends information to an accounting accumulator at one of the plurality of network service layers.

61. The communications network of claim 59 wherein the session server instructs a connection management server at the first set of a plurality of the local service layer to record usage information according to resources used by the first user.

62. The communications network of claim 61 wherein the usage information includes at least one of the group consisting of: time used by first user, packets used by first user flat rate for each access by the first user or bytes used

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by first user.

63. The communications network of claim 59 wherein each of the plurality of network service layers includes a mobility manager that provides handoff services to the first user when the first user leaves one of the first set of the plurality of local service function layers for another of the first set of the plurality of local service function layers.

64. The communications network of claim 59 wherein at least one of the plurality of the network service layers includes a mobility manager that provides handoff services to the first user when the first user leaves one of the first set of the plurality of access management layers for another one of the first set of the plurality of access management layers.

65. The communications network of claim 59 wherein the session server reserves any quality of service parameters and an amount of bandwidth requested by the first user.

66. The communications network of claim 59 wherein an access and a termination functions at one of the first set of the plurality of access management layers reserves any quality of service parameters and an amount of bandwidth requested by the first user.

67. The communications network of claim 49 further including an application layer that sends communications from the first user and an user agent client residing at the first user.

68. The communications network of claim 49 further including a layer 3 at the first user that sends communications to the network and an user agent client residing at one of the first set of the plurality of access service function layers.

69. The communications network of claim 49 further including an user agent server associated for each of a plurality of access interface layer at the first set of the plurality of access service function layers.

70. The communications network of claim 69 wherein the user agent server acts as a gateway by converting incoming protocols of incoming communications to a protocol understood by the first user.

71. The communications network of claim 69 wherein the user agent server delivers incoming protocols of incoming communications to the first user when the incoming protocol is understood by the first user.

72. The communications network of claim 59 wherein the session server further provides admission control functions and address resolution to an user agent client and an user agent client proxy at a SIP protocol server.

73. The communications network of claim 59 wherein the session server further provides admission control functions and address resolution to a H.323 terminal and a H.323 gateway at a H.323 protocol server.

74. The communications network of claim 59 further including a connection management server at a access management layer within one of the first set of access service function layers and wherein the connection management server can transport communications on a plurality of backbone infrastructures.

75. The communications network of claim 74 wherein the connection management server can transport communications on a point to point basis.

76. The communications network of claim 74 wherein the connection management server can transport communications on a point to multi-point basis.

77. The communications network of claim 74 wherein the connection management server provides a requested amount of network resources by utilizing a plurality of protocols to deliver a requested quality of service for latency.

78. The communications network of claim 74 wherein the connection management server provides a requested amount of network resources by utilizing a plurality of protocols to deliver a requested bandwidth.

79. The communications network of claim 49 further including a core network lever including the plurality of network service function layers and the first set of the plurality of local service function layers and wherein the core network layer decides policy parameters.

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80. The communications network of claim 49 further including an access management layer within the first set of access service function layers and wherein the access management layer enforces policy parameters.

81. A communications network architecture for an Internet Protocol centric wireless network for a first user to communicate to a destination, the architecture comprising:

a network service function layer within the wireless network, wherein the network service layer comprises a plurality of interconnected servers including:

a policy management server;
an authorization server;
a service accounting server;
an authentication, authorization and accounting server;
an unified directory within a directory server;
a security gateway; and
a mobility manager;

a local service function layer communicably linked with the network service function layer within the wireless network, wherein the local service function layer comprises a plurality of interconnected servers including:

an access accounting server;
an authentication, authorization and accounting server;
a security gateway;
a policy enforcement server;
a mobility manager;
a network management server; and
a wireless gateway;

an access management layer communicably linked with the local service function layer, wherein the access management layer comprises a plurality of interconnected servers including:

a location tracking server;
a connection management server;
a plurality of protocol servers;
a RF management server which includes power control, traffic control and channel assignment;
an access management server includes access, termination and paging;
a domain database server which provides a local decision point to expedite service invocation for the first user;
a policy enforcement server;
a network management server; and
a resource management server; and

an access interface layer communicably linked with the access management layer, wherein the access interface layer comprises a plurality of interconnected servers including:

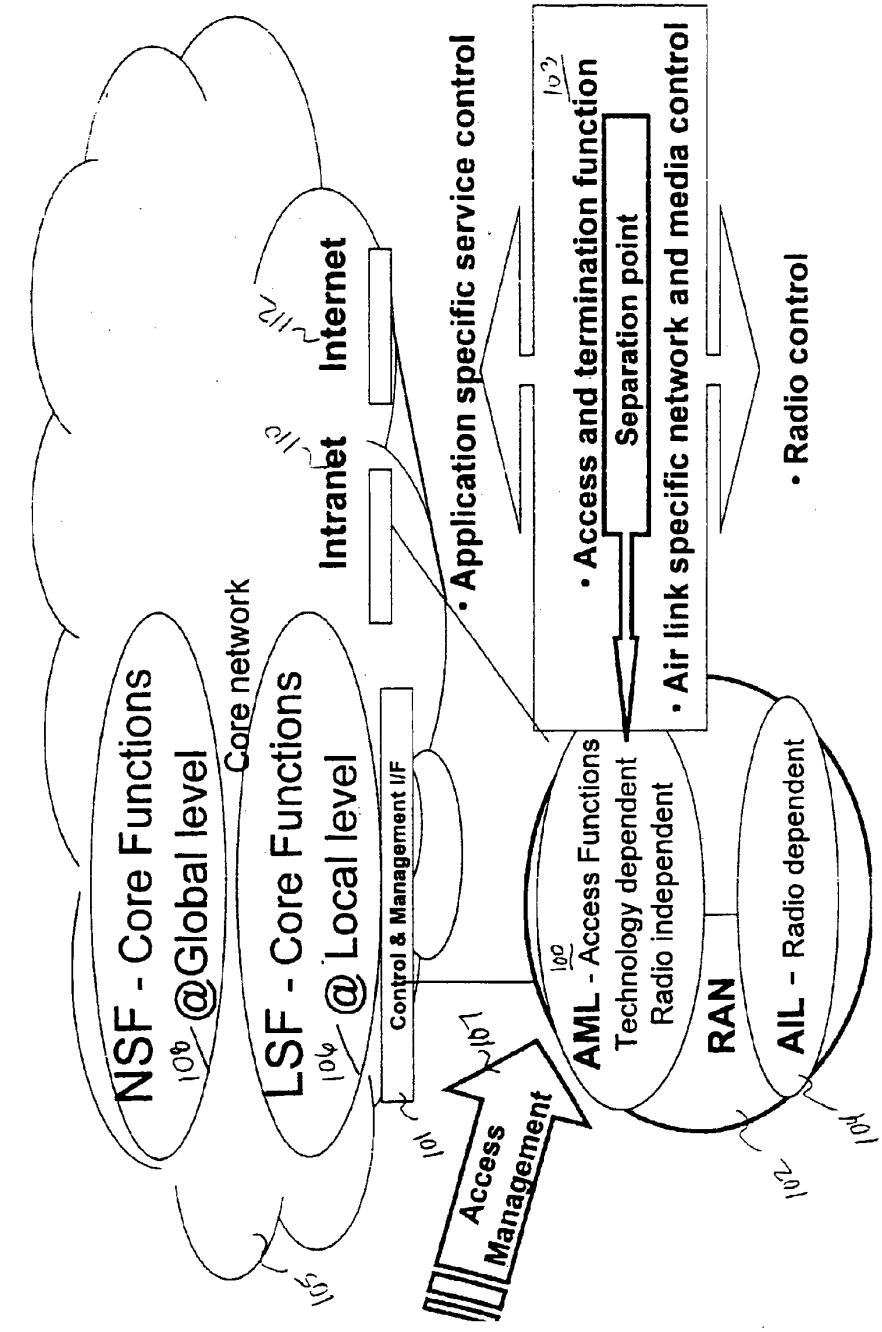
a channel management server;
a policy enforcement server;
an administration and maintenance server; and
a radio frequency server.

82. The communications network architecture of claim 81 wherein the access management layer provides policy enforcement.

83. The communications network architecture of claim 81 wherein the local service layer provides policy decision functions.

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FIGURE 1



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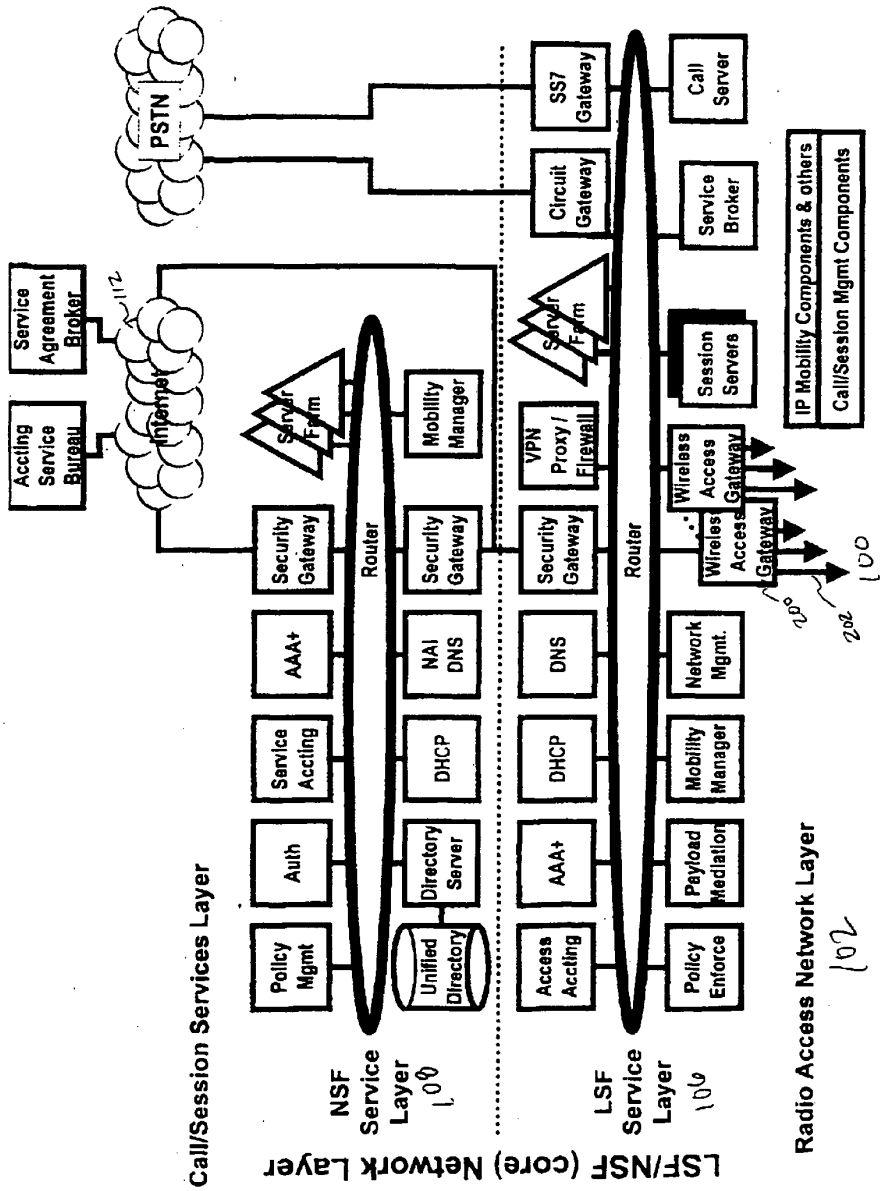


FIGURE 2

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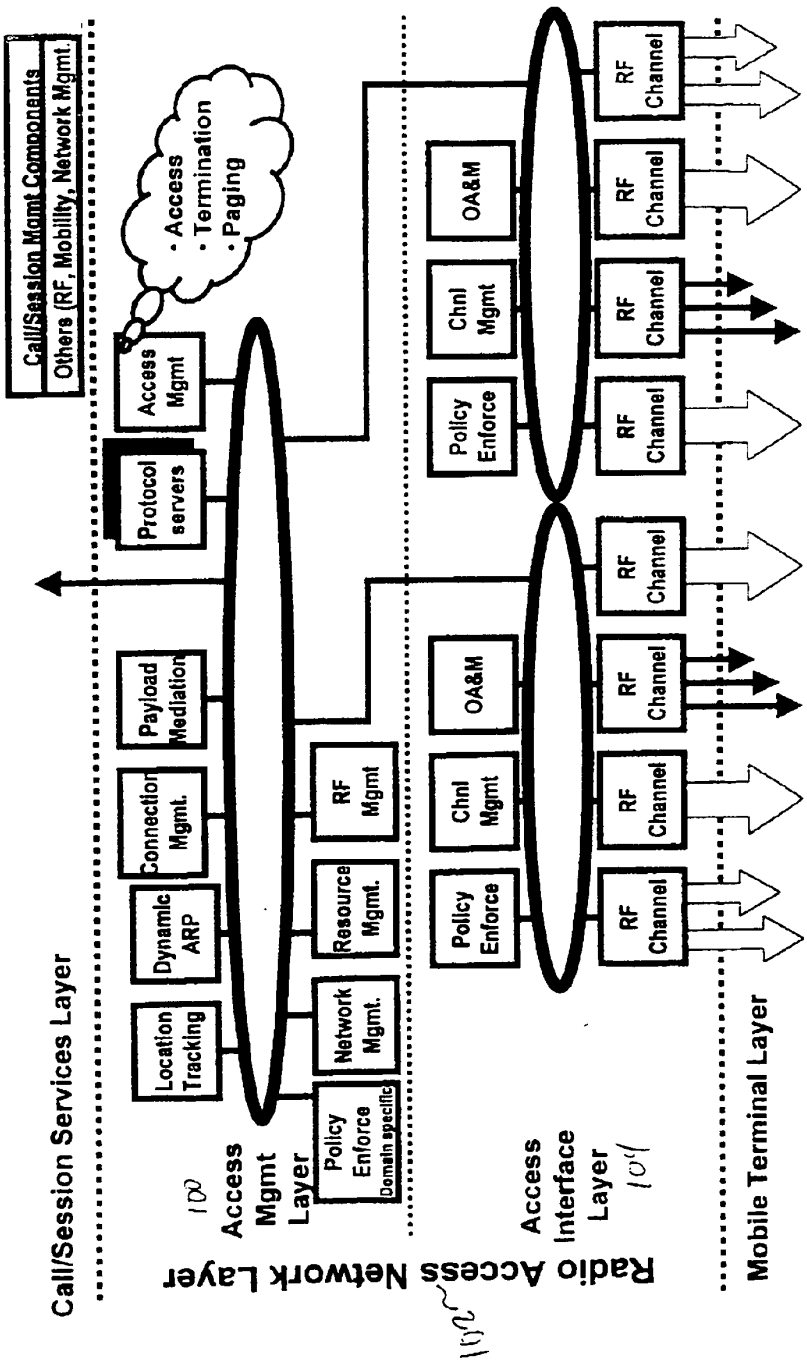


FIGURE 3

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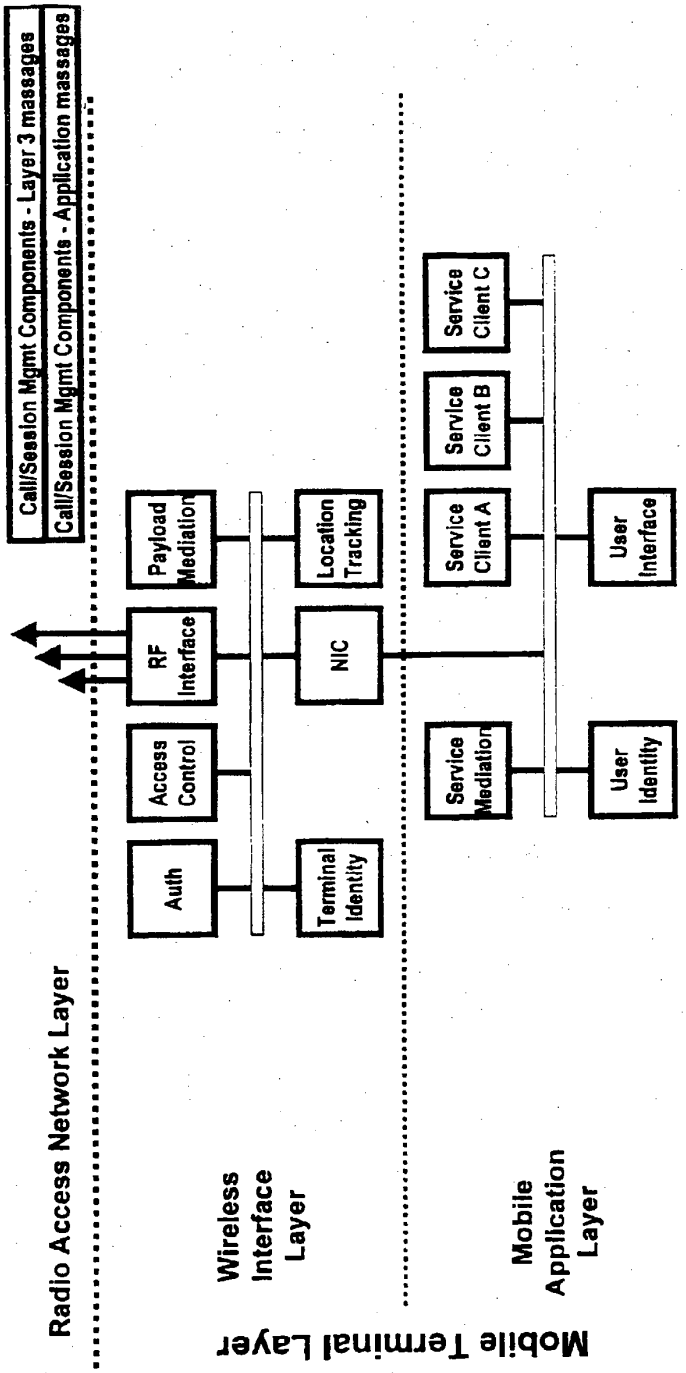


FIGURE 4

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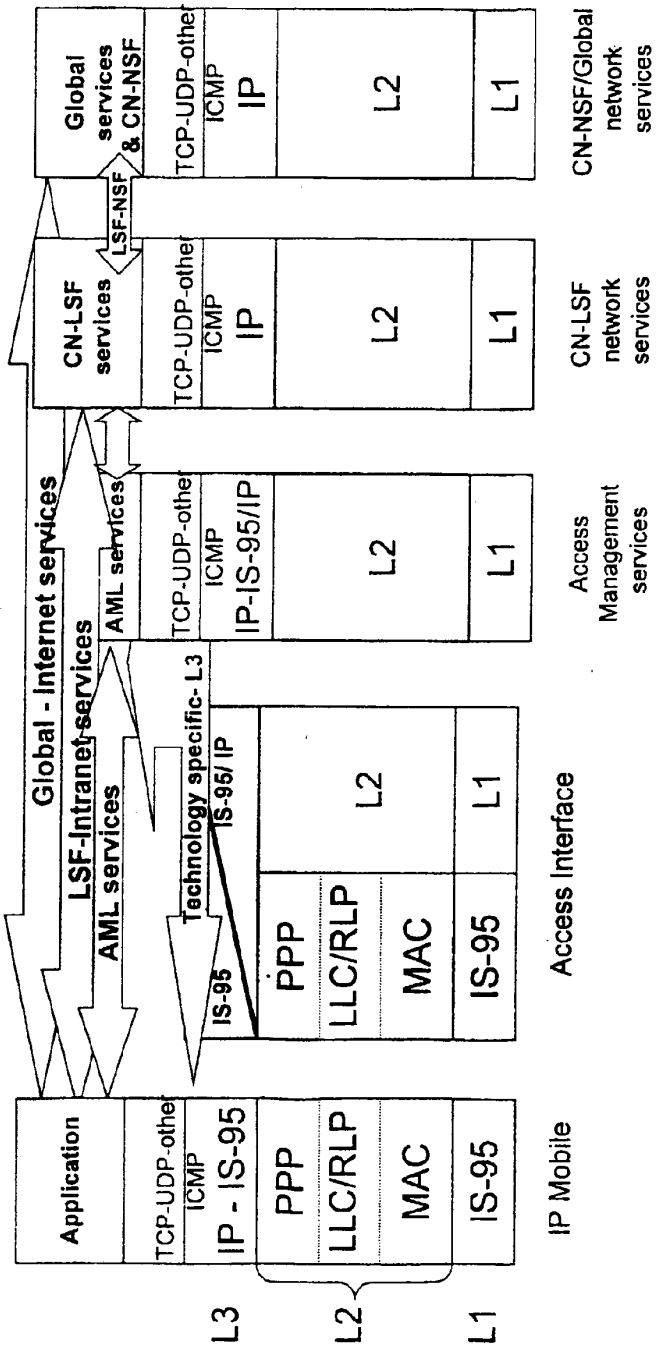


FIGURE 5

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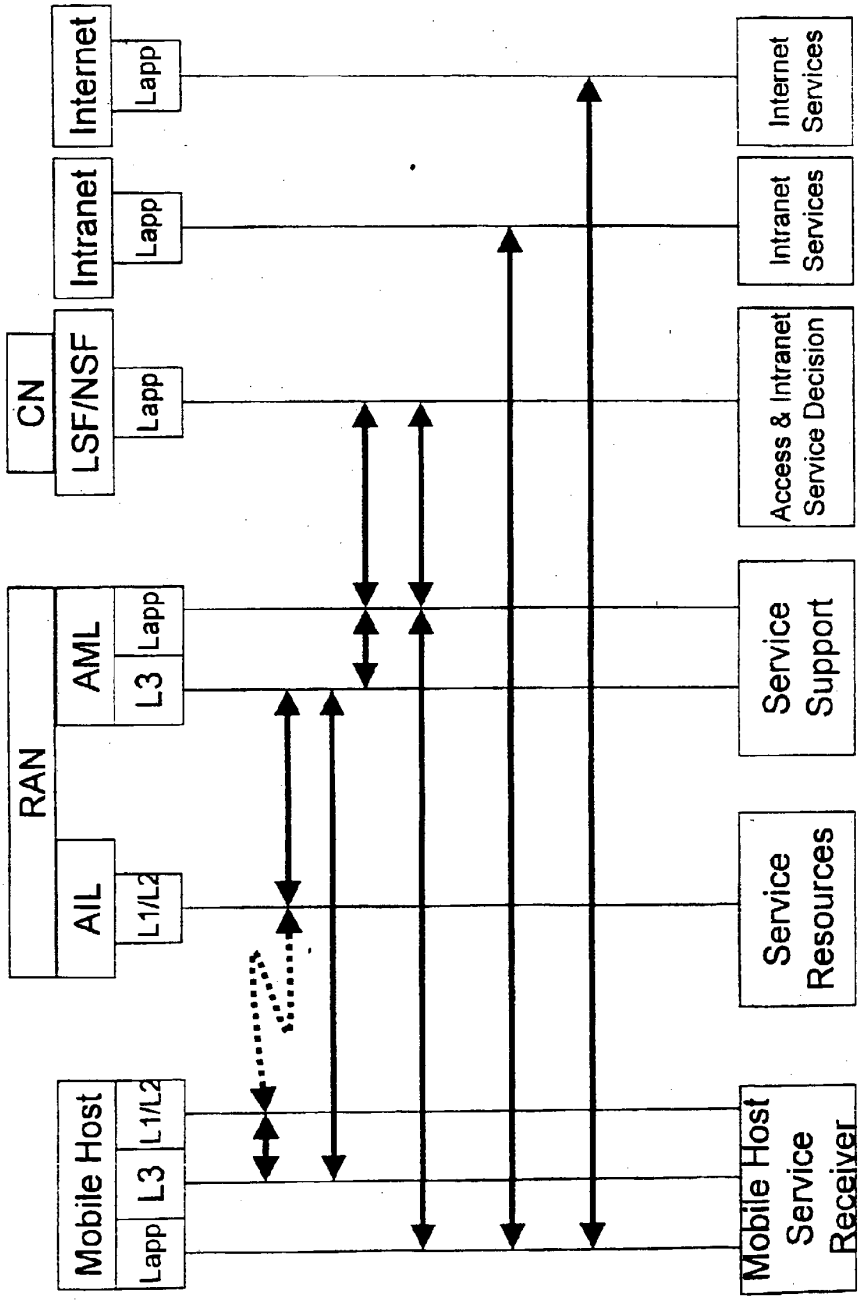


Figure 6

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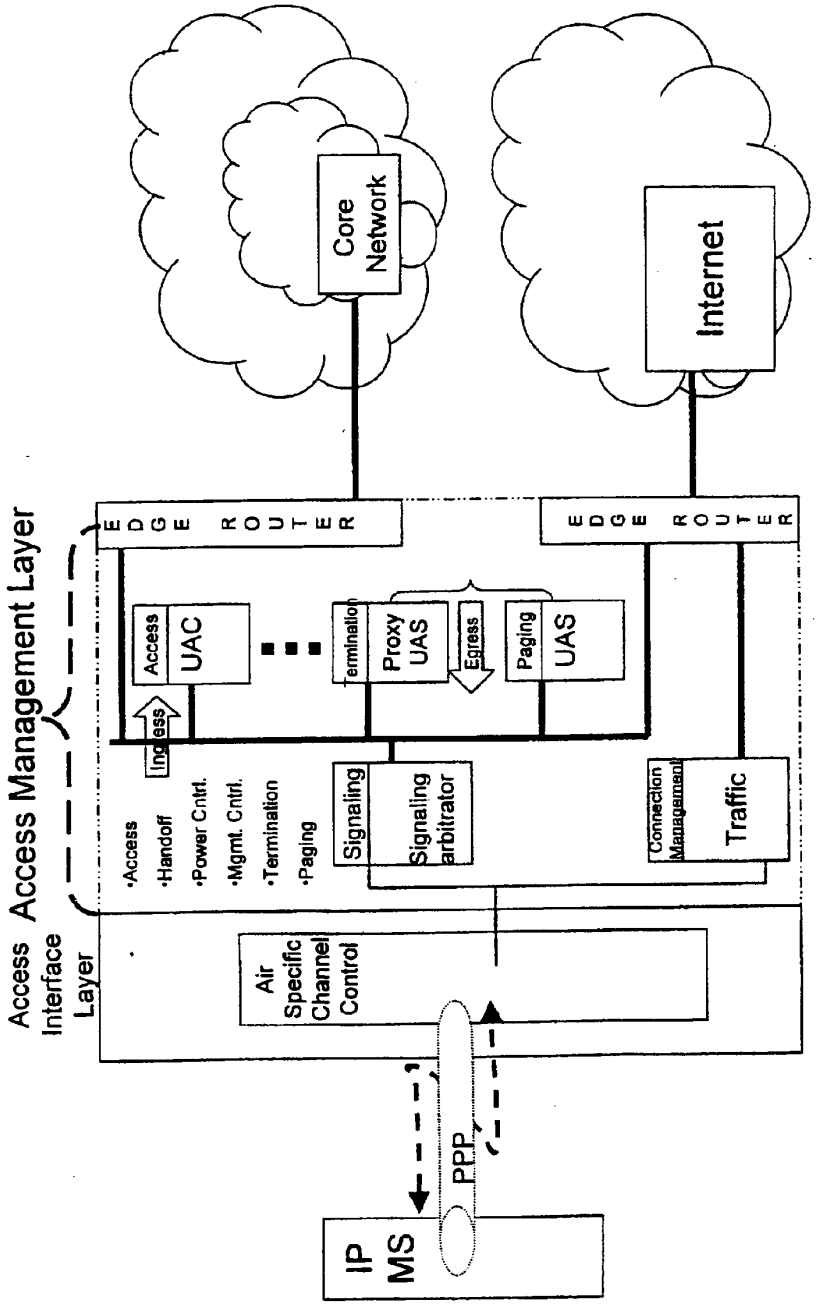


FIGURE 7

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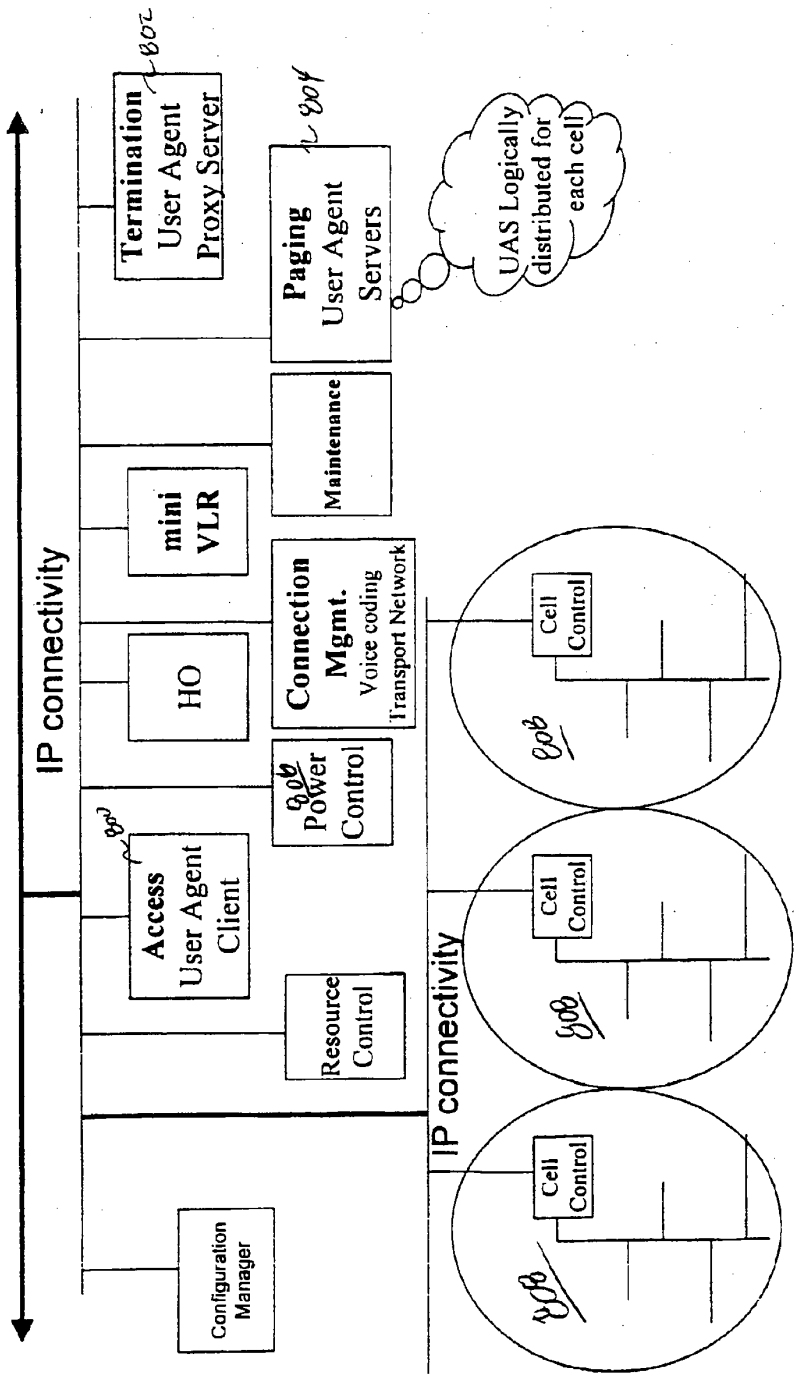


FIGURE 8

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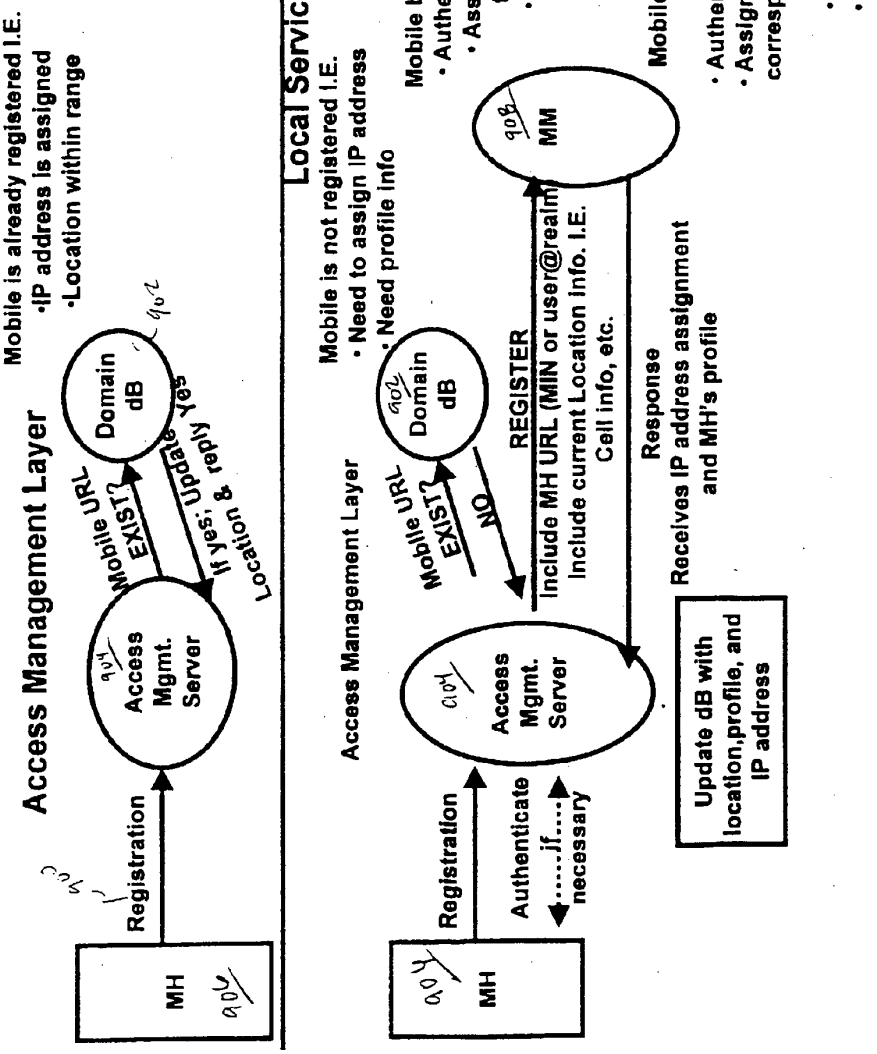


Figure 9

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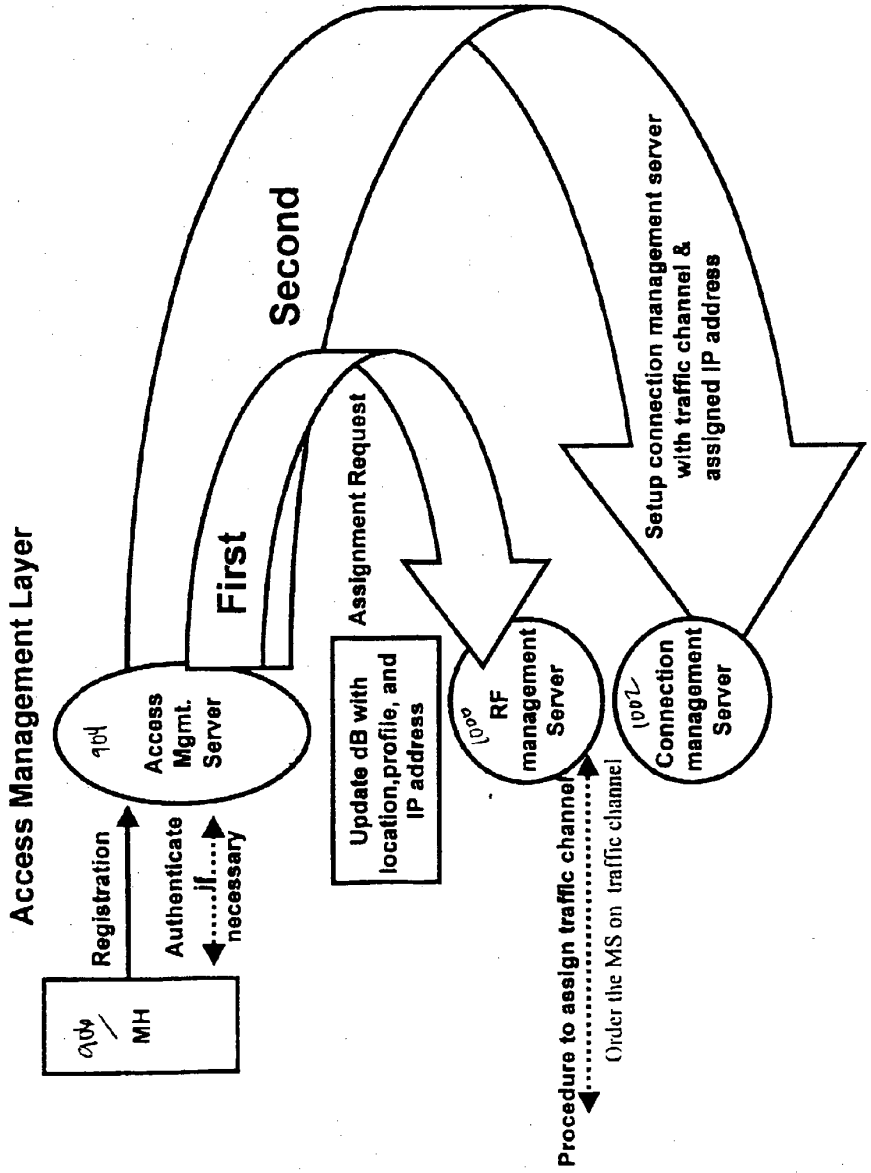


FIGURE 10

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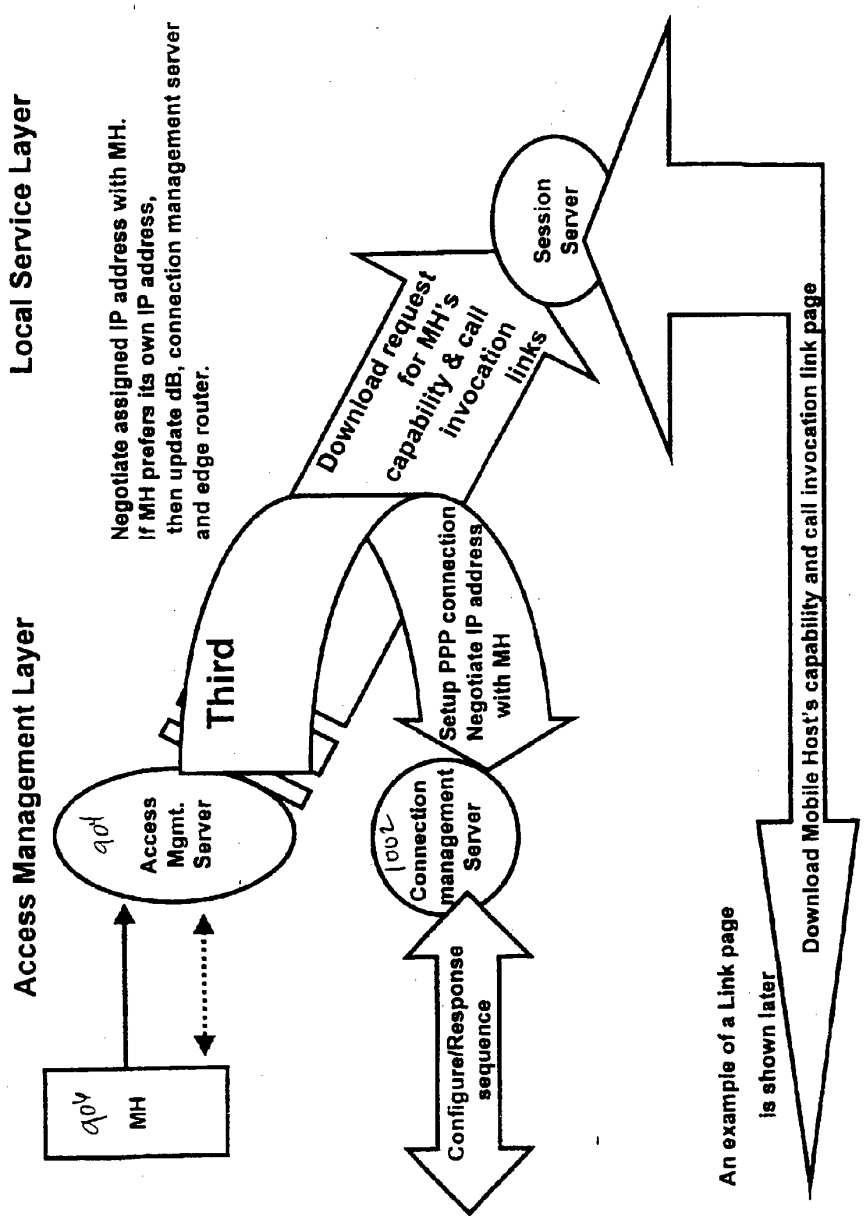


FIGURE 11

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Figure 12

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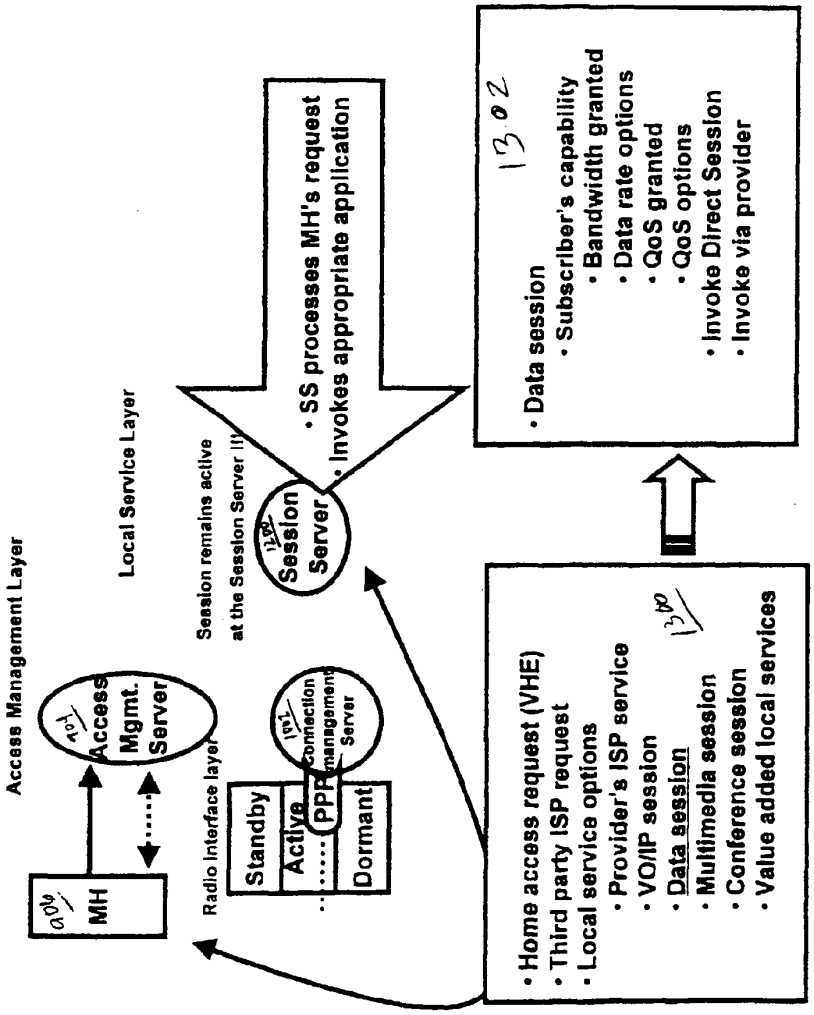


FIGURE 13

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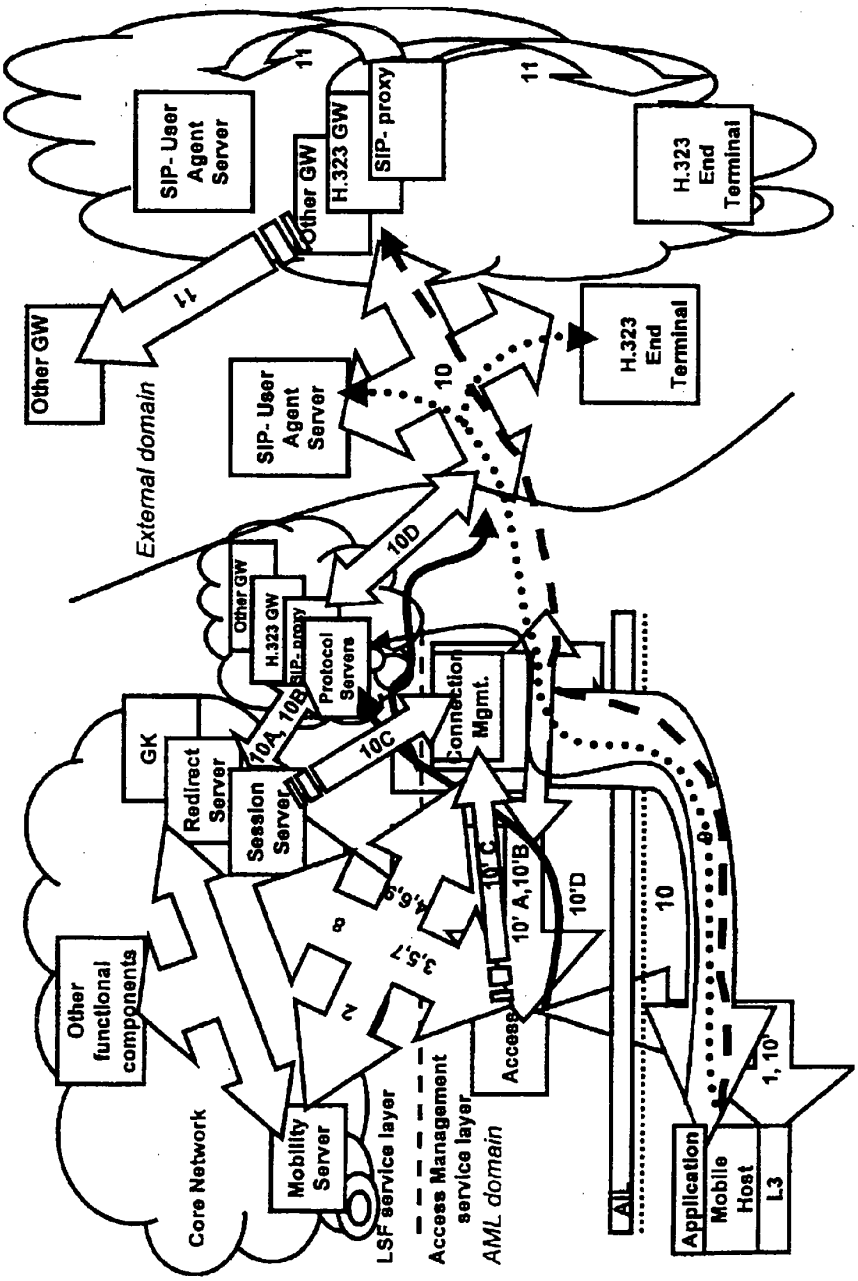


Figure 17

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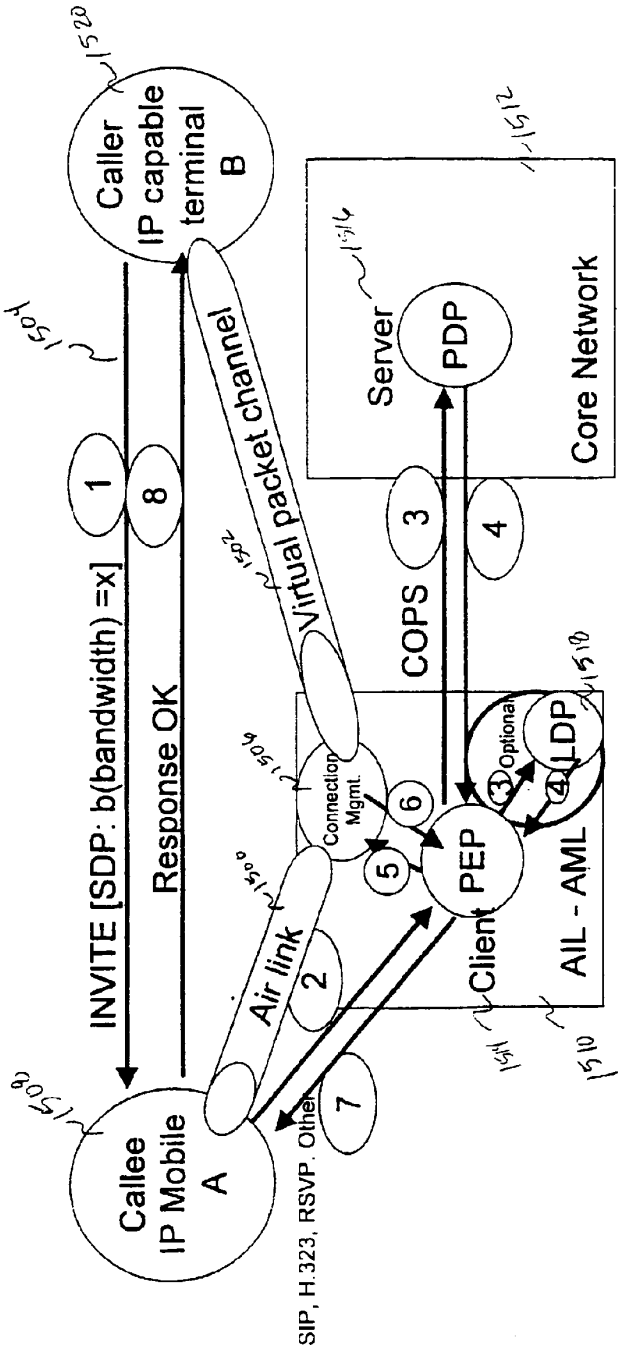


FIGURE 15

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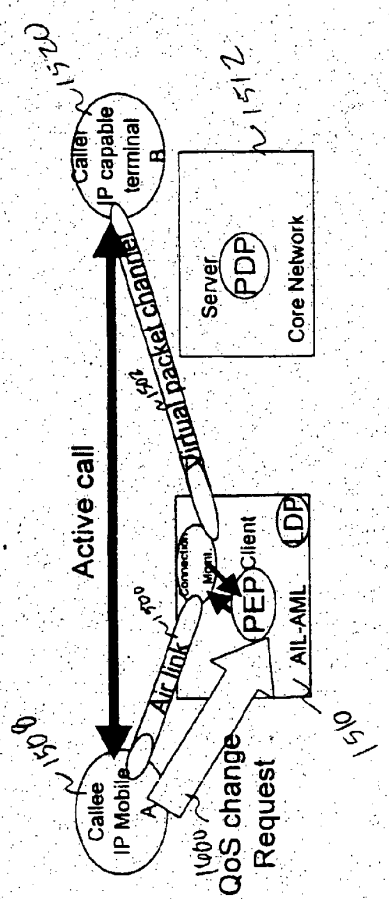


Figure 16

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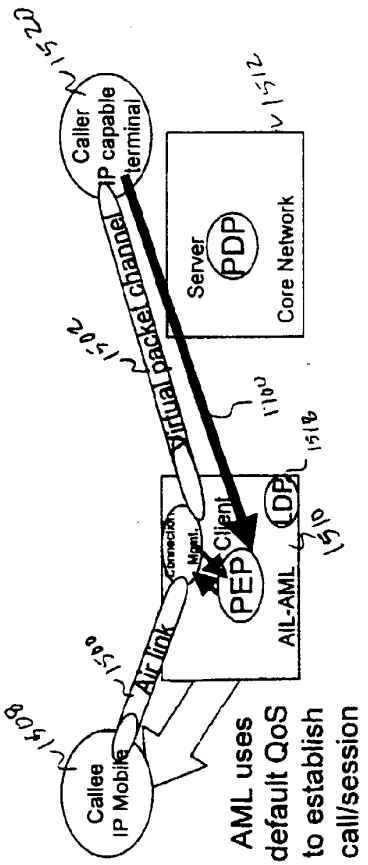


FIGURE 17

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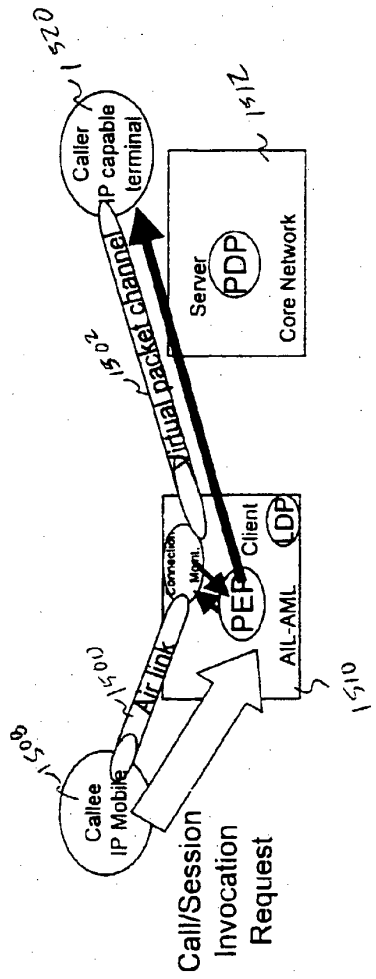


FIGURE 18

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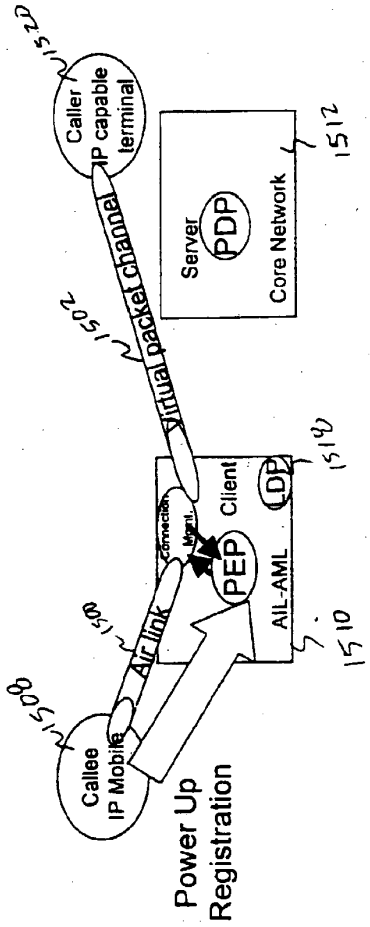
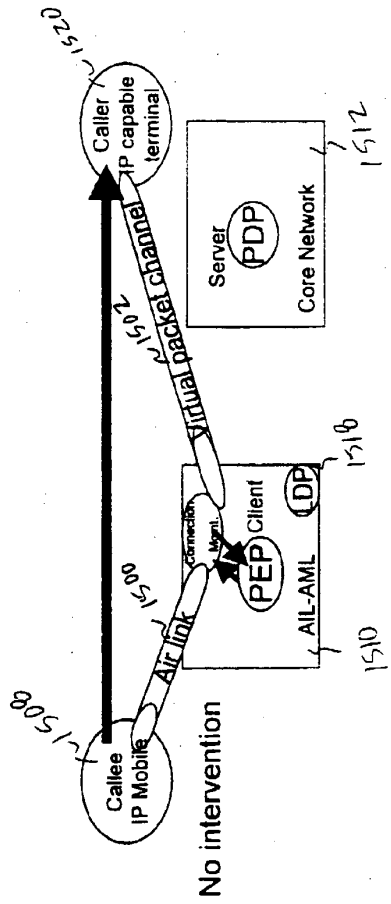


FIGURE 17

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FIGURE 20



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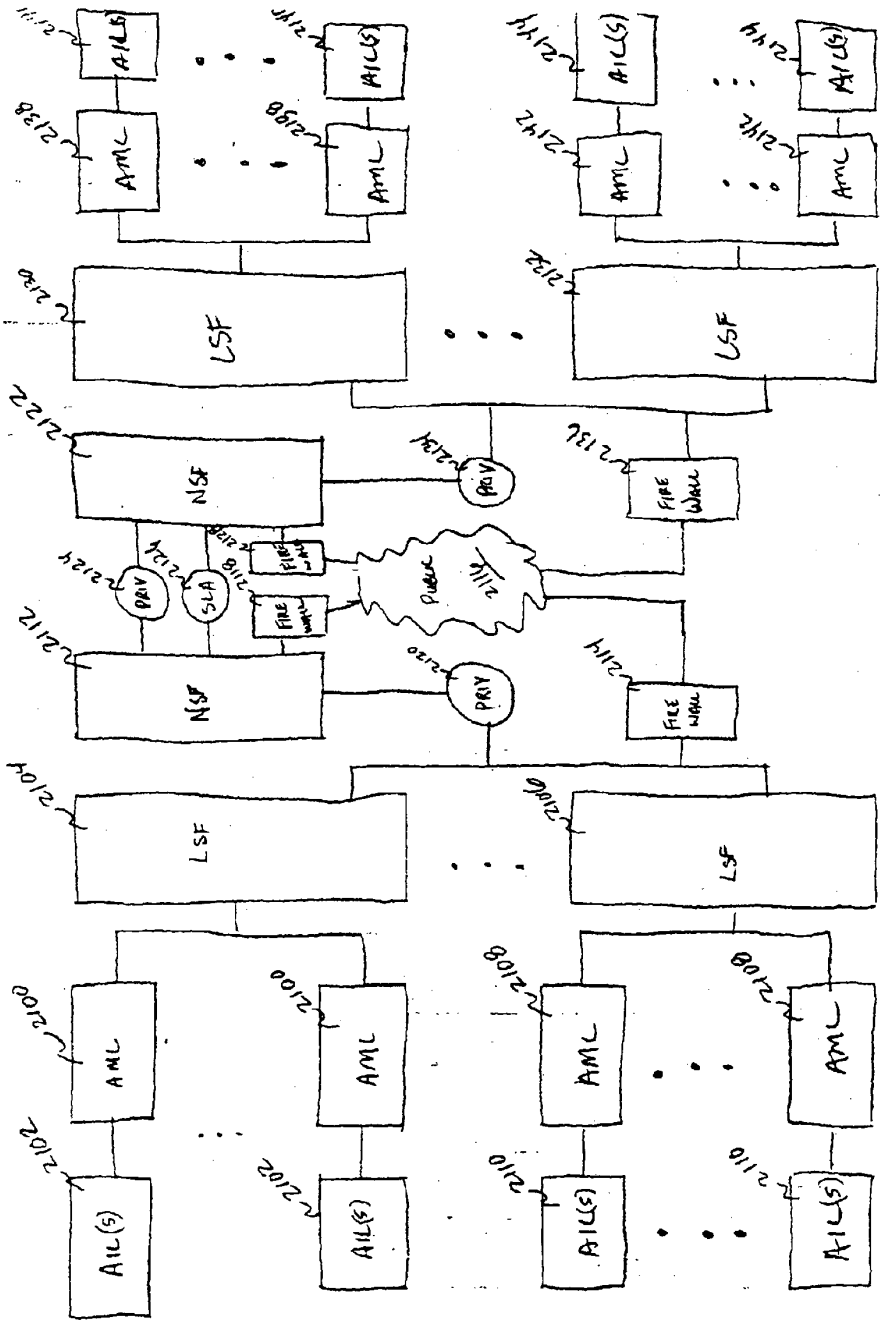


FIGURE 21

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(11) EP 1 098 490 A3

(12) **EUROPEAN PATENT APPLICATION**

(88) Date of publication A3:
27.08.2003 Bulletin 2003/35

(43) Date of publication A2:
09.05.2001 Bulletin 2001/19

(21) Application number: **00309735.9**

(22) Date of filing: **03.11.2000**

(51) Int Cl.7: **H04L 29/06**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **05.11.1999 US 434628**

(71) Applicant: **Nortel Networks Limited**
Montreal, Quebec H2Y 3Y4 (CA)

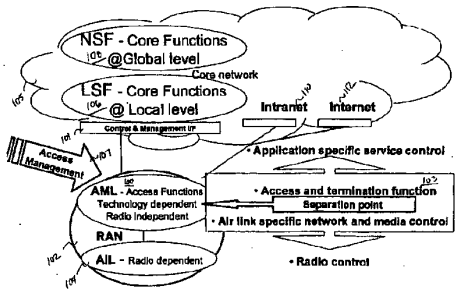
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(54) **An architecture for an IP centric distributed network**

(57) A method and system to for a communications network architecture for an Internet Protocol centric wireless network for a first user to communicate to a destination, the architecture comprising: a network service function layer within the wireless network. The network service function layer can include: a policy management server; an authorization server; a service accounting server; an authentication, authorization and accounting server; an unified directory within a directory server; a security gateway; and a mobility manager. The architecture also includes a local service function layer associated with the network service function layer. The local service function layer can include: an access accounting server; an authentication, authorization and accounting server; a security gateway; a policy enforcement server; a mobility manager; a network management server; and a wireless gateway. The architecture also includes an access management layer associated with the local service function layer. The access management layer can include: a location tracking server; a connection management server; a protocol server; an access management server; a policy enforcement server; a network management server; and a resource management server. The architecture also includes an access interface layer associated with the access management layer. The access interface layer can include: a channel management server; a policy enforcement server; an administration and maintenance server; and a radio frequency server.

FIGURE 1



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EUROPEAN SEARCH REPORT

Application Number
EP 00 30 9735

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	WO 99 48310 A (NOKIA TELECOMMUNICATIONS OY ;PUUSKARI MIKKO (FI)) 23 September 1999 (1999-09-23)	1-5, 7-14, 16-23, 26-34, 36-42, 44-50, 52-63, 65-71, 74-83	H04L29/06
Y	* page 1, line 17 - line 24 *	6,15,24, 25,35, 43,51, 64,72,73	
	* page 9, line 2 - line 5 *		
	* page 9, line 27 - page 10, line 23 *		
	* page 11, line 7 - line 30 *		
	* page 12, line 26 - line 29 *		
	* page 14, line 27 - line 29 *		
	* page 19, line 28 - line 35 *		
	* page 22, line 15 - line 20 *		
	* figure 1 *		
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	* column 2, line 52 - column 3, line 5 *		
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	* the whole document *		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	1 July 2003	HORN, R

CATEGORY OF CITED DOCUMENTS

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

BNSDOCID: <EP_____1098490A3_I_>

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01-07-2003

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

BNSDOCID: <EP_____1098490A3_I_>

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
15 November 2007 (15.11.2007)

PCT

(10) International Publication Number
WO 2007/129180 A2

(51) International Patent Classification:
H04B 7/005 (2006.01)

(21) International Application Number:
PCT/IB2007/001120

(22) International Filing Date: 30 April 2007 (30.04.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/797,943 5 May 2006 (05.05.2006) US

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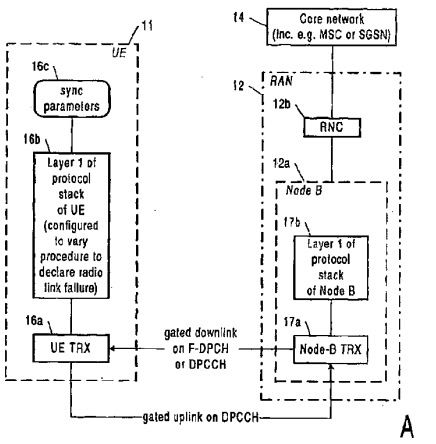
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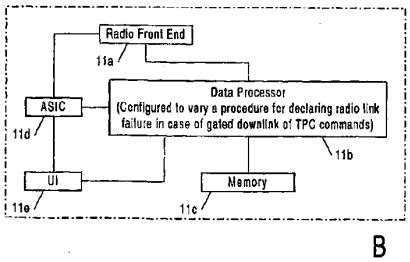
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),

[Continued on next page]

(54) Title: ENHANCED UE OUT-OF-SYNC BEHAVIOR WITH GATED UPLINK DPCCH OR GATED DOWNLINK F-DPCH OR DPCCH TRANSMISSION





(57) Abstract: A method and corresponding equipment by which a wireless terminal communicatively coupled to a radio access network adapts to gating in respect to a downlink signal from a radio access network carrying power control commands (e.g. the F-DPCH of UTRAN with WCDMA), including gating by the radio access network of either just the power control commands or the channel itself, or gating of reception of the power control commands by the user equipment. The adaptation can include changing values of parameters used in determining when the wireless terminal declares a radio link failure, or instead only changing the procedures used to determine whether a parameter value has been achieved and thus only effectively changing the parameter values (or one or more of the parameters can be actually and effectively changed).

WO 2007/129180 A2

BNSDOCID: <WO____2007129180A2_I_>

European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *without international search report and to be republished upon receipt of that report*

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.

BNSDOCID: <WO_____2007129180A2_I_>

ENHANCED UE OUT-OF-SYNC BEHAVIOR WITH GATED UPLINK DPCCH OR GATED DOWNLINK F-DPCH OR DPCCH TRANSMISSION

CROSS REFERENCE TO RELATED APPLICATION

Reference is made to and priority claimed from U.S. provisional application Ser. No. 60/797,943 filed 5 May 2006.

BACKGROUND OF THE INVENTION

1. *Technical Field*

The present invention pertains to the field of wireless communications. More particularly, the present invention pertains to procedures to be followed by wireless terminals in case of gating of transmit power by the wireless terminals.

2. *Discussion of related art*

In some wireless communications systems, in particular UMTS (Universal Mobile Telecommunications System) using WCDMA (Wideband Code Division Multiple Access) for the air interface of its UTRAN (UMTS terrestrial radio access network), in order to save power a UE (user equipment) wireless communication terminal could turn its transmit power on and off, i.e. it could *gate* its transmit power according to a gating pattern (among other factors), i.e. according (at least in part) to a duty cycle having an on period and an off period. Using a UTRAN with WCDMA as an example, a UE sends data and/or control information (such as pilot bits) to a Node-B of the UTRAN, and the Node-B then estimates the UE uplink quality based on the control information, and commands the UE to change its transmit power accordingly. If a UE were to use transmit power gating, there would then be periods of time in which no control information would be transmitted, and correspondingly, there could be periods of time in which no power change commands would be issued by the Node-B, or periods of time in

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which if the Node-B were to issue power change commands, the commands would be based on unreliable quality information (signal to interference ratio measurements, for example) because of no control bits having been transmitted for the period of time in which the quality measurements are made (taking into account the time it takes for a transmission from the UE to reach the Node-B).

At present, there are procedures according to which a UE is to declare a radio link failure based on a predetermined threshold for minimum quality of the signal from the Node-B, and a predetermined value for a number of consecutive below threshold quality indications. These procedures and the predetermined threshold and number of below minimum quality indications assume continuous transmit power by the UE. But if a UE were to gate its uplink, then because the Node-B would in effect follow and gate its downlink (because of having no control information to estimate the uplink quality from when the UE is not transmitting), and because the UE uses the downlink as a basis for estimating the quality of the radio link, the UE could declare a radio link failure when in fact there would be no such failure. The apparent inability to "hear" the Node-B for a period of time would be due simply to the Node-B not transmitting during that period of time, not because of poor radio link quality.

What is needed, therefore, is a way to adapt the procedure for declaring a radio link failure, and also related procedures, in case of a UE gating its uplink.

UTRAN with WCDMA as the radio technology is a particular example of the need for a new procedure for declaring a radio link failure. First consider the need for gating by a UE. When no dedicated channels (DCHs)--and thus, no dedicated physical data channels (DPDCHs) (which carry payload as well as high-level signalling)--have been configured in the uplink

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(UL), all data is transmitted on the enhanced data channel (E-DCH), which is mapped to the enhanced dedicated physical data channel (E-DPDCH). Control signalling associated with E-DCH is transmitted on E-DPCCH. E-DPDCH and E-DPCCH are discontinuous, i.e. they are transmitted only when there is data to be transmitted and the transmission has been granted by the network. For an E-DCH transmission, a grant is needed: a non-scheduled grant for non-scheduled MAC-d (media access control-d) flows and a serving grant (and an allowed, active HARQ process) for scheduled transmissions.

The UL DPCCH carries control information generated at Layer-1 (i.e. the physical layer of the protocol stack). The layer-1 control information consists of e.g. known pilot bits for supporting channel estimation for coherent detection, for use in the Node-B determining transmit power control (TPC) commands to downlink (DL) on DPCH or on Fractional-DPCH (F-DPCH), feedback information (FBI), and an optional transport format combination indicator (TFCI).

UL DPCCH is continuously transmitted (even if there is no data to transmit for awhile), and there is one UL DPCCH for each radio link. Continuous transmission is acceptable with circuit-switched services, which typically send continuously. For bursty packet services, however, continuous DPCCH transmission is less desirable because it has substantial overhead.

The uplink capacity can be increased by decreasing the control overhead. One possibility for decreasing control overhead is UL DPCCH gating, i.e., not transmitting DPCCH all the time. A pattern could (at least in part) define the DPCCH transmission time periods and/or DPCCH may depend (also) on E-DCH and HS-DPCCH transmission times. (Other rules may in effect supercede the pattern so that from time to time the UE may uplink during what would ordinarily be an off-period/gap

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in the transmission, with the net result being irregular transmission, i.e. not strictly according to a pattern.) Gating can provide UE power saving and so longer battery life, depending on the duty cycle, i.e. the length of on period for DPCCH compared to the off period. Also, interference with other UEs could be reduced, and thus network capacity could be increased.

F-DPCH carries TPC command bits to a UE determined by the Node-B serving the UE, based on data and/or control information uplinked by the UE on DPCCH. F-DPCH is currently transmitted every time slot, independently of the data or control transmission activity by the UE, i.e. independent of whether the UE gates the DPCCH. However, in case of UL DPCCH gating by the UE so that an UL DPCCH time slot does not contain and data and/or control transmission by the UE (i.e. because the UE does not transmit during that UL DPCCH time slot on account of its gating), the Node-B cannot derive a sensible power control command corresponding to the time slot, to transmit on F-DPCH. Thus, if UL DPCCH is to be gated, F-DPCH and/or DL DPCCH could also be gated and/or discontinuously received. Discontinuous DL transmission decreases downlink interference and corresponding discontinuous reception by the UE improves UE battery consumption.

With respect to power control commands issued by the serving Node-B, a UE is considered out-of-sync (not synchronized) if the DL DPCCH quality or the quality of the TPC fields of the F-DPCH frame received from the serving HS-DSCH cell over the previous 160 ms period is worse than a threshold Q_{out} defined (implicitly) by tests in 3GPP TS 25.101. A UE is considered in-sync (synchronized) if the UE estimates the quality of the DL DPCCH or the TPC fields of the F-DPCH frame received from the serving HS-DSCH cell over the previous

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160 ms period to be better than a threshold Q_{in} also defined (implicitly) by tests in 3GPP TS 25.101.

According to 3GPP TS 25.101, if a UE estimates the DPCCH quality or the quality of the TPC fields of the F-DPCH frame received from the serving HS-DSCH cell over the last 160 ms period to be worse than the threshold Q_{out}, the UE is to turn its power off. On the other hand, if a UE estimates the DPCCH quality or the quality of the TPC fields of the F-DPCH frame received from the serving HS-DSCH cell over the last 160 ms period to be better than the threshold Q_{in}, the UE is to turn its power on. A UE is to determine that radio link failure has occurred if after some number N313 of consecutive out-of-syncs have been indicated (N313 being the label of a parameter whose value is the number), less than some number N315 of successive in-syncs are indicated before some number T313 of time periods expires (where the counting toward the number T313 is starting from when the N313 consecutive out-of-syncs are indicated).

DISCLOSURE OF INVENTION

The invention provides a method for use by a user equipment wireless communication terminal, comprising: determining on periods and off periods of a gated transmission in connection with receiving power control commands over a downlink channel of a radio access network; and varying a procedure used to determine when to declare a radio link failure based on the gated transmission by actually and/or effectively varying a quality measurement period used in the procedure or a parameter value used in the procedure. To actually vary a parameter, the value of the parameter would be changed. To only effectively vary a parameter, a procedure using the parameter is changed but the value of the parameter is not changed (so that the same parameter value then has a different effect).

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Corresponding equipment, including computer program products and application specific integrated circuits are also provided. In addition, wireless terminals are provided including such equipment and so operative according to methods provided by the invention. Also, a wireless communication system including elements communicatively coupled to such wireless terminals are also provided.

Brief Description of the Drawings

The above and other objects, features and advantages of the invention will become apparent from a consideration of the subsequent detailed description presented in connection with accompanying drawings, in which:

Figure 1A is a block diagram/ flow diagram of a UE and a Node-B communicatively coupled via a radio link including a gated uplink channel and a gated downlink channel, and showing parameters stored in the UE for use in (among other things) determining when to declare a radio link failure.

Figure 1B is a reduced block diagram (only portions relevant to the invention being shown) of the UE terminal or the Node B of Figure 1A.

Figure 2 is a block diagram showing a layer one (physical layer) of a protocol stack implemented in the UE receiving as inputs information indicating the gated downlink, and also the sync parameter values in case of no downlink gating, and providing changed sync parameters.

Figure 3 is a flow chart of the operation of a UE, according to the invention.

Figure 4 is a flow chart of the operation of a Node, B according to the invention.

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BEST MODE FOR CARRYING OUT THE INVENTION

The invention provides a method by which a UE, communicatively coupled to a Node-B of a UTRAN (UMTS radio access network) (or coupled to a corresponding entity of a radio access network on another cellular technology), adapts to gating (so as to perform what is sometimes called discontinuous transmission) of a downlink channel (F-DPCH or DPCCH) carrying power control commands from the Node-B. As explained above, such gating of the downlink can be the direct result of gating of the uplink by the UE, or can be at least associated with such gating, and the downlink gating is presumed known or knowable to the UE (as a result of monitoring/ measurements or other mechanism not the subject of the invention). As also explained above, the UE is required by standards to turn its power off in case of a number of consecutive out-of-sync indications, each corresponding to a determination that a quality metric for receiving control commands from the Node-B is below a threshold Q_{out}. Without adapting to such gating, the UE could turn its power off more than is desirable because of out-of-sync indications due simply to the Node-B not transmitting for a period of time--the off period of an on/off duty cycle. As indicated above, what is needed therefore, is a way to adapt the procedure for declaring a radio link failure, and also related procedures, in case of a UE gating its uplink.

In case of gating, different options exist for how the out-of-synch criterion could be determined. In general, according to the invention, to accommodate gating by the Node-B, the UE actually and/or effectively varies one or more parameter values used to determine when to declare a radio link failure based on the downlink gating. To actually vary a parameter, the value of the parameter is changed. To effectively vary a parameter, a procedure using the parameter

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is changed but the value of the parameter used in the procedure is not. For example, a procedure could require a number N of occurrences of an event in a time T. To actually vary N, the value of N would be changed, but not (necessarily) the value of T. (Alternatively, the value of T could be actually changed.) To effectively vary N, how T is measured could be changed. (This can also be viewed as effectively changing the value of T.) For example, the procedure could be changed so that off-period of a duty cycle does not count in measuring T.

Now in a first option for how the out-of-synch criterion could be determined, the Q_{out} and Q_{in} thresholds and the measurement window (the 160 ms time period) could be kept unchanged, and values for the parameters N313, T313 and N315, could be signaled to a UE to achieve the desired behavior for the downlink gated transmission. However, this has as a disadvantage lowered reliability of Q_{in} or Q_{out} due to a lower number of samples. In addition, the parameters are currently broadcast, and so they would need to be separately set for each user having a different gated transmission.

In a second option, the thresholds and parameters could be kept unchanged, but the measurement window could be increased (from 160 ms), or instead only effectively increased by counting only time increments when according to the gated transmission by the Node-B there is an actual downlink transmission. With both approaches--increasing the window or only changing how time is counted as contributing to the window--the measurement window could be set so that the number of evaluated samples (in terms of TPC commands) would be kept constant. This way the reliability of Q_{in} or Q_{out} could be improved.

In a third option, the option provided by the invention in at least some embodiments, the N313, T313 and N315

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parameter values would be broadcast by the network as before (and so known to all UEs served by the Node-B broadcasting the parameters). However, a UE would autonomously adjust one or more of the broadcast values for the N313, T313 and/or N315 parameters based on an on period and an off period of a gated transmission having an on/off duty cycle and associated with the transmission of the power control commands on the downlink channel of the radio access network, based on a predetermined methodology. In some other embodiments, the UE could adjust the values it used for the thresholds Q_{out} and Q_{in}.

In case of a UE changing the values it uses for one or more of the N313, T313 and N315 parameters, the methodology could, for example, increase the value of the T313 value and so lengthen the time before a radio link failure is declared (and perhaps prevent declaring a radio link failure because of allowing more time to receive an in-sync indication after N313 out-of-sync indications). For example, the T313 parameter would be increased by the percentage of time the Node-B is not transmitting compared to the total time. Alternatively, the methodology could increase the number N313 to require a greater number of out-of-sync indications, and again for example, in direct proportion to the off period of the duty cycle compared to the whole period of the duty cycle. (This alternative starts the T313 and N315 usage and thus has the greatest impact.) In still another alternative, the methodology could decrease the number N315 and so decrease the number of consecutive in-sync indications (before T313 units of time has expired) required to prevent a declaration of radio link failure (after N313 consecutive out-of-sync indications have been observed).

The invention also encompasses changing not just one of the N313, T313 and N315 parameters, but any combination of these parameters. Also, instead of changing a parameter value in direct proportion to the length of the off-period of the

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gated transmission (i.e. the off-period of the duty cycle of the UE transmitter), the parameter values could be changed in some other proportion, i.e. in a non-linear way.

As an alternative to changing the values of the N313, T313 and N315 parameters, the UE could change how it counts consecutive out-of-sync indications, and how it counts consecutive in-sync indications, and/or how it measures the time period corresponding to T313. The UE could, for example, only count as a consecutive out-of-sync indication an indication of out-of-sync occurring in a time when the Node-B gated transmission is in an on-period, i.e. when the Node-B is known by the UE to be transmitting. Similarly for the counting up to N315 in-sync indications, and similarly for measuring time after N313 consecutive out-of-sync indications (i.e. time would be measured only when the Node-B is known to be transmitting). Thus, the UE could only *effectively* change one or more of the N313, T313 and N315 parameter values, by changing how the UE determines whether a condition(s) corresponding to the one or more parameter values has occurred, e.g. changing the procedure used to monitor out-of-sync indications so as to count as a consecutive out-of-sync indication such an indication only if the out-of-sync indication occurs during the on period of the on/off duty cycle (and only if there has not been an in-sync indication anytime between the most recent previous out-of-sync indication occurring during an on period).

In order to vary (one or more of) the N313, T313 and N315 parameters (actually or just effectively), the UE must learn/ determine the on period and the off period of the on/off duty cycle used by the Node-B of the radio access network in gating the downlink channel conveying the power control commands. One way for the UE to determine the on and off periods of the duty cycle is by assuming that they are the same as the on and off periods of the duty cycle used by the UE in gating its

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uplink (on DPCCH), and so equating the downlink gated transmission by the Node-B to the uplink gated transmission of the UE. Another way is to monitor the downlink, observing the pattern of variation in received power on the gated downlink channel (for example, the F-DPCH in case of WCDMA and UTRAN), and equating the off period of the gated downlink pattern to the observed period of low received power, and equating the on period to the observed period of higher low received power. Another way is for the UE to receive via signaling from the Node-B information indicating the gated transmission used by the Node-B, and to determine from the signaling the on period and the off period of a duty cycle.

As mentioned, a UE could also change one or more of the values it uses for the thresholds Q_{out} and/or Q_{in}. This could be as an alternative to changing one or more of the N313, T313 and N315 parameters, or in addition. A UE could autonomously adjust the values it uses for the thresholds Q_{out} and/or Q_{in}, or it could select the values of the thresholds from a predefined set (in determining when out-of-sync or in-sync occurs and through out-of-sync / in-sync indications determining when a radio link failure is deemed to have occurred).

Instead of gating the downlink channel (and in particular, F-DPCH or DPCCH), the downlink channel could be continuously transmitted but discontinuously power controlled due to uplink gating, i.e. power control commands could be sent only in downlink time slots corresponding to uplink time slots when the UE is transmitting. Alternatively, the downlink channel (F-DPCH or DPCCH) could be continuously transmitted, but discontinuously received by the UE, in order to improve UE power consumption. Discontinuous power control potentially degrades performance during uplink transmission gaps and right after the gaps. Therefore methods could be applied similar to those described above and below (for use in case of a gated downlink channel) that treat downlink

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transmission during periods corresponding to an uplink transmission gap similarly to downlink off periods (of a gated downlink). Discontinuous reception is in effect the same as a gated downlink channel from the standpoint of F-DPCH usage in the UE and performance.

Referring now to Figure 1A, a UE 11 is shown communicatively coupled to a Node-B 12a of a UTRAN 12, via a radio link having an uplink and a downlink, where the downlink is gated according to a gated transmission, and the uplink is also gated (and as explained above, may cause the gating of the downlink). As illustrated, the UTRAN also includes a Radio Network Controller (RNC) 12b, for controlling the Node-B in at least some respects, and for coupling the Node-B to a Core Network 14 (and hence ultimately to other communication terminals, not shown). The UE is shown as including a UE transceiver (TRX) 16a rigged for radio communication with a corresponding Node-B TRX 17a. The UE is shown as also including a Protocol Stack Layer-1 16b that operates the UE TRX 16a, and the Node-B is shown as including a peer Protocol Stack Layer-1 17b. The UE is shown as also including a data store 16c for holding values of the various parameters and/ or thresholds used in different embodiments of the invention, called here the sync parameters.

Figure 1B shows some components of the UE 11 of Figure 1A from a different perspective. The UE is shown as including a suitable radio front end 11a (including a wireless transceiver, not shown) coupled to a data processor 11b that in turn is coupled to a (volatile and/or non-volatile) memory structure 11c. The data processor can be for example a microprocessor, i.e. a programmable digital electronic component that incorporates the functions of a central processing unit on a single semiconducting integrated circuit. The radio front end may include a digital signal processor (not shown), or the data processor 11b may provide digital

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signal processing in respect to signals transmitted or received by the wireless terminal. The memory structure 11c stores program code that is executable by the processor 11b, including program code that is provided to implement all or part of the invention. The UE 11, as shown, can also include one or more application specific integrated circuits 11d, for providing some or all of the functionality of the UE, as an alternative to providing the functionality via stored instructions executed by the processor. Finally, the UE 11, as shown, includes a user interface (UI) 11e (usually including, among other things, a display, a keypad, a microphone, and a speaker), coupled to the data processor and possibly also to one or more of the one or more ASICs. The UE TRX 16a of Figure 1A is a component of the radio front end 11a. The UE Protocol Stack Layer-1 16b of Figure 1A can be implemented so as to include one or more ASICs 11d, and/or program code stored in the memory structure 11c executable by the data processor 11b, and/or one or more components of the radio front end 11a.

Although not illustrated in the drawings, it will be appreciated that each Node-B 12a also includes a radio front end and a data processor and a memory structure and may include one or more ASICs coupled as shown in Figure 1B, and the RNC 12b also includes a data processor and a memory structure and possibly one or more ASICs.

In general, the various embodiments of the UE 11 can include, but are not limited to, cellular telephones, personal digital assistants (PDAs) having wireless communication capabilities, portable computers having wireless communication capabilities, image capture devices such as digital cameras having wireless communication capabilities, gaming devices having wireless communication capabilities, music storage and playback appliances having wireless communication capabilities, Internet appliances permitting wireless Internet

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access and browsing, as well as portable units or terminals that incorporate combinations of such functions.

Referring now also to Figures 2 and 3, in a first step 31, the UE determines that the downlink is gated, and then in a next step 32 adjusts values of one or more of the sync parameters it uses (actually or only effectively, as described above) compared to values used in case of no gating of the downlink. The term "sync parameter" is used here to indicate any one or more of the N and T parameters (N313, T313 and N315), and/ or any one or more of the thresholds (Q_{out} and Q_{in}). The adjustment is based on the downlink gated transmission. (As explained above, the adjustment may be based on, or may be proportional to, the off period of the on/off duty cycle of the gated transmission.) In Figure 2, the UE is shown (optionally) obtaining original values of the procedures and then storing the changed sync parameters (i.e. their values) in a data store of the UE for use for example in determining when to declare a radio link failure (or otherwise responding to out-of-sync or in-sync indications). As indicated in Figures 1 and 2, the functionality for changing the sync parameters can reside in the layer one (physical layer) implementation (in hardware or software) of the UE protocol stack.

Referring now to Figure 4, the Node-B is indicated there as operative according to a first step 41 in which the Node-B determines that the UE is gating its uplink. The Node-B can make such a determination by for example monitoring the power received on the uplink channel in case of a dedicated channel. In a next step 42, the Node-B gates its downlink to correspond to the uplink gating by the UE. For example, as explained above, the Node-B can simply respond to power change requests actually received (during an on period of the UE uplink gated transmission), and even turn off its receiver during the off period of the UE uplink.

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The functionality described above as provided by the invention can be implemented as software modules stored in a non-volatile memory of a device such as a mobile station, and executed as needed by the device (or more specifically, an operating system of the device) copying all or part of the software into executable RAM (random access memory). Alternatively, the logic provided by such software can also be provided by an ASIC (application specific integrated circuit). In case of a software implementation, the invention provided as a computer program product including a computer readable storage structure embodying computer program code--i.e. the software--thereon for execution by a computer processor.

It is to be understood that the above-described arrangements are only illustrative of the application of the principles of the present invention. Numerous modifications and alternative arrangements may be devised by those skilled in the art without departing from the scope of the present invention, and the appended claims are intended to cover such modifications and arrangements.

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What is claimed is:

1. A method for use by a user equipment wireless communication terminal, comprising:

determining on periods and off periods of a gated transmission in connection with receiving power control commands over a downlink channel of a radio access network; and

varying a procedure used to determine when to declare a radio link failure based on the gated transmission by actually and/or effectively varying a quality measurement period used in the procedure or one or more parameter values used in the procedure.

2. A method as in claim 1, wherein the gated transmission corresponds to a gating of transmission power or a gating of only the power control commands or a gating of reception of the power control commands by the UE.

3. A method as in claim 1, wherein the procedure is varied by changing how to measure a parameter value used by the procedure.

4. A method as in claim 3, wherein the change in the procedure is to count occurrences of events corresponding to the parameter value only if the events occur during one or another of the on periods of the gated transmission, instead of counting occurrences of such events regardless of when the events occur.

5. A method as in claim 3, wherein the change in the procedure is to count occurrences of events corresponding to the parameter for a period of time longer than in case of no gating.

6. A method as in claim 5, wherein the procedure used to measure when the parameter value is changed includes evaluating

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power change commands received during a time window, and wherein the change in the procedure is to evaluate power change commands over a longer time window.

7. A method as in claim 6, wherein the longer time window is longer than the time window in case of no gating by an amount such that the same number of power change commands are evaluated as in case of no gating.

8. A method as in claim 1, wherein the procedure uses one or more parameter values including a number N313 of consecutive out-of-sync indications, and/or a number N315 of successive in-sync indications, and/or a number T313 indicating a length of time, and/or a first threshold Q_{out} for minimum quality and/or a second threshold Q_{in} for minimum quality, and wherein the radio link to the radio access network is declared failed according to the procedure if N313 consecutive out-of-sync indications are determined and then a time interval of T313 units of time expires before N315 consecutive in-sync indications are determined, wherein an out-of-sync indication is determined whenever a quality metric for the downlink channel falls below the first threshold Q_{out} for minimum quality, and an in-sync indication is determined whenever the quality metric exceeds the second threshold Q_{in} for minimum quality.

9. A method as in claim 1, wherein the on periods and the off periods each correspond respectively to an on period and an off period of a duty cycle, and wherein at least one of the parameter values is changed from a broadcast or predetermined value by an amount that is based on the off period compared to a whole period of the on/off duty cycle.

10. A computer program product comprising a computer readable storage structure embodying computer program code thereon for execution by a computer processor, wherein said computer program

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code comprises instructions for performing a method according to any of claims 1-9.

11. An application specific integrated circuit provided so as to operate according to a method as in any of claims 1-9.

12. An apparatus for use by a user equipment wireless communication terminal, comprising:

means for determining on periods and off periods of a gated transmission in connection with receiving power control commands over a downlink channel of a radio access network; and

means for varying a procedure used to determine when to declare a radio link failure based on the gated transmission by actually and/or effectively varying a quality measurement period used in the procedure or a parameter value used in the procedure.

13. An apparatus as in claim 12, wherein the gated transmission corresponds to a gating of transmission power or a gating of only the power control commands or a gating of reception of the power control commands by the UE.

14. An apparatus as in claim 12, wherein the means for varying a procedure is configured to vary the procedure by changing how to measure a parameter value used by the procedure.

15. An apparatus for use by a user equipment wireless communication terminal, comprising:

a first component of a physical layer implementation of a protocol stack of a wireless terminal, for determining on periods and off periods of a gated transmission in connection with receiving power control commands over a downlink channel of a radio access network; and

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a second component of a physical layer implementation, for varying a procedure used to determine when to declare a radio link failure based on the gated transmission by actually and/or effectively varying a quality measurement period used in the procedure or a parameter value used in the procedure.

16. An apparatus as in claim 15, wherein the gated transmission corresponds to a gating of transmission power or a gating of only the power control commands or a gating of reception of the power control commands by the UE.

17. An apparatus as in claim 15, wherein the second component is configured to vary the procedure by changing how to measure a parameter value used by the procedure.

18. An apparatus as in claim 17, wherein the change in the procedure is to count occurrences of events corresponding to the parameter value only if the events occur during one or another of the on periods of the gated transmission, instead of counting occurrences of such events regardless of when the events occur.

19. An apparatus as in claim 17, wherein the change in the procedure is to count occurrences of events corresponding to the parameter for a period of time longer than in case of no gating.

20. An apparatus as in claim 19, wherein the procedure used to measure when the parameter value is changed includes evaluating power change commands received during a time window, and wherein the change in the procedure is to evaluate power change commands over a longer time window.

21. An apparatus as in claim 20, wherein the longer time window is longer than the time window in case of no gating by an amount such that the same number of power change commands are evaluated as in case of no gating.

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22. An apparatus as in claim 15, wherein the procedure uses one or more parameter values including a number N313 of consecutive out-of-sync indications, and/or a number N315 of successive in-sync indications, and/or a number T313 indicating a length of time, and/or a first threshold Q_{out} for minimum quality and/or a second threshold Q_{in} for minimum quality, and wherein the radio link to the radio access network is declared failed according to the procedure if N313 consecutive out-of-sync indications are determined and then a time interval of T313 units of time expires before N315 consecutive in-sync indications are determined, wherein an out-of-sync indication is determined whenever a quality metric for the downlink channel falls below the first threshold Q_{out} for minimum quality, and an in-sync indication is determined whenever the quality metric exceeds the second threshold Q_{in} for minimum quality.

23. An apparatus as in claim 15, wherein the on periods and the off periods each correspond respectively to an on period and an off period of a duty cycle, and wherein at least one of the parameter values is changed from a broadcast or predetermined value by an amount that is based on the off period compared to a whole period of the on/off duty cycle.

24. A user equipment wireless communication terminal, comprising:

an apparatus as in claim 12; and

a transceiver for communicatively coupling with the radio access network, and configured to transmit to the radio access network.

25. A user equipment wireless communication terminal, comprising:

a radio front end;

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a processor communicably coupled to the radio front end; and

a memory coupled to the processor for storing a set of instructions, executable by the processor, wherein the instructions comprise:

determining on periods and off periods of a gated transmission in connection with receiving power control commands over a downlink channel of a radio access network; and

varying a procedure used to determine when to declare a radio link failure based on the gated transmission by actually and/or effectively varying a quality measurement period used in the procedure or a parameter value used in the procedure.

26. A system comprising a user equipment wireless communication terminal as in claim 24 or claim 25 and a radio access network including a wireless terminal for communicably coupling to the user equipment wireless terminal by transmitting downlink signals to the user equipment wireless communication terminal and by receiving uplink signals from the user equipment wireless communication terminal.

27. A system as in claim 26, wherein the wireless terminal of the radio access network is configured to:

determine that the uplink signals are being transmitted according to a gated transmission; and

gate the downlink signals to correspond to the uplink gating.

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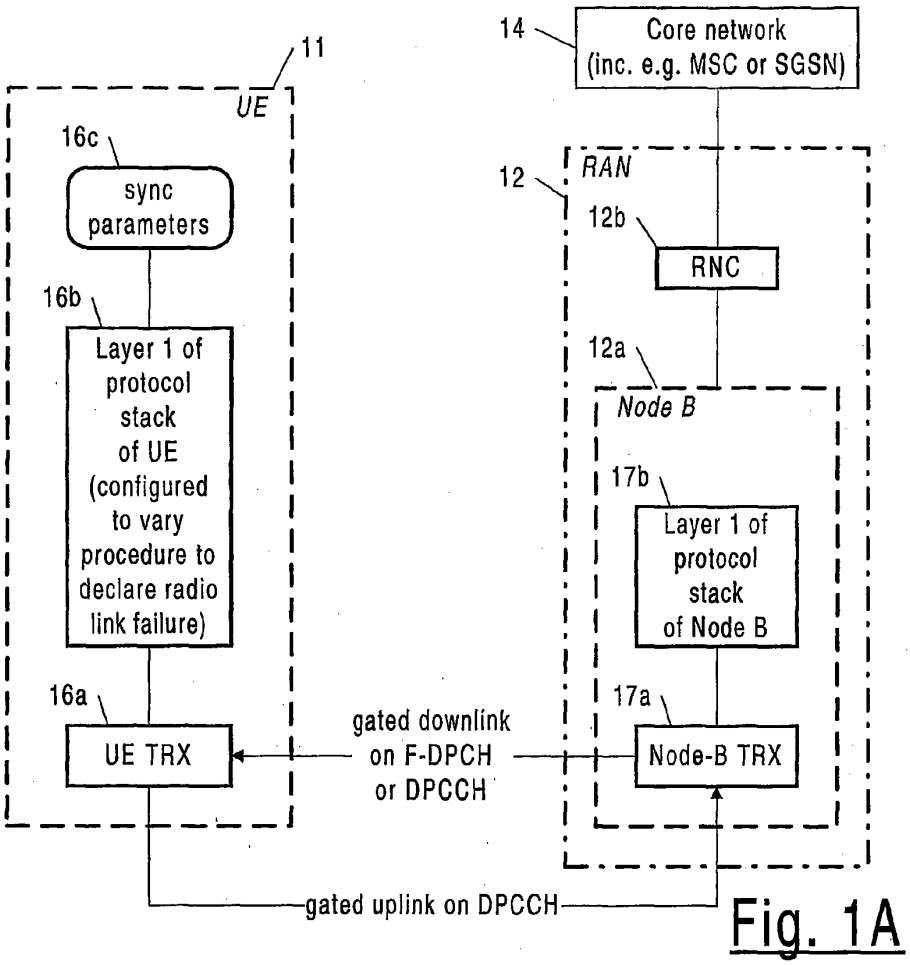


Fig. 1A

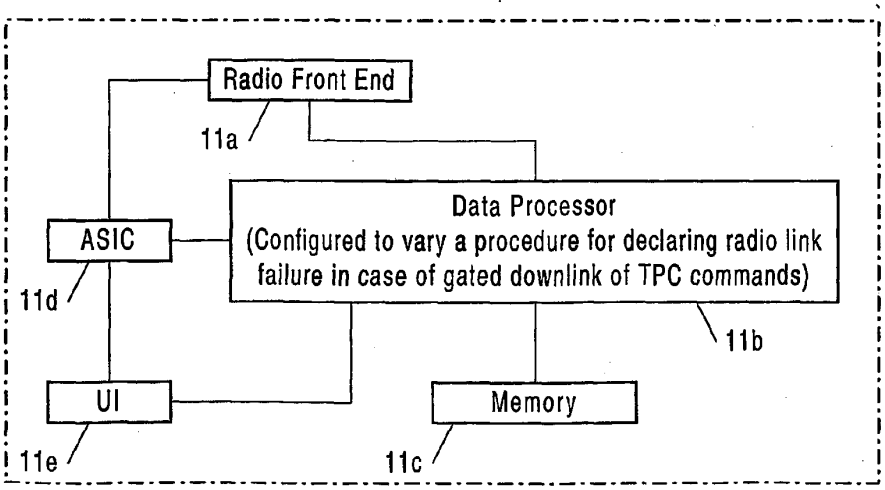


Fig. 1B

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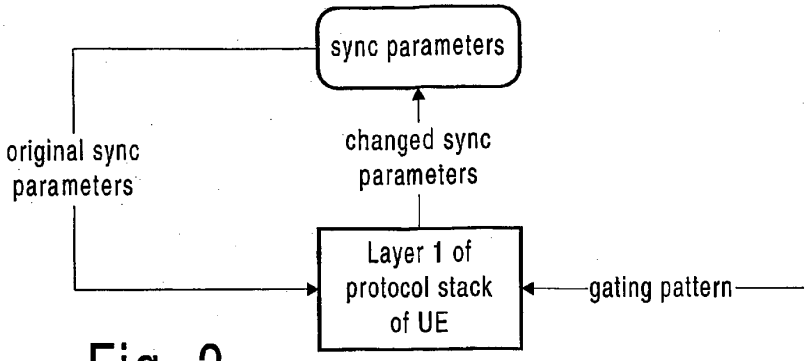


Fig. 2

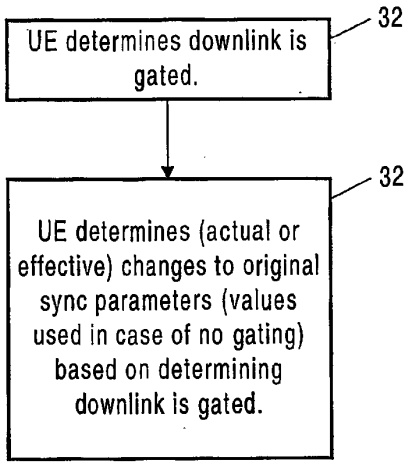


Fig. 3

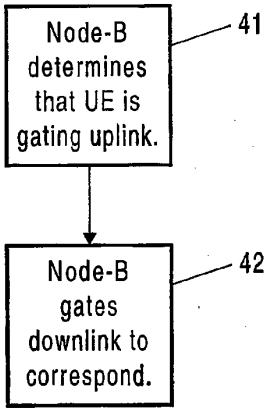


Fig. 4

BNSDOCID: <WO_____2007129180A2_I_>

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
15 November 2007 (15.11.2007)

PCT

(10) International Publication Number
WO 2007/129180 A3

(51) International Patent Classification:
H04B 7/005 (2006.01) *H04Q 7/32* (2006.01)

(21) International Application Number:
PCT/IB2007/001120

(22) International Filing Date: 30 April 2007 (30.04.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/797,943 5 May 2006 (05.05.2006) US

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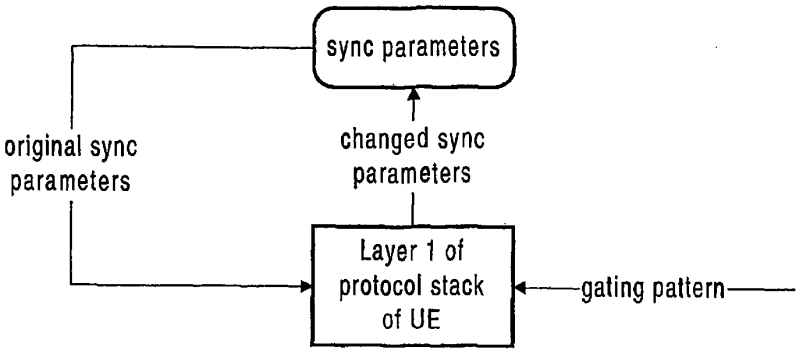
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

(88) Date of publication of the international search report:
28 February 2008

(54) Title: ENHANCED UE OUT-OF-SYNC BEHAVIOR WITH GATED UPLINK DPCCH OR GATED DOWNLINK F-DPCH OR DPCCH TRANSMISSION



(57) Abstract: A method and corresponding equipment by which a wireless terminal communicatively coupled to a radio access network adapts to gating in respect to a downlink signal from a radio access network carrying power control commands (e.g. the F-DPCH of UTRAN with WCDMA), including gating by the radio access network of either just the power control commands or the channel itself, or gating of reception of the power control commands by the user equipment. The adaptation can include changing values of parameters used in determining when the wireless terminal declares a radio link failure, or instead only changing the procedures used to determine whether a parameter value has been achieved and thus only effectively changing the parameter values (or one or more of the parameters can be actually and effectively changed).

WO 2007/129180 A3

BNSDOCID: <WO____2007129180A3_I_>

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2007/001120

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet
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: H04B, H04L, 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)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	3GPP TS 25.331 V6.9.0 (2006-03), paragraph 8.5.4, 8.5.6	1-27
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A	3GPP TS 25.101 V6.11.0 (2006-03), 3rd Generation Partnership Project: Technical Specification Group Radio Access Network: User Equipment(UE) radio transmission and reception (FDD) (Release 6), paragraph 6.4.4	1-27
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A	3GPP TS 25.214 V6.8.0 (2006-03), 3rd Generation Partnership Project: Technical Specification Radio Access Network: Physical layer procedures (FDD) (Release 6), page 9-page 13	1-27
	--	

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

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Date of the actual completion of the international search	Date of mailing of the international search report
6 December 2007	10 -12- 2007
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BNSDOCID: <WO____2007129180A3_I_>

INTERNATIONAL SEARCH REPORT

International application No.
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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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A	US 20020112288 A1 (LUNDBY, S ET AL), 15 August 2002 (15.08.2002), paragraphs [0025]-[0028],[0035]-[0037],[0045], figures 3B-C, claims 1-9, abstract	1-27
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A	US 6493541 B1 (GUNNARSSON, F ET AL), 10 December 2002 (10.12.2002), column 5, figure 8, abstract	1-27
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A	3GPP TSG RAN2#47 Athens, Greece, 9-13 May, 2005. Change Request: "Faster L1 DCH synchronization". Paragraph 8.5.6	1-27
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BNSDOCID: <WO_____2007129180A3_I_>

International patent classification (IPC)
H04B 7/005 (2006.01)
H04Q 7/32 (2006.01)

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Paper copies can be ordered at a cost of 50 SEK per copy from PRV InterPat (telephone number 08-782 28 85).

Cited literature, if any, will be enclosed in paper form.

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				WO	2006000876	A	05/01/2006

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 026 514 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
18.02.2009 Bulletin 2009/08

(51) Int Cl.:
H04L 12/56 *(2006.01)*

(21) Application number: **07425527.4**

(22) Date of filing: **14.08.2007**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK RS

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(54) Resource management method for multi acces networks

(57) Every controller (RNC, BSC, E-NodeB, BS) of multi-RAT PLMN (UTRAN, GERAN, LTE, WiMAX) calculates for each controlled cell a MUB IE describing the availability of transport services in terms of maximum user bitrate that can currently be allowed to each transport service, separately for UL and DL, needed to plan usage of radio resources in the current and neighbouring cells, such as for handovers, cell reselections and new service setups. The MUB computation avails of:
-calculating an available capacity for a given service by taking a normalised capacity accessible to said service and by subtracting to it a normalized load of said service and of any other service that cannot be pre-empted by said service;
-calculating the MUBN for said service as the minimum between said available capacity and the maximum capacity MAXUB allowed to the single user for said service as a configuration setting;
-calculating a quantized representation MUB of the MUBN for said service as the nearest power of two raised at an integer n.

The MUB is included into management messages forwarded to the other controllers, either of the same or different technologies. Every controller checks the received MUB coming from the other controllers in order to decide on the most suited target cell, among the current and neighbouring cells, for resource management issues such as handover, cell reselection, and new service set-up (fig.6).

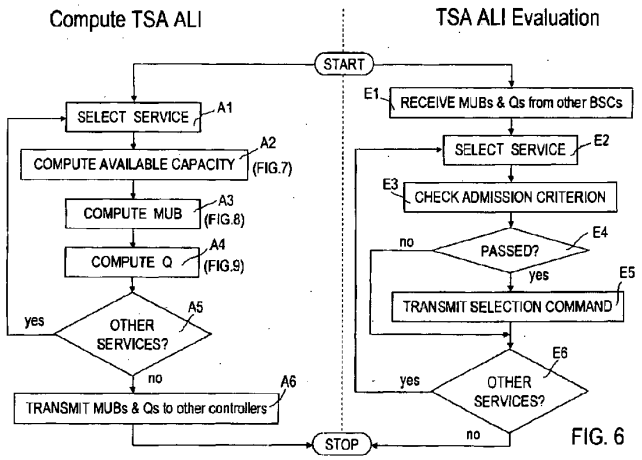


FIG. 6

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EP 2 026 514 A1

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to the so-called Ambient Networks (AN), and in particular to a resource management method for multi-access networks. (Used acronyms description and bibliographic references are given at the end of the description).

BACKGROUND ART

[0002] The communications industry has a truly historic opportunity over the coming years to connect the majority of the world using mobile, wireless broadband and fixed broadband systems. As a result, in 2015 we will live in a world, in which five billion people are connected, most of them 'always on' with a broadband connection. People can use the services they want anytime, anywhere with their preferred devices.

[0003] The Internet will be the dominant platform to connect these five billion people and their various devices with each other, and to provide access to a great variety of content and applications. Mobility will dominate in voice services with 70-90% of all traffic, depending on the market.

[0004] Broadband IP connections will be available practically anywhere in the world, across developed and growth markets. A combination of mobile, wireless and fixed systems will ensure global coverage, full mobility and adequate speed and capacity. In the growth markets mobile and wireless broadband will play a crucial role in broadband coverage.

[0005] In the converged telecom, Internet, media and IT landscape there will be a much larger variety of services providers and business models compared to today's telecom environment. Each provider will compete in a larger market than traditionally seen, creating both a huge opportunity and increased competition.

[0006] Taking into account said converged landscape, future internetworking will continue to signify "the interaction of heterogeneous networks", today including cellular, wireless and wire-line networks, public and private, belonging to users and operators. In this context the Ambient Networks project (see Ref. [1], [2], and [3] at the end) works for specifying a system capable to handle future internetworking by enabling dynamic composition of networks and establishment of inter-network agreements, coexistence of multiple access technologies, multi-operator and multi-hop functions, mobility and security support. The vision for multi-access operations is characterized by heterogeneous access technologies, radio or fixed, through which data may flow in series (multi-hop) or in parallel, alternatively or concurrently.

[0007] To enable multi-access operations, efficient resource management methods need to consider the diverse characteristics of the heterogeneous access technologies. This translates into the need to identify how the dissimilar access resources should be abstracted in order to provide the most suited building block for resource management operations, optimizing the trade-off between performance of the adopted resource management schemes, and cost of signalling and processing as contextualized in today's technologies. Started in January 2004 as part of the IST 6th Framework Programme of the European Union, the Ambient Networks project is developing a new networking environment providing thorough inter-working among today's networks, characterized by their diverse features and services. The objectives include enabling the emergence of new businesses, as well as stimulating continuous growth in the communication market.

[0008] Ambient Networks described in Ref.[3] realizes its objectives through the definition of a new network convergence layer, the "Ambient Control Space" (ACS), as a control stratum typically referred to as an overlay, where the envisaged Ambient Networks functionality is introduced. Open implementation options exist how this networking realm should be realized, while the main interfaces are under specification process.

[0009] **Fig.1** schematizes a typical Ambient Network (AN) scenario characterised by the ACS as a control plane, and an Ambient Connectivity (ACY) functionality. The ACS includes a number of functionalities capable of managing Multi-radio Access, Context information, mobility, security and even more. The ACS includes interfaces towards the higher layers of control functionality, such as user applications through the Ambient Service Interface (ASI), and also includes Ambient Resource Interfaces (ARI) towards the ACY, i.e. the lower layers of control functionality. ANs and their respective ACSs interact through the ANI. ASI, ARI and ANI are logical interfaces that may run over heterogeneous communication means and access technologies.

[0010] The issue of multi-access in the ACS described in Ref.[4] mainly refers to criteria how resource management may handle communication paths of diverse access technology both in series and in parallel, alternatively or concurrently. For solving this issue, it is of primary importance to identify suitable abstractions of the access resource through which the ACS can view and control the "Ambient Connectivity" layers, where technology-specific communication paths are accessible via the "Ambient Resource Interface" (ARI). **Fig.2** schematizes a process involving both ACS and Ambient connectivity in which technology-specific information needs to be abstracted up to a level and to a type that allows provisioning the envisaged multi-access operations in the ACS through respective algorithms. To this aim, "Abstracted (load) information" is defined as a more generic type of information, typically technology-independent, or quasi-technol-

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ogy-independent, obtained by transformation through algorithms (abstraction layer algorithms) from a technology specific information. The goal is therefore not only defining the most suitable abstractions, but also providing the related mechanisms and algorithms for the technology-specific Abstraction Layers, together with the related access selection and admission control algorithms for the ACS.

[0011] Cell Capacity/load abstractions have been suggested up to now within discussions around load balancing in 3GPP for achieving a timely specification enabling some coordination between RNCs and BSCs. Cell load is a measurement typically easy to retrieve from parameters like total transmitted power, interference, number of occupied timeslots, etc.

[0012] "Transport Service Availability" (TSA) abstraction, limitedly to the bearer service, is disclosed in Patent application EP-A1-1503606 of the same inventors, which describes: a common radio resource management method in a mobile radio communication network employing different radio access technologies that overlap over a geographic area subdivided into cells belonging to the domains of respective controllers which are connected to each other in overlapping or adjacent domains and to a core network by means of relevant interfaces, suitable to be carried out for each controlled cell by the respective controller through the steps of:

- starting from acquired information about QoS and throughput of all the active connections with the served mobile terminals (UE/MS), calculating traffic-related Information Elements, separately for uplink and downlink, needed to plan handovers and/or cell reselections; said traffic-related Information Elements including indications of the availability of bearer services in the cell in terms of maximum bitrate, either guaranteed or not guaranteed, that can currently be allowed to each bearer service, said bearer service being distinguished by traffic class due to the different QoS characteristics of the bearer services in terms of Eb/No, error rates, priorities, and delay;
- including said traffic-related Information Elements in management messages forwarded to the controllers of different cells to the one in turn considered, either of the same or different technologies;
- checking said traffic-related Information Elements coming from the other controllers (BSC, RNC) in order to decide either of issuing or preventing handovers and/or cell reselection commands towards a neighbouring cell.

OUTLINED TECHNICAL PROBLEM

[0013] The teaching of the aforementioned document EP-A1-1503606 was only directed to announce the Bearer Service Availability as an exemplary abstraction based on Transport Service, but none other than reference to generic tables it is said of how calculating the Bearer Service Availability, so it is not currently known how to produce Transport Service Availability information elements. Without an effective criterion of how calculating said TSA, the access network controllers originating the information cannot "forecast" the outcome of the resident admission control algorithms for the specific service to be admitted.

OBJECT AND SUMMARY OF THE INVENTION

[0014] The main object of the present invention is that to overcome the lack of a clear teaching in the prior art of how calculating a transport service availability information element.

[0015] The invention achieves said object by providing a radio resource management method in a mobile radio communication network employing different radio access technologies, e.g.: UTRAN, GERAN, LTE, WiMAX, that overlap over a geographic area subdivided into cells belonging to the domains of respective controllers (RNC, BSC, E-NodeB, BS), including the following steps carried out by every controller for each controlled cell:

a) calculating a transport service availability information element, called hereafter MUB, describing the availability of transport services in terms of maximum user bitrate that can currently be allowed to each transport service, separately for uplink and downlink, needed to plan usage of radio resources in the current and neighbouring cells, such as for handovers, cell reselections and new service setups; the computation at step a) including at least the following substeps executed for each implemented service characterised by service type and high/low priority:

a1) calculating an available capacity for a given service by taking a normalised capacity accessible to said service and by subtracting to it a normalized load of said service and of any other service that cannot be preempted by said service;

a2) calculating the MUBN for said service as the minimum between said available capacity and the maximum capacity MAXUB allowed to the single user for said service as a configuration setting;

a3) calculating a quantized representation MUB of the MUBN for said service for transmission over digital transmission means;

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b) including said MUB information elements calculated as above into management messages forwarded to the other controllers, either of the same or different technologies;
c) checking said MUB information elements coming from the other controllers (BSC, RNC, E-NodeB, BS) in order to decide on the most suited target cell, among the current and neighbouring cells, for resource management issues such as handover, cell reselection, and new service setup, as described in claim 1.

[0016] Details on the calculation and other aspects of the invention are described in the dependent claims.

[0017] A radio resource management method which avails of the precise teaching of how calculating TSA information according to the present invention, constitutes an effective improvement of the access selection and admission control algorithms in the control space of the Ambient Networks.

[0018] The smartness of the method has been tested by means of a comparative emulation applied to a GSM access network between TSA Abstraction Layer Information (ALI) calculated according to the method of the invention and 3GPP ALI based on Cell capacity/load. To the only aim of the emulation, some algorithms have been appositely developed also for calculating 3GPP (GSM) ALI and successively using it in evaluating some selection criteria of target cells for a given service.

[0019] Finally, a comparative algorithm between performances of two types of ALI has been developed for calculating the admission control error probability versus minimum cell load using 3GPP ALI instead of TSA ALI in emulating a GSM scenario characterized by a single target cell. The outcome of the comparative algorithm is the bunch of error curves reported in **fig.10** which clearly attests the superiority of TSA ALI calculated according to the method of the invention: typically, gains are higher for higher cell load, i.e. in the most critical situations.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] The invention and its advantages may be understood with reference to the following detailed description of an embodiment thereof taken in conjunction with the accompanying drawings given for purely non-limiting explanatory purposes and wherein:

- **fig.1** shows an Ambient Control Space and Connectivity diagram of the so-called Ambient Networks;
- **fig.2** schematized the mechanisms involved with the abstraction paradigm used at the ARI interface between ACS and Connectivity of fig.1;
- **fig.3** shows a known diagram of a Multi-RAT (GSM + 3G) PLMN as an exemplary scenario of Ambient Network;
- **fig.4** shows a very general diagram of the exchange of TSA Abstracted Load Information (ALI) calculated according to the method of the present invention, between a GSM controller and another Access Controller which performs TSA-based evaluation algorithms for traffic planning inside the network of fig.3;
- **fig.5** shows a very general diagram which differs from the previous one for the additional exchange of traditional 3GPP ALI based on capacity /load, so at the other Access Controller two evaluation algorithms for access selection can be compared to each other in order to calculate the evaluation error of the 3GPP ALI approach in respect of more correct evaluations performed by the algorithm which makes use of TSA ALI calculated according to the method of the invention;
- **fig.6** is the most general flow chart of GSM abstraction layer for computation of TSA ALI and concurrent execution of TSA ALI evaluation for admission control according to the method of the invention;
- **figures 7, 8, and 9** are flow charts relevant to corresponding steps of the flow chart of fig.6;
- **fig.10** shows a bunch of 3GPP ALI error curves versus minimum cell load (plotted for various services) in taking cell selection decisions comparatively based on both 3GPP ALI and TSA ALI, when the GSM scenario of fig.5 is emulated limitedly to a single target cell;
- **fig.11** shows an evolution of the Multi-RAT PLMN depicted in fig.3 as a future candidate to host the present invention;
- **fig.12** shows a diagram of inter E-Node B communication according to 3GPP Long Term Evolution (LTE) Access Network as another candidate to host the present invention;
- **fig.13** shows a similar diagram for a WiMAX Access Network as still another candidate to host the present invention.

DETAILED DESCRIPTION OF AN EMBODIMENT OF THE INVENTION

[0021] **Fig.3** shows a multi-RAT (Radio Access Technology) PLMN that will be soon completed in Europe. The new Universal Mobile Telecommunications System (UMTS) shares the existing GSM (Global System for Mobile communications) Core Network CN with the GPRS service. Relevant GSM RAN (Radio Access Network) in fig.3 is the so-called GERAN (GSM EDGE RAN), corresponding to the ultimate GSM RAN based on new EDGE (Enhanced Data rates for GSM Evolution) techniques that allow higher data rates in GSM, e.g. higher modulations. The Core Network CN is connected to one or more BSS (Base Station Subsystem) of the GSM, and to one or more RNS (Radio Network

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Subsystem) of an UTRAN (Universal Terrestrial Radio Access Network). The UMTS system of fig.3 is described in the TS 23.002 (CN) and TS 25.401 (UTRAN). Both the UTRAN and BSS are connected, on air, to a plurality of User Equipment UE/MS, each including a Mobile Equipment ME with a respective USIM card (UMTS Subscriber Identity Module). The present invention applies to UEs of single but preferably multistandard type: so that they are indicated as UE/MS (without limitation, often the only term UE is indicated). The UTRAN includes a plurality of Node B blocks each connected to a respective Radio Network Controller RNC by means of an Iub interface. A node B includes a Base Transceiver Station BTS connected to the UEs through an on-air Uu interface. The upper RNC is a Serving S-RNC connected to the Core Network CN by means of a first Iu(CS) interface for Circuits Switched and a second Iu(PS) interface for Packet Switched of the GPRS. It is also connected to an Operation and Maintenance Centre (OMC). The RNC placed below can be a Drift D-RNC and is connected to the upper S-RNC by means of an Iur interface. The UTRAN with the served UEs constitute a Radio Network Subsystem (RNS) disclosed in TS 23.110.

[0022] The GSM - BSS block includes a plurality of BTSs connected to a Base Station Controller BSC by means of an Abis Interface and to the UEs through an on-air Um interface. The BSC is interfaced to the Core Network CN by means of a Gb interface (packet switched) and is further connected to a Transcoder and Rate Adaptor Unit TRAU also connected to the Core Network CN through an A interface. It is also connected to an Operation and Maintenance Centre (OMC).

[0023] The CN network includes the following Network Elements: Switching Centre MSC / Visitor Location Register VLR, Gateway MSC GMSC, Interworking Function IWF / Transcoder TC, Camel Service Environment CSE, Equipment Identity Register EIR, Home Location Register HLR, Authentication Centre AuC, Serving GPRS Support Node SGSN, and Gateway GPRS Support Node GGSN. The following interfaces are visible inside the CN block: A, E, Gs, F, C, D, Gf, Gr, Gc, Gn, and Gi. The IWF block translates the Iu(CS) interface into the A interface towards MSC / VLR block. The TC element performs the transcoding function for speech compression/expansion concerning UTRAN (differently from GSM where this function is performed outside the CN network) also connected to the MSC block through the A interface. The GMSC is connected to the MSC / VLR through the E interface and to a Public Switched Telephone Network PSTN and an Integrated Services Digital Network ISDN. Blocks CSE, EIR, HLR, AUC are connected to the MSC / VLR through, in order, the Gs, F, C, and D interfaces, and to the SGSN node through the Gf and Gr interfaces. The SGSN block is interfaced at one side to the S-RNC inside UTRAN block by means of the Iu(PS) interface, and to the BSC inside the GSM-BSS block through the Gb interface. At the other side the SGSN node is interfaced to the GGSN node through the Gn interface. The last block is connected through the Gi interface to a packet data switching network of the IP (Internet Protocol) type and/or the X.25 type. The Core Network CN of fig.3 consists of an enhanced GSM Phase 2+, as described in TS 23.101, with a Circuit Switched CS part and a packet Switched part (GPRS). Another important Phase 2+ is the CAMEL (Customised Application for Mobile network Enhanced Logic) Application Part (CAP) used between the MSC and CSE for Intelligent Network (IN) applications. CAP is described in TS 29.078.

[0024] In operation, the MSC, so as the SGSN node, keep records of the individual locations of the mobiles and performs the safety and access control functions. More BSS and RNS blocks are connected to the CN Network, which is able to perform intrasystem handovers between adjacent RNSs or between adjacent BSSs, and intersystem handovers between a RNS and an adjacent BSS. UTRAN in respect of GSM further improves data service by making possible greater throughputs and the asymmetrical traffic typical of the Internet Protocol (IP). The network of fig.3, which only represents a minimal part of a world-wide network, shall allow the routing of a telephone call inside an International UMTS / GSM Service Area subdivided into National Service Areas. By way of the hierarchical structure of the network, each National Service Area is subdivided into the following nested domains of decreasing area: PLMN Service Area; MSC / SGSN Service Area; Location Area LA (CS-domain) uniquely defined by its LAI (Location Area Identity) code; Routing Area RA inside the SGSN Service Area as a partition of the CS Location Area; Cell Area where the UE is actually located in the radio coverage of a target Node B or BTS. Many known protocols described in the relevant standardization are deputed to govern the exchange of information at the various interfaces.

[0025] To the aim of the present invention the multi-RAT network of **fig.3** is a particular embodiment of the Ambient Network of **fig.1** whose controllers RNC and BSC are capable of handling TSA ALI calculated as will be described soon. More in particular, the functional blocks indicated in **figures 4** and **5** are mapped in the network of **fig.3.**

[0026] Referring also to **figures 11** to **13** for what concerns the SAE/LTE and WiMAX technologies, this figures being explained later in detail, we describe a method where different access technologies (including UTRAN, GERAN, LTE and WiMAX) totally or partially overlapping over a geographic area, or having respective neighbouring cells, are coordinated through their respective controllers (RNC, BSC, E-NodeB, BS, ...) for the sake of handovers, cell reselections and new service setups. The method is based on the calculation, exchange and evaluation of TSA information, including indication of the maximum user bitrate (MUB) and quantity (Q) that can currently be allowed to the single user for each service.

[0027] Now with reference to the **figures 6** to **9** a TSA ALI computation algorithm is described limitedly to the GSM case for the BSC, but this shouldn't constitute a bar for the skilled in the art in adapting the algorithm to the UTRAN or other RAT networks. Parallelly to the description of the TSA ALI computation algorithm a 3GPP ALI computation algorithm

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is described to the only aim of comparison between the twos and without dedicated figures.

[0028] We consider for GSM a number of transport service types including conversational circuit-switched services, Enhanced GPRS streaming services, non-real-time GPRS services and non-real-time Enhanced GPRS services. Also, we consider different service priorities for a portion of the described service types: in particular we consider as higher priority services the ones in handover, and as lower priority services any new service setup request.

[0029] We start describing the algorithm for computing the TSA information described in **fig.6 (leftmost part).** For each service (**fig.6,** steps A1 and A5), characterised by service type and service priority, we compute the available capacity (step A2), then we compute the MUB (step A3) and finally we compute the additional element Q (step A4) describing the quantity of available services at the bitrate indicated by MUB.

[0030] For computing the available capacity for a given service, we start by computing the accessible capacity to that service, which equals at first the total fixed cell capacity. However, when taking into account reserved capacities for different services, the accessible capacity for that service needs to exclude any capacity reserved to other services, for example resources reserved to circuit switched and/or packet switched services (**fig.7** step C1). In particular, reserved resources can be dynamically set in time according to policies, current resource usage and resource bookings.

[0031] Moreover, the accessible capacity is either all capacity accessible to the given service type for the highest service priority of that service, or a percentage of all capacity accessible to the given service type according to a respective load threshold set for lower service priorities (**fig.7** steps C2 and C3). When taking into account reserved capacities for different services, load thresholds for lower service priorities can be set on the reserved and shared capacities limiting the accessible capacity for those service priorities accordingly to a related portion.

[0032] Having computed the accessible capacity, its current occupation in terms of load needs to be considered. When there exist non-guaranteed resources given as a surplus resource to any service, the guaranteed load of any service needs to be computed as the current load in the portion required for providing a guaranteed Quality of Service, excluding any surplus resource currently allocated (**fig.7** step C4).

[0033] The available capacity for a given service is then computed (**fig.7** step C5) by taking the capacity accessible to the service and by subtracting to it the guaranteed load of that service and of any other service that cannot be pre-empted by that service. When taking into account reserved capacities for different services, the load of any other service that cannot be pre-empted by that service would be considered only in the portion of allocation into the capacity accessible to that service. Finally, when taking into account additional control signalling load, the available capacity for a given service would need not to include the capacity allocated for control signalling in the portion of allocation into the capacity accessible to that service.

[0034] The available capacity, together with the accessible capacity and the load of different services, can be computed in a number of ways, for example as a bitrate indication or a pure number. When computing it as a bitrate indication a normalisation criteria is required: for example for any service the capacity available can be computed first as a gross normalised bitrate as if the capacity available would be used by a reference service (e.g. voice), and only in a second step the capacity available can be expressed as net user bitrate through a conversion factor (**fig.7** step C6).

[0035] Once computed the available capacity for a given service, taking into account the maximum capacity MAXUB allowed to the single user for that service as a configuration setting, the algorithm needs to compute MUBN as the minimum between the available capacity and MAXUB (**fig.8** step M1). In particular, MAXUB can be dynamically set in time as a function of the available capacity. The algorithm then computes for the given service the TSA parameter MUB as a quantized representation of MUBN, for the sake of transmission over digital transmission means (**fig.8** step M2). This can be done in a number of ways, e.g. by taking the integer part of MUBN, or by taking the nearest power of two raised at an integer n.

[0036] Once computed MUB, and in particular MUBN, the algorithm computes QN describing the number of available services of bitrate MUBN as the ratio between the available capacity and MUBN (**fig.9** step Q1). Finally the algorithm computes for the given service the TSA parameter Q as a quantized representation of QN, for the sake of transmission over digital transmission means (**fig.9** step Q2). This can be done e.g. through thresholds on QN distinguishing a number of quantity levels.

[0037] When TSA is computed for each service of interest in terms of MUB and Q, this information is passed to other access controllers (**fig.6** step A6), which on need will use this information for performing access selection for a given service (**fig.6** step E1).

[0038] With regards to the access selection algorithms, **fig.6 (rightmost part)** describes the undertaken steps. First of all, a service is selected (**fig.6** step E2) for which an access selection decision needs to be taken, based e.g. on handover/cell reselection needs, new service requests and load management needs.

[0039] Regarding the access selection criterion (**fig.6** step E3) there exist two cases: the case where a single cell is evaluated as a potential target, and the case where two or more cells are compared as potential targets. In both cases the algorithms need to take the TSA information corresponding to that service. In the former case the algorithm needs then to check if the MUB information indicates the availability of the required bitrate for that service, in which case the cell is a suitable target cell. In the latter case instead the algorithm needs then to check if the MUB information indicates

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the availability of the required bitrate for that service in each cell, in which case the cells satisfying this requirement are suitable target cells, and if required finally check the Q information element of the different suitable target cells for selecting the cell with highest Q as the best target cell.

[0040] If a target cell could be selected (**fig.6** step E4), a selection command is transmitted (**fig.6** step E5), triggering e.g. handover/cell reselection requests of service setup requests towards the target cell. Concluding, the algorithm may be repeated for any additional service requiring access selection (**fig.6** step E6).

General assumptions

[0041]

- UUDL: in general, similar parameters and characteristics apply for uplink and downlink. For simplicity we refer e.g. to only DL for calculation and evaluation of the TSA, although similar work should be done for UL. Also, an aggregated figure could be obtained for UL and DL by combining the TSA for UL and DL.
- there exist resources reserved for different services (voice, GPRS) and priorities (voice handover), and/or vendor specific thresholds (e.g. new calls will be accepted only under 75% load). We assume for simplicity that for each service dedicated (reserved) resources are filled first, i.e. that the system can be configured as such.
- there exists a varying capacity occupied by signalling and other overheads (broadcast channels, coding, signalling for call setup, ...)
- there exist surplus resources, i.e. resources that are given to the user as a surplus, i.e. above the guaranteed bitrate, under favourable conditions. This exists only for RT services, as for NRT nothing is guaranteed. E.g. it considers the allocation of full-rate codecs or high-quality AMR codecs, that can be given under favourable load conditions, but which availability cannot be guaranteed.
- there exist different classes of terminals with different values for max throughput that can be provided to the user. Also, due to particular interference conditions, different terminals may adopt more or less favourable coding schemes. Still, we don't use these assumptions because the described realization of TSA is agnostic of the specific user exploiting the service.

DEFINITION OF ABSTRACTED RESOURCES

GSM Resource Status (RS)

[0042] The following characterization is defined in order to build the abstraction layers on something concrete. The information elements presented have the following requirements:

- They need to represent technology-specific resource abstractions.
- They need to significantly describe the status of the resources.
- They need to be obtainable, i.e. it must be possible to calculate them through specific modules.

[0043] We characterize GSM resource status (RS) as follows:

- C: a total fixed capacity, depending on the number of TRX/channels, in normalised kbit/s (normalised for a typical channel, e.g. voice under normal conditions - gross occupancy) [182.4 .. 8755.2 kbit/s]
- C(C), C(P): set of resources reserved to circuit (C) and packet (P) services [0 .. 8755.2 kbit/s]
- L: load parameter in normalised kbit/s indicating the gross total occupancy [0 .. 8755.2 kbit/s]
- L(RTC): load parameter in normalised kbit/s indicating the gross occupancy due to circuit RT services (voice) [0 .. 8755.2 kbit/s]
- L(RTP): load parameter in normalised kbit/s indicating the gross occupancy due to packet RT services (streaming)

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[0 .. 8755.2 kbit/s]

- L(NRT): load parameter in normalised kbit/s indicating the gross occupancy due to (packet) NRT services [0 .. 8755.2 kbit/s]

- L(S): load parameter in normalised kbit/s indicating the gross occupancy due to overheads including call signalling, L2 overheads and other overheads (BCCH, ... overhead not yet included in other parameters L(RTC), L(RTP), L (NRT)). [0 .. 8755.2 kbit/s]

- K(service): parameter indicating for every service the ratio between the net kbit/s of the user service (maximum for the best case, while possible) and the gross normalised kbit/s of the same service [k(service)].

    o k(conv) = 13 / 22.8 = 0.570

    o k(str) = 59.2 / 22.8 = 2.596

    o k(GPRS NRT) = 21.4 / 22.8 = 0.939

    o k(EGPRS NRT) = 59.2 / 22.8 = 2.596

- O(RTC): load parameter in normalised kbit/s indicating within L(RTC) the gross occupancy due to SURPLUS RT circuit services [0 .. 8755.2 kbit/s]. O(RTC)<L(RTC)

- O(RTP): load parameter in normalised kbit/s indicating within L(RTP) the gross occupancy due to SURPLUS RT packet services [0 .. 8755.2 kbit/s]. O(RTP)<L(RTP)

- S: load threshold above which the system does not accept requests for new guaranteed services (e.g. 0.75 (75%)).

[0044] 3GPP ALI (it is only used for the comparison with TSA ALI)
From 3GPP specifications, abstracted load information is characterized as follows:

- UL CCC: cell capacity class [1..100]
- DL CCC: cell capacity class [1..100]
- UL LV: load value [0..100] (linear, percentage of capacity)
- DL LV: load value [0..100]
- UL RTLV: RT load value [0..100] (linear, RT percentage of load value)
- DL RTLV: RT load value [0..100]
- UL NRTLI: NRT load indication [0..3] (low, medium, high, overload)
- DL NRTLI: NRT load indication [0..3]

TSA ALI (GSM)

[0045] We characterize abstracted load information in terms of "Transport Service Availability" (TSA), defined as follows:

- UL/DL information may be communicated separately or jointly.
- conversational TSA
- EGPRS streaming TSA
- GPRS NRT TSA
- EGPRS NRT TSA
- TSA includes: 1 bit for priority (high = 1, any = 0); 5 bits for max user bitrate according to a table, 1 bit for a quantity indicator (few / many).

ABSTRACTION LAYER ALGORITHMS

[0046] Abstraction layer algorithms are given for both 3GPP ALI and TSA ALI.
[0047] These algorithms are candidate for inclusion in the GLL Abstraction Layer, or in the abstraction layers below the ACS in general.

Algorithms GSM RS → 3GPP ALI (it is only used for the comparison with TSA ALI) Assumption:
MPL = 0.95 (maximum planned load as a fraction of the maximum capacity).
Algorithms:
CCC = C / 182.4 (in this way CCC will go from 1 to 48, allowing other technologies to go further up)
LV = (L / (C x MPL)) x 100
L(RT) = L(RTC) + L(RTP)
RTLV = (L(RT) / L) x 100
NRTOCC = L(NRT) / (C - L(RT) - L(S))
NRTLI = 0 [NRTOCC < 0.3]; 1 [NRTOCC < 0.6]; 2 [NRTOCC < 0.9]; 3 [NRTOCC ≥0.9].
Algorithms GSM RS → TSA ALI (GSM) (is part of the invention)
Assumptions:
prio = priority
MAXUB(service, prio) = maximum capacity that the system can give to a single user as a configuration setting. It may be allowed to vary depending on load condition (e.g. the higher the load, the smaller MAXUB)
CATS(service, prio) = Considerable Amount of Transport Services: threshold on the number of transport services determining discrimination between availability in quantity "few" or "many" for the same transport service. E.g. CATS = 2.

Algorithms:

[0048] With reference to **fig. 6 (leftmost part)**, the TSA ALI computation algorithm starts with the execution of step A1 in which one out of n foreseen services is selected; in the successive step A2 the Available Capacity is calculated as will be illustrated in **fig.7.** The sequential steps A3 and A4 are devoted to computation of MUB (fig.**8**) and Q (fig.**9**) parameters: MUB is the maximum capacity that the system can give to a single user according to Cavail and configuration settings. MUB can be expressed as an integer: note that an integer value already represents a quantization of a real value. In real messaging, it would need to be coded in a more compact format, e.g. by using n, where 2 at the power of n would indicate the approximate maximum user bitrate. Quantity QN indicates the available number of described bearers or transport services, while Q is a quantized description of QN indicating e.g. whether few (0) or many (1) of the described bearers are available. In the next step A5 the computation is iterated to the other services. When all services are completed, the BSC transmits MUB and Q Information Elements (IE) to other controllers in step A6. Alternatively, the transmission might be executed inside the loop.

[0049] With reference to **fig.7,** for any service and prio the Available Capacity is calculated as indicated in steps C1 to C6 described hereafter for the various services:

```
*/for all services /*
GL(RTC) (Guaranteed L(RTC)) = L(RTC) - O(RTC)
GL(RTP) = L(RTP) - O(RTP)
GL(RT) = GL(RTC) + GL(RTP)
*/ conversational /*
if GL (RTP) < C(P)
Cavail(conv, any prio) = (C - C(P) - GL(RTC) - L(S)) x k(conv)
else Cavail(conv, any prio) = (C - GL(RT) - L(S)) x k(conv)
if GL(RT)/C > S ≥Cavail(conv, prio 0) = 0
*/ streaming /*
if GL(RTC) < C(C)
Cavail(str, any prio) = (C-C(C)-GL(RTP)-L(S)) x k(str)
else Cavail(str, any prio) = (C-GL(RT) - L(S)) x k(str)
if GL(RT)/C > S → Cavail(str, prio 0) = 0
*/ NRT /*
if GL(RTC) < C(C)
Cavail(NRT) = C-C(C) - GL(RTP)-L(NRT) - L(S)
else Cavail(NRT) = C-GL(RT) - L(NRT)-L(S)
Cavail(GPRS NRT, any prio) = Cavail(NRT) x k(GPRS NRT)
Cavail(EGPRS NRT, any prio) = Cavail(NRT) x k(EGPRS NRT).
    With reference to fig.8 and fig.9, for any service and prio,
if Cavail(service, prio) ≥MAXUB(service, prio) then {
MUBN(service, prio) = MUB(service, prio) = MAXUB(service, prio);
QN = Cavail(service, prio) / MAXUB(service, prio);
if QN > CATS(service, prio) then Q(service, prio) = 1 else Q(service, prio) = 0;}
else {
MUBN = Cavail(service, prio);
```


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```
MUB(service, prio) = int (MUBN);
QN(service, prio) = Q(service, prio) = 0;}
endif
```

ALI EVALUATION ALGORITHMS

[0050] Algorithms are given for both 3GPP ALI and TSA ALI.

[0051] These algorithms are candidate for inclusion in MRRM, or in access selection algorithms within the ACS in general.

3GPP ALI evaluation algorithm (it is only used for the comparison with TSA ALI). Input variables: service, 3GPP ALI info of candidate target cells

Note: the (100 - Cell_Load) x Cell_Capacity_Class gives the absolute free capacity in the cell. This is what needs to be compared in order to decide the best cell load-wise, in order to take into account different cell sizes.

Note: thresholds mechanisms are not included because we assume LV is relative to "the maximum planned load".

[0052] We do not make straight connection between CCC and kbit/s because it was not meant by the 3GPP solution to do so.

service: conversational RT, streaming RT, GPRS NRT, EGPRS NRT;

```
if there is only one candidate target cell
ranking = 0 (i.e. service cannot fit in)
if (service = RT and LV < 100) ranking = 1 (i.e. service can fit in)
if (service = NRT and NRTLI < 3) ranking = 1
if there are two candidate cells (1, 2) to be compared
ranking(1) = 0;
ranking(2) = 0;
freecapacity:
FC(1) = (100-LV(1)) x CCC(1);
FC(2) = (100-LV(2)) x CCC(2);
if (service = RT)
if FC(1) ≥FC(2) and FC(1) > 0 then
 ranking(1) = 1;
 else
 if FC(2) > 0 then ranking(2) = 1;
endif
endif
if (service = NRT)
if NRTLI(1) ≤NRTLI(2) and NRTLI(1) < 3 then
 ranking(1) = 1;
 else
 if NRTLI(2) < 3 then ranking(2) = 1;
endif
endif
```

TSA ALI evaluation algorithm (is part of the invention)

[0053] With reference to **fig. 6 (rightmost part)**, the TSA ALI Evaluation algorithm starts with the execution of step E1 in which MUBs and Qs IEs transmitted by other BSCs are received. The successive steps E2 to E6 is a loop to check for each service the access selection criterion and, if passed, transmit an access selection command for that service towards a target cell. In the following the TSA ALI Evaluation algorithm is better detailed. Input variables: service, prio, bitrate, TSA ALI info of candidate target cells

```
if there is only one candidate target cell
if MUB(service, prio) ≥bitrate then ranking = 1; else ranking = 0;
if there are two candidate cells (1, 2) to be compared:
ranking(1) = 0;
ranking(2) = 0;
if Quantity(1, service, prio) ≥Quantity(2, service, prio) and MUB(1, service, prio) ≥bitrate
then
ranking(1) = 1;
else
if MUB(2, service, prio) ≥bitrate then ranking(2) = 1;
```


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```
endif.
```

EVALUATING TSA vs. 3GPP ALI PERFORMANCES (calculates the curves of **fig.10**)

[0054] Now 3GPP and TSA approaches are compared within a scenario characterized by a single target cell, where a controller has to decide if a given service fits or not in the target cell based on the ALI.

[0055] The comparative evaluation algorithm provides estimation of the difference in admission control success rate implied by use of 3GPP ALI vs. TSA ALI. By performing the evaluation for different values of minimum cell load, we obtain curves. The method is rather fast, since each RS configuration is considered only once.

[0056] The comparative algorithm does not emulate variations in the RS that could allow measuring the effects of aged information on both 3GPP ALI and TSA ALI. However, results show that TSA performs better then capacity/load even when generation and evaluation of the abstractions are done simultaneously.

[0057] Variables and parameters considered in the evaluation includes: Service type; Resource status.

Service type

[0058] The following service types are considered:

1. Conversational, MUB =13 kbit/s (Max User Bitrate), prio = 1 (e.g. handover)
2. Conversational, MUB =13 kbit/s, prio = 0 (e.g. new service request)
3. EGPRS streaming, MUB = 59.2 kbit/s, prio = 1
4. EGPRS streaming, MUB = 59.2 kbit/s, prio = 0
5. GPRS NRT, MUB = 21.4 kbit/s
6. EGPRS NRT, MUB = 59.2 kbit/s

Resource Status (RS)

[0059] The RS Information elements: C, C(C), C(P), L, L(RTC), L(RTP), L(NRT), L(S), K(channel), O(RTC), O(RTP) and S have been already defined.

Setting GSM RS parameters and variable limits

[0060] In the following, we assign values to GSM RS parameters and variable limits. Parameters:

- TRX = 182.4 kbit/s
- C = 5 x TRX kbit/s
- C(C) = 2 x TRX kbit/s
- C(P) = 1 x TRX kbit/s
- K(channel):
    - o k(conv) = 13 / 22.8 = 0.570
    - o k(EGPRS str) = 59.2 / 22.8 = 2.596
    - o k(GPRS NRT) = 21.4 / 22.8 = 0.939
    - o k(EGPRS NRT) = 59.2 / 22.8 = 2.596
- S = 0.75
- Sigmin = 0.04
- Sigmax = 0.08
- Op = 0.5
- Step = 8 kbit/s
- StepSig = 0.01
- Lmin: 60% = 0.6*C = 1094.4 kbit/s (we emulate loaded situations only, therefore the overall load ≥Lmin)

Variable limits:

- L [C x Lmin .. C kbit/s]
- L(RTC) [0 .. (C - C(P)) kbit/s]
- L(RTP) [0 .. (C - C(C)) kbit/s]

- L(NRT) [0 .. (C - C(C)) kbit/s]
- L(S) [Sigmin x L .. Sigmax x L kbit/s]
- O(RTC) [0 .. Op x L(RTC)]
- O(RTP) [0 .. Op x L(RTP)]

COMPARATIVE EVALUATION ALGORITHM

[0061] This algorithm goes through each configuration of interest for the RS and performs evaluation.

```
Count = 0;
Errcount(..) = 0;
Cc = C-C(P);
For L(RTC) = 0 to Cc step = Step
{Coc = Op x L(RTC);
Cp = min (C-C(C), C-L(RTC));
For O(RTC) = 0 to Coc step = Step
{For L(RTP) = 0 to Cp step = Step
  Cop=Op x L(RTP);
 {For O(RTP) = 0 to Cop step = Step
   {Lrt = L(RTC) + L(RTP);
     Cnrt= Cp - L(RTP);
     For L(NRT) = 0 to Cnrt step = Step
     {Lt = Lrt + L(NRT);
      For Sig = Sigmin to Sigmax step StepSig
      {L(S) = Lt x Sig;
        L = Lt + L(S);
        if L ≤C and Lmin < L
        {Count = Count + 1;
          For any service:
          {Errcount(service) = Errcount(service) + XOR (ALlevaluation(service,
3GPP ALI (RS)), ALlevaluation(service, TSA ALI (RS));}}}}}}}}.
```

[0062] The next **figures 11, 12,** and **13** report some future 3GPP and WiMAX network architectures candidate to host the present invention.

[0063] With reference to fig.**11**, 3GPP System Architecture Evolution (SAE) is a recent architectural development for the 3GPP system reported as a feasibility study in 3GPP TR 23.882 v1.9.0, "3GPP System Architecture Evolution: Report on Technical Options and Conclusions (Release 7)", March 2007.

[0064] SAE is composed by an Evolved Packet Core (EPC) that connects to several access networks, other core networks (including the legacy GPRS core network) and external elements. External elements include Policy and Charging Rules Function (PCRF, interface S7), Home Subscriber Server (HSS, interface S6), Operator IP Services or external Packed Data Networks (interface SGi). In particular, EPC connects to several access networks including Evolved RAN (also called LTE RAN, interface S1), trusted non-3GPP IP access including trusted fixed IP access (interface S2a), VVLAN access network. Within the EPC, the Mobility Management Entity (MME) and User Plane Entity (UPE) connect to the Evolved RAN (interface S1), the enhanced Packet Data Gateway (ePDG) connects to the VVLAV access network, while the inter Access System Anchor (IASA) connects to trusted non-3GPP IP access (interface S2a) and external Packet Data Networks (interface SGi). Regarding the elements within EPC, MME/UPE connects to IASA through interface S5a, IASA connects to ePDG through interface S2b. IASA is formed by the two additional elements 3GPP Anchor and SAE Anchor connected through S5b. EPC and GPRS Core networks may be interconnected in several ways (interfaces S3 and S4), for example through MME/UPE or through IASA. It should be noted that the presented SAE architecture is not the finalized architecture model for the evolved system, i.e. it does not contain all functions/interfaces required, and some functions/interfaces may be added, deleted or modified in the course of the key issue discussions within 3GPP.

[0065] With reference to fig.**12**, 3GPP Evolved RAN, or Long Term Evolution (LTE) RAN, or evolved UTRAN (E-UTRAN), is a recent architectural development for future 3GPP radio access networks, described in 3GPP TR25.813 v710. The LTE RAN is composed by Enhanced-NodeBs (E-NodeBs), directly interfacing to user terminals through antennas, connected to each other through interface X2, and connected to the EPC and in particular to an access Gateway through the interface S1 already described.

[0066] With reference to fig.13, the WiMAX Access Network is another access network being described in the IEEE 802.16 protocol suite and in documents originated by the WiMAX Forum. The WiMAX Access Network is composed by Base Stations (BS), directly interfacing to user terminals through antennas, possibly connected to each other through

respective interfaces, and connected to the Edge Router (also called Broadband Remote Access Server) through a respective interface. The WiMAX Access Network can connect to the 3GPP system via a Packet Data Gateway, ePDG or through an external Packet Data Network like the Internet.

[0067] In particular, TSA information along with its elements MUB and Q can be exchanged between entities such as E-NodeB, Access Gateway, MME/UPE, IASA, EPC, GPRS Core, BS, Edge Router and the controllers of any access network on the respective interfaces. For a GSM cell, TSA information can be exchanged between GERAN, GPRS Core and EPC, towards any relevant controller.

USED ACRONYMS

[0068]

3GPP	3rd Generation Partnership Program
ACS	Ambient Control Space
ALI	Abstracted Load Information
AMR	Adaptive Multi-Rate
AN	Ambient Network
ANI	Ambient Networks Interface
ARI	Ambient Resource Interface
ASI	Ambient Service Interface
BCCH	Broadcast Control CHannel
BS	Base Station
BSC	Base Station Controller
CS	Circuit Switched
DL	Downlink
E-NodeB	Enhanced NodeB
e-PDG	Packet Data Gateway
EGPRS	Enhanced GPRS
EPC	Evolved Packet Core
FC	Free Capacity
GERAN	GSM EDGE Radio Access Network
GLL	Generic Link Layer
GPRS	General Packet Radio Service
GSM	Global System for Mobile communications
HP	High Priority
HSS	Home Subscriber Server
HTTP	Hyper Text Transfer Protocol
IASA	Inter Access System Anchor
IE	information Element
IEEE	Institute of Electrical and Electronics Engineers
IMS	IP Multimedia Subsystem
IP	Internet Protocol
IST	Information Society Technologies
LP	Low Priority
LTE	3GPP Long Term Evolution
MME	Mobility Management Entity
MPL	Maximum Planned Load
MRRM	Multi-Radio Resource Management
NRT	Non Real Time
NRTLI	Non Real Time Load Information
NSN	Nokia Siemens Networks
NW	Network
PCRF	Policy and Charging Rules Function
PS	Packet Switched
PSS	Packet-Switched Streaming service
QoS	Quality of Service
RA	Routing Area
RAN	Radio Access Network

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RAT	Radio Access Technology
RNC	Radio Network Controller
RRM	Radio Resource Management
RS	Resource Status
RT	Real Time
SAE	3GPP System Architecture Evolution
SGSN	Serving GPRS Support Node
TRX	Transceiver
TSA	Transport Service Availability
UE	User Equipment
UL	Uplink
UMTS	Universal Mobile Telecommunication System
UPE	User Plane Entity
UTRAN	Universal Terrestrial Radio Access Network
WiMAX	Worldwide Interoperability for Microwave Access
WLAN	Wireless Local Area Network

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[0069]

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Claims

1. Radio resource management method in a mobile radio communication network employing different radio access technologies (UTRAN, GERAN, LTE, WiMAX) that overlap over a geographic area subdivided into cells belonging to the domains of respective controllers (RNC, BSC, E-NodeB, BS), including the following steps carried out by every controller for each controlled cell:

   d) calculating a transport service availability information element, called hereafter MUB, describing the availability of transport services in terms of maximum user bitrate that can currently be allowed to each transport service, separately for uplink and downlink, needed to plan usage of radio resources in the current and neighbouring cells, such as for handovers, cell reselections and new service setups;
   e) including said MUB information elements into management messages forwarded to the other controllers, either of the same or different technologies;
   f) checking said MUB information elements coming from the other controllers (BSC, RNC, E-NodeB, BS) in order to decide on the most suited target cell, among the current and neighbouring cells, for resource management issues such as handover, cell reselection, and new service setup;

   characterised in that said calculating step a) includes in its turn the following steps executed for each implemented service **characterised by** service type and high/low priority:

   a1) calculating an available capacity for a given service by taking a normalised capacity accessible to said service and by subtracting to it a normalized load of said service and of any other service that cannot be pre-empted by said service;
   a2) calculating a MUBN parameter for said service as the minimum between said available capacity and the maximum capacity MAXUB allowed to the single user for said service as a configuration setting;

a3) calculating a quantized representation MUB of the MUBN for said service for transmission over digital transmission means.

2. The method of claim 1, **characterized in that** said calculating step a) further includes for said service the steps of:

a4) calculating a parameter QN associated to MUB for said service and describing the number of available services of bitrate MUBN as the ratio between the available capacity and MUBN;
a5) calculating a parameter Q associated to MUB for said service as a quantized representation of QN for transmission over digital transmission means.

3. The method of claim 1, **characterized in that** in said step a1) the accessible capacity is either:

- all capacity accessible to the given service type for the highest service priority of said service or
- a percentage of all capacity accessible to the given service type according to a respective load threshold set for lower service priorities.

4. The method of claim 1, **characterized in that** said step a1) further includes the steps of:

- calculating the capacity accessible to said service by taking the total fixed cell capacity and by subtracting to it any capacity reserved to other services;
- considering the load of any other service that cannot be pre-empted by said service only in the portion of allocation into the capacity accessible to said service.

5. The method of claim 1, **characterized in that** said step a1) further includes subtracting the capacity allocated for control signalling in the portion of allocation into the capacity accessible to said service.

6. The method of claim 1, **characterized in that** said step a1) further includes considering the load of said service and of any other service that cannot be pre-empted by said service only in the portion required for providing a guaranteed Quality of Service, excluding any surplus resources currently given to said services.

7. The method of claim 1, **characterized in that** in said step a1) further includes using a conversion factor for translating normalised values of available capacity in net user bitrate indications of the same available capacity.

8. The method of claim 1, **characterized in that** in said step a2) further includes dynamically set in time the MAXUB as a function of the available capacity for the same service.

9. The method of claim 4, **characterized in that** further includes dynamically set in time said reserved capacities according to policies, current resource usage, resource bookings.

10. The method of claim 3 and 4, **characterized in that** further includes setting load thresholds on the reserved capacities for limiting access to the same capacities to a related portion, limiting **in that** the capacity accessible for lower service priorities.

11. The method of any claim from 1 to 10, **characterized in that** said MUB concerns conversational circuit-switched services.

12. The method of any claim from 1 to 10, **characterized in that** said MUB concerns Enhanced GPRS streaming services.

13. The method of any claim from 1 to 10, **characterized in that** said MUB concerns non-real-time GPRS services.

14. The method of any claim from 1 to 10, **characterized in that** said MUB concerns non-real-time Enhanced GPRS services.

15. The method of any claim from 1 to 10, **characterized in that** said MUB concerns low priority services.

16. The method of any claim from 1 to 10, **characterized in that** said MUB concerns high priority services.

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17. The method of claim 1, **characterized in that** when a cell is evaluated as a potential target for a given service, said checking step c) includes in its turn the following steps:

c1) selecting for said cell the MUB information corresponding to said service;
c2) checking if the MUB information indicates the availability of the required bitrate for said service, in which case the cell is a suitable target cell.

18. The method of claim 2, **characterized in that** when two or more cells are compared as a potential target cells for a given service, said checking step c) includes in its turn the following steps:

c1) selecting for said cells the MUB information corresponding to said service;
c2) checking if the MUB information indicates the availability of the required bitrate for said service, in which case the cells satisfying this requirement are suitable target cells;
c3) checking the Q information element associated to said MUB information of different suitable target cells and selecting the cell with highest Q as the best target cell.

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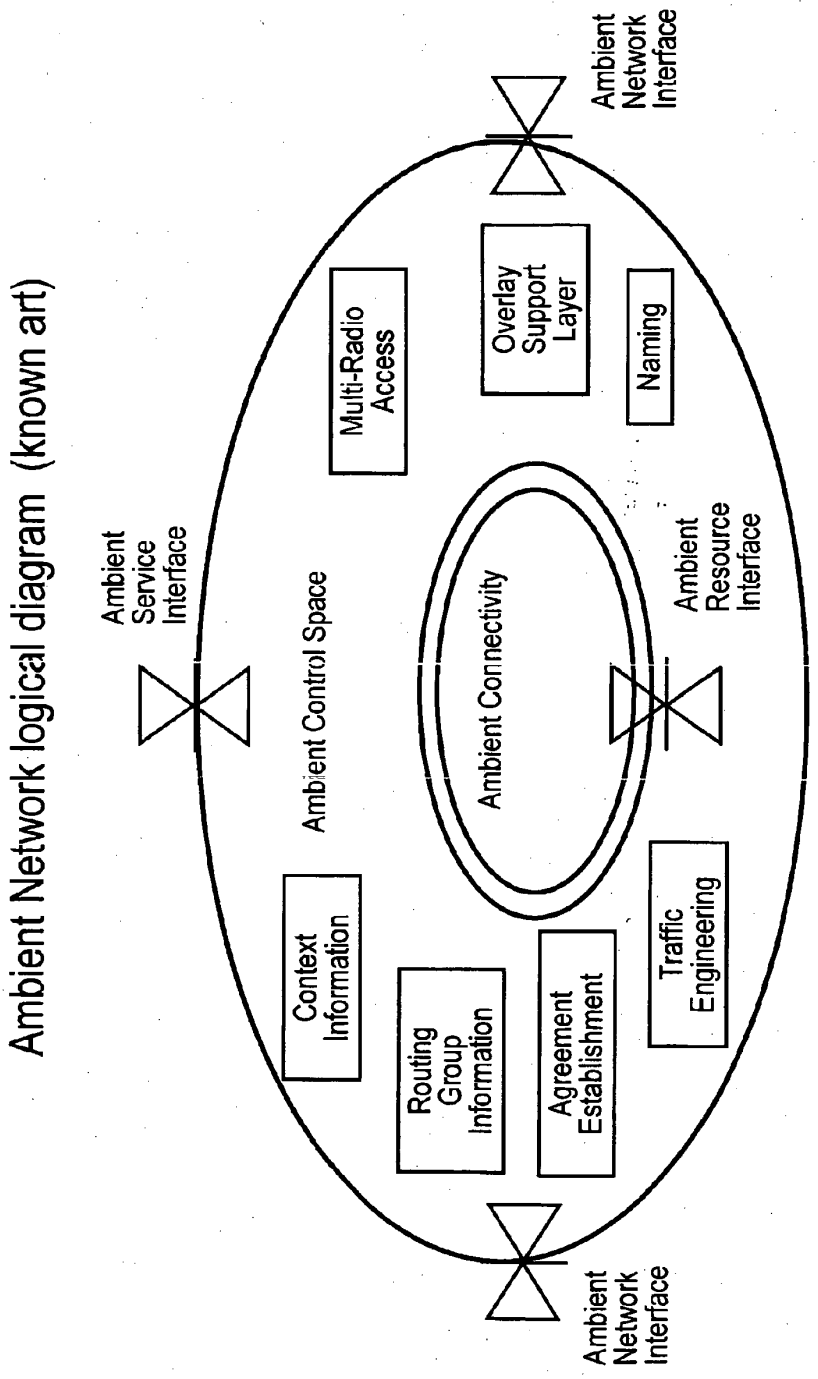


FIG. 1

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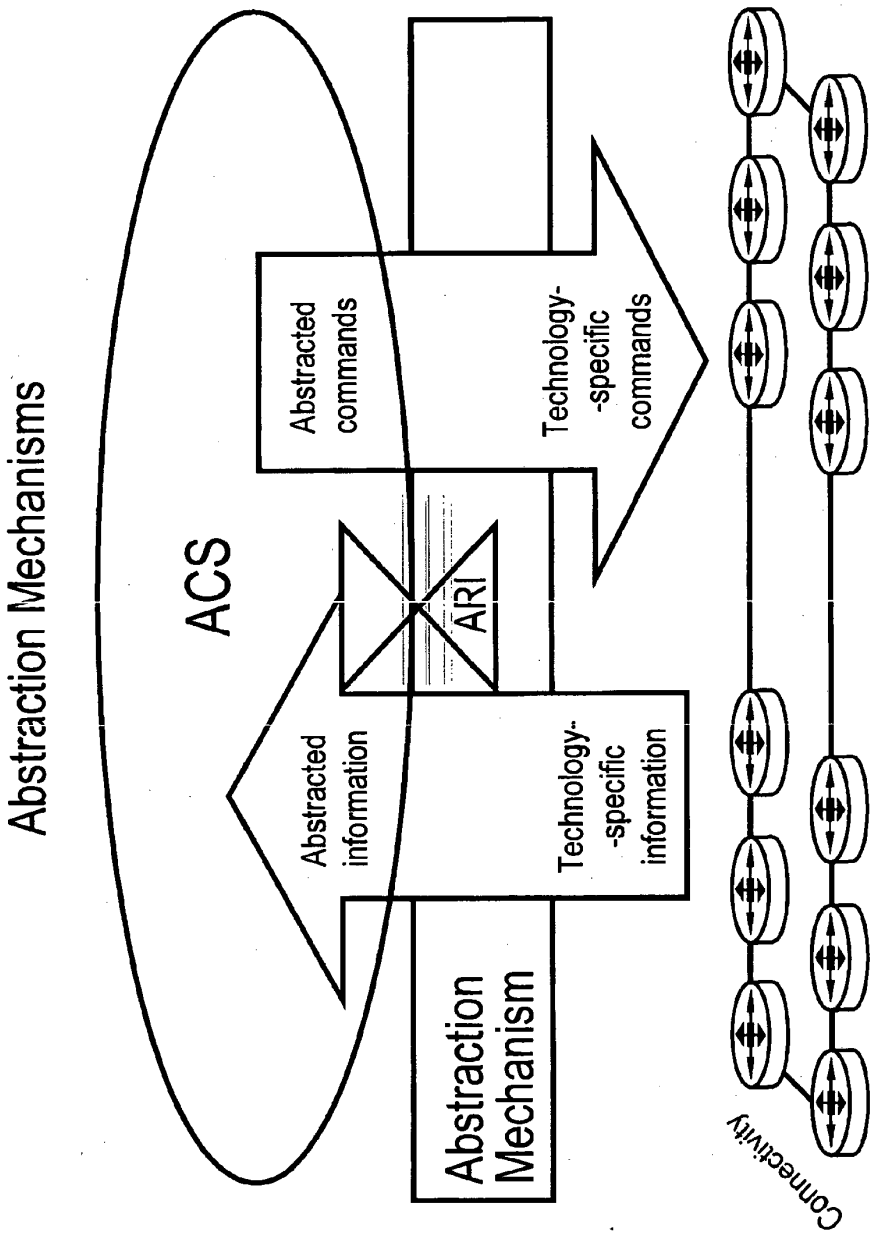


FIG. 2

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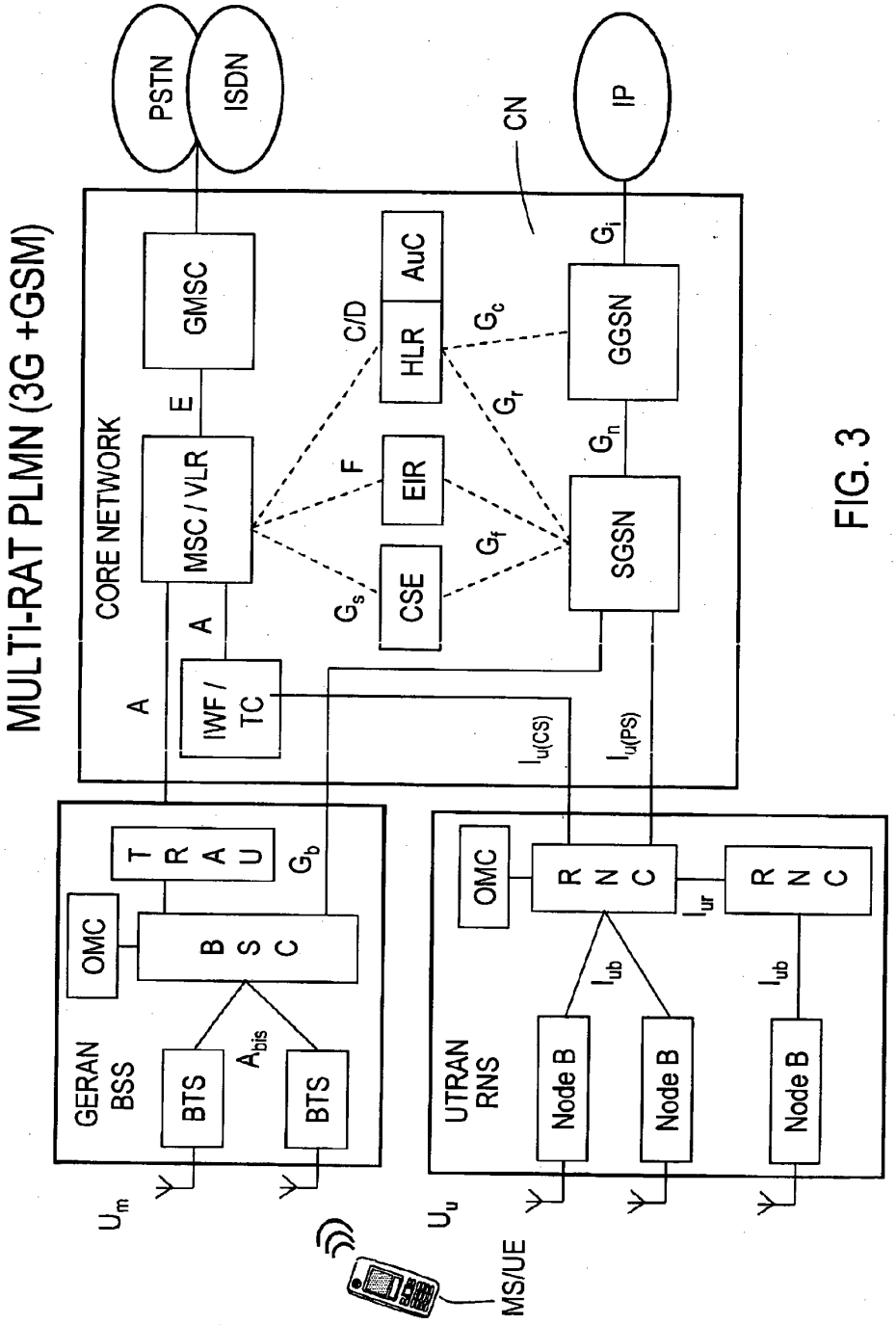


FIG. 3

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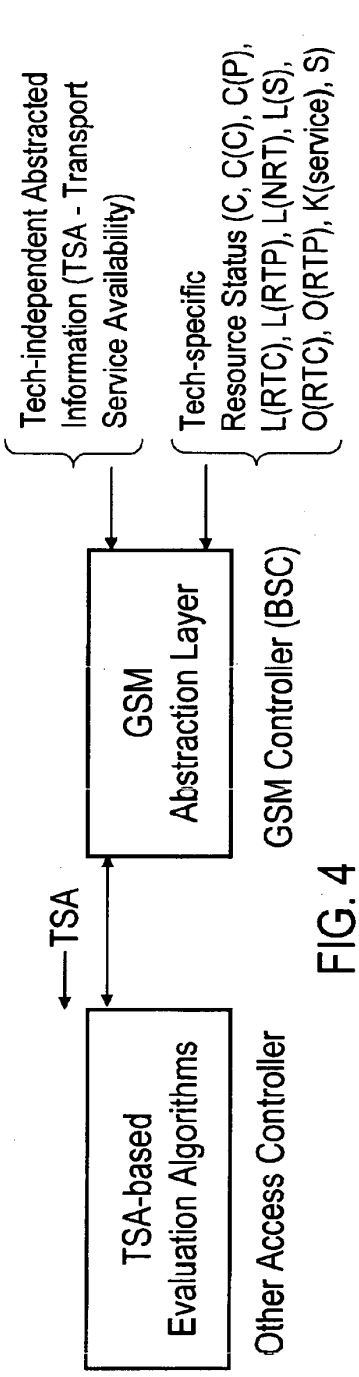


FIG. 4

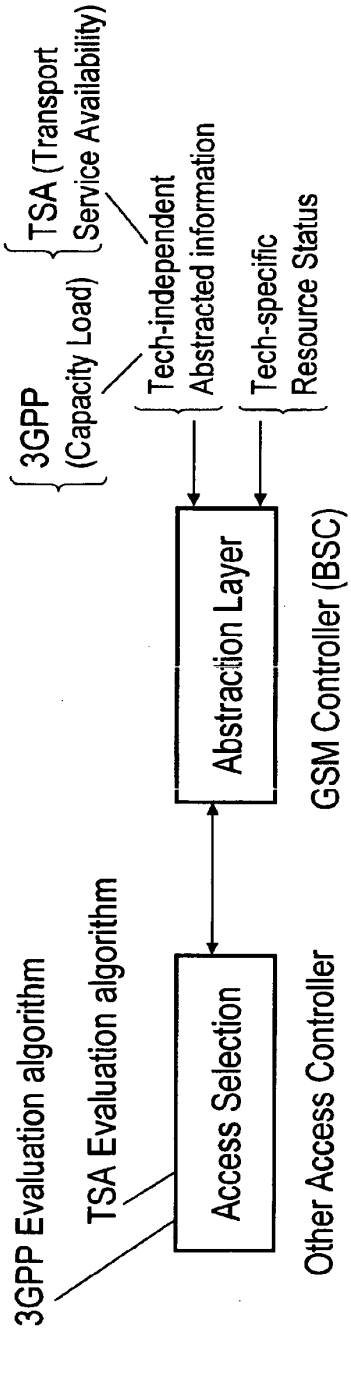


FIG. 5

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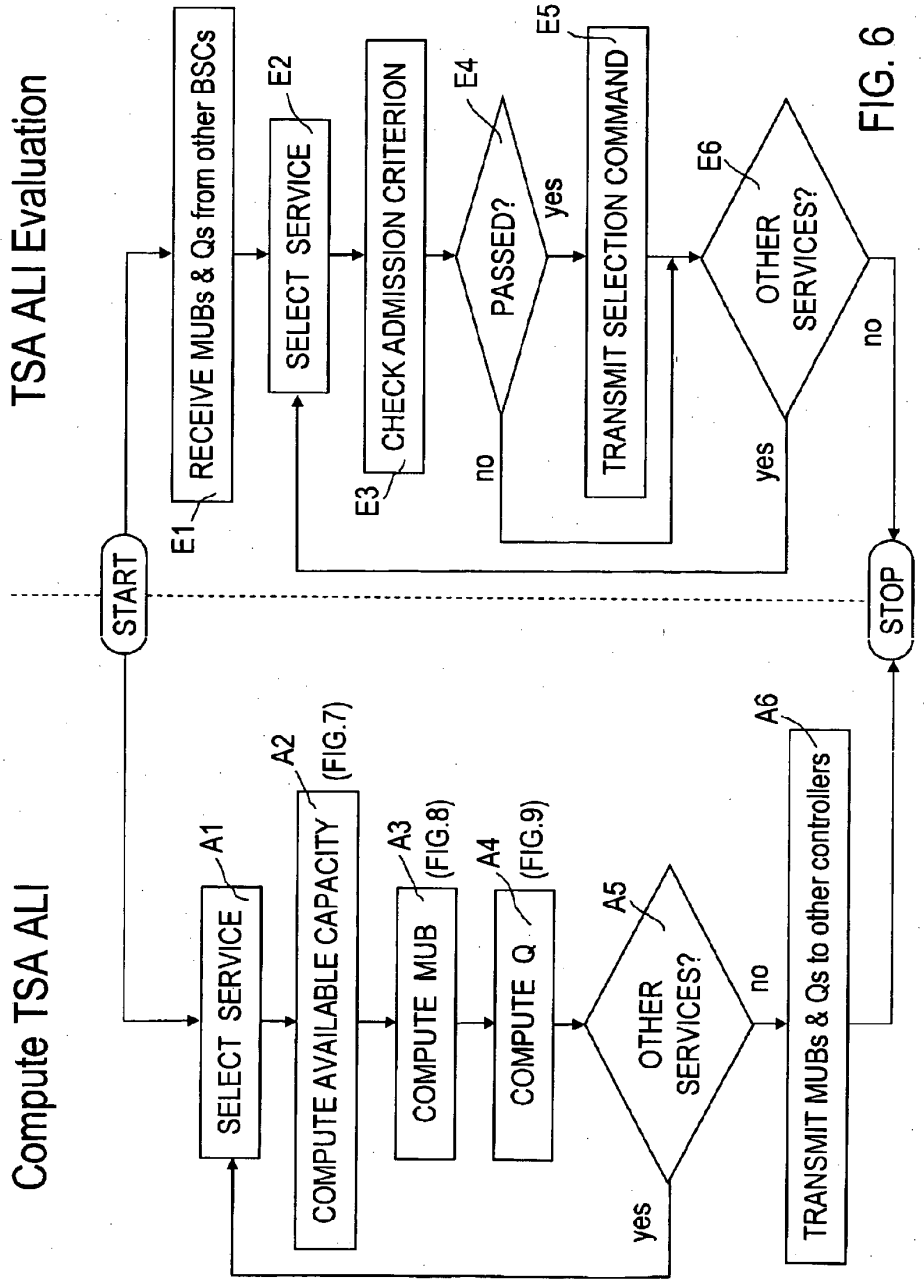


FIG. 6

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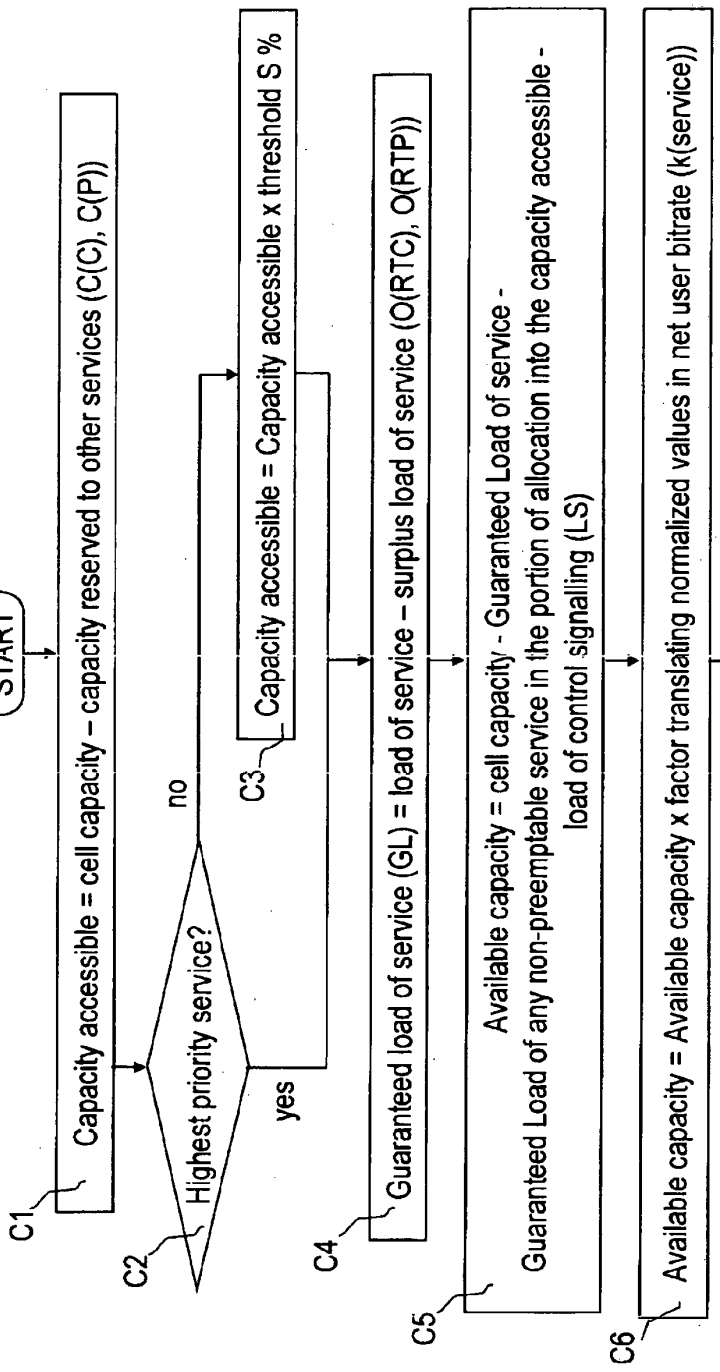


FIG. 7

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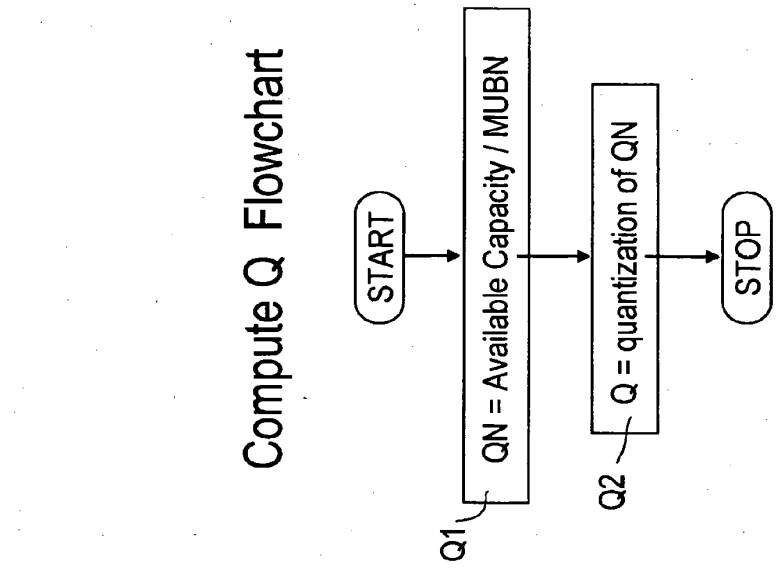


FIG. 9

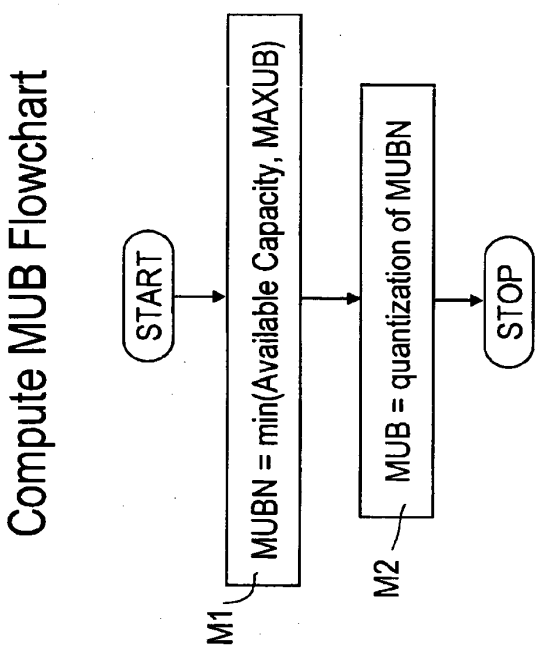


FIG. 8

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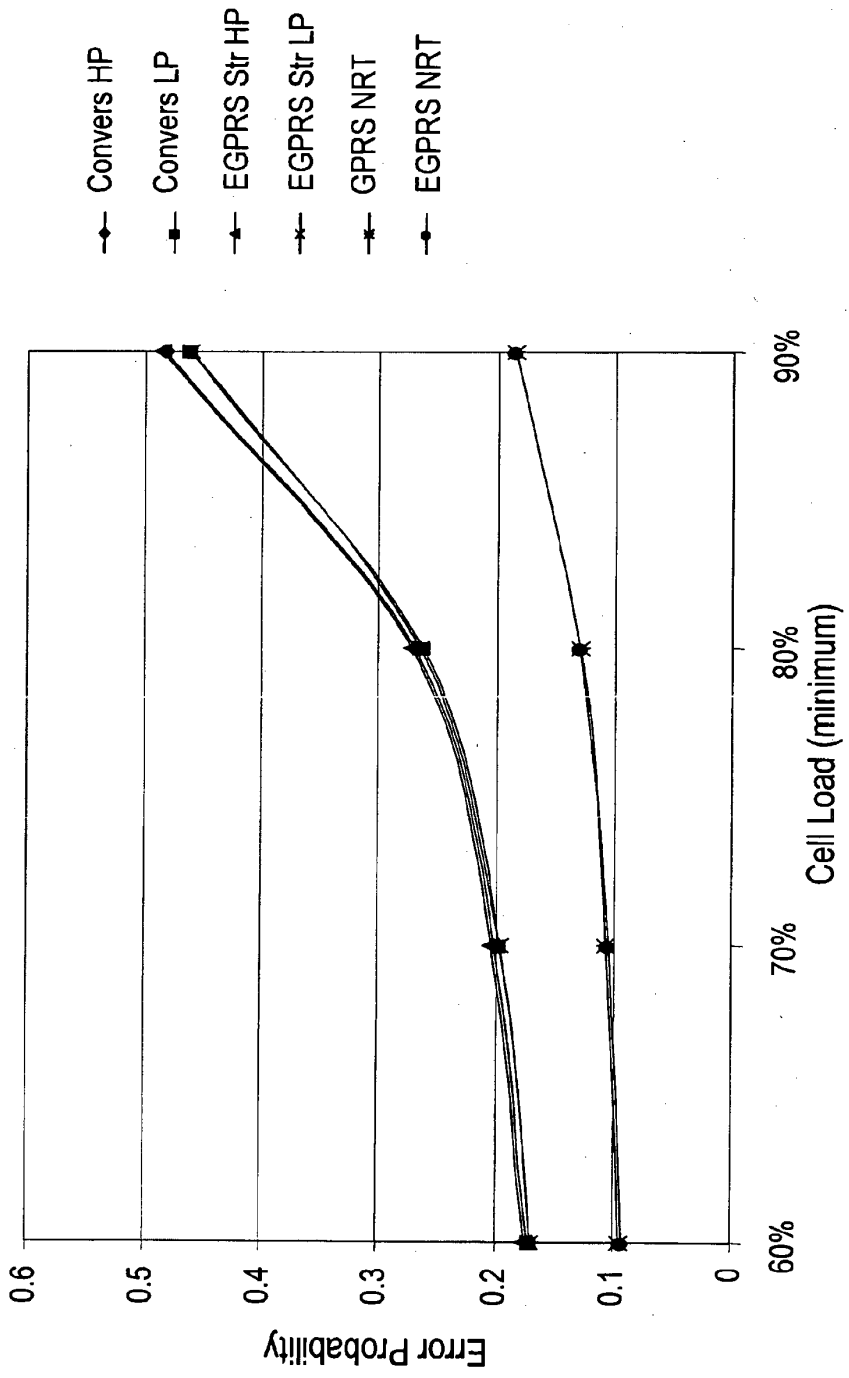


FIG. 10

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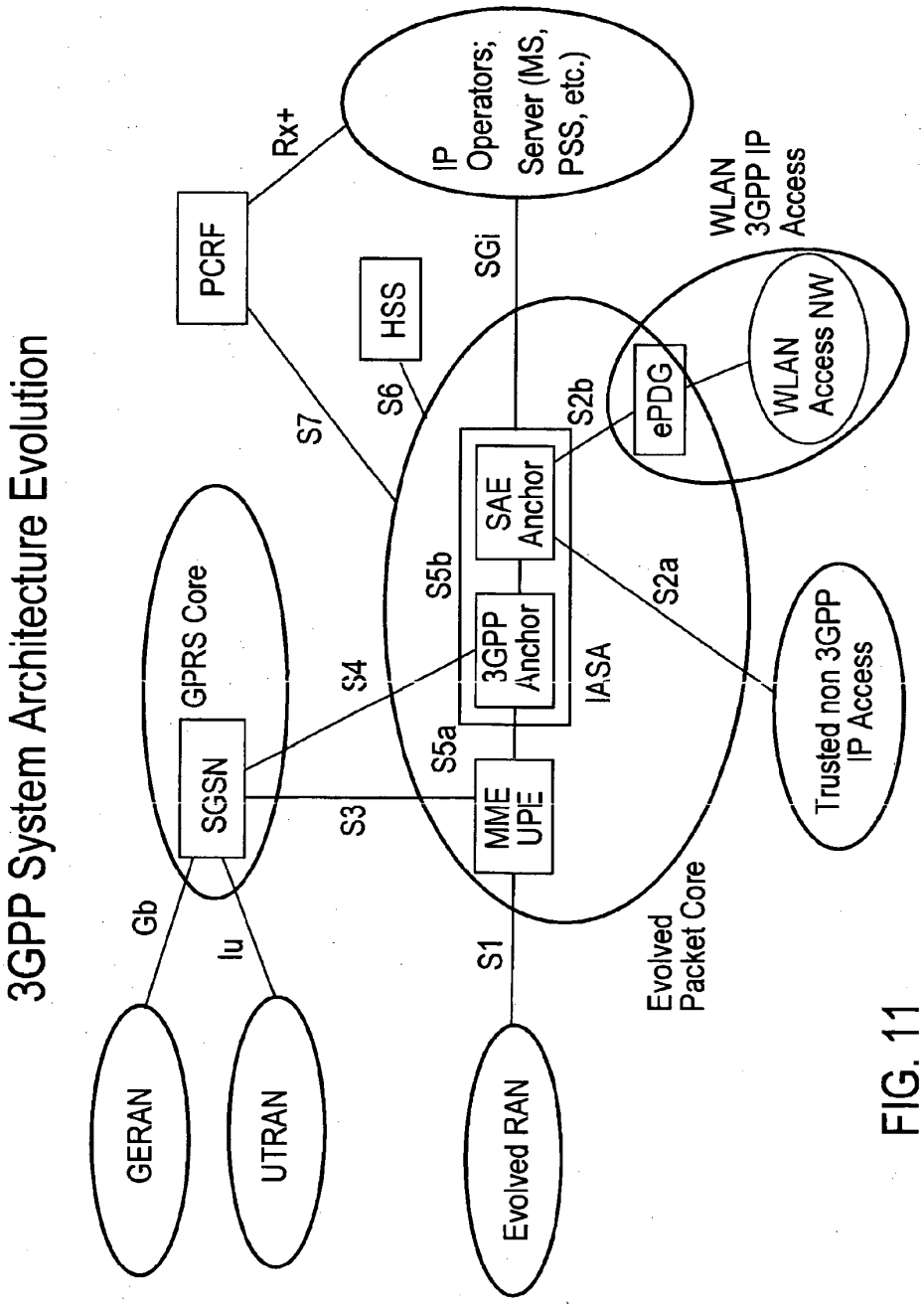


FIG. 11

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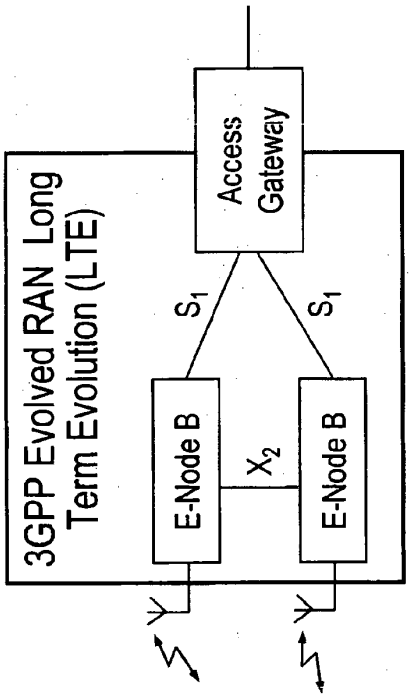


FIG. 12

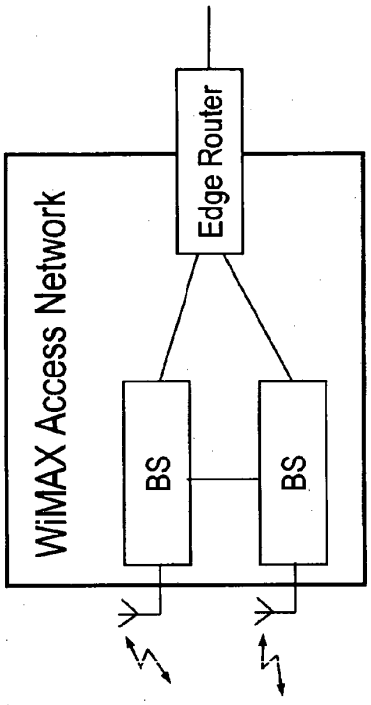


FIG. 13

BNSDOCID: <EP_____2026514A1_I_>

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 42 5527

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Y	US 6 804 222 B1 (LIN WEI [US] ET AL) 12 October 2004 (2004-10-12) * abstract * * column 12, line 41 - column 13, line 11 * -----	1-18	
A	US 2003/117951 A1 (WIEBE MARVIN JAKE [CA] ET AL) 26 June 2003 (2003-06-26) * abstract * -----	1-18	
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			TECHNICAL FIELDS SEARCHED (IPC) H04L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	13 February 2008	Wolf, William

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 07 42 5527

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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13-02-2008

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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

BNSDOCID: <EP_____2026514A1_I_>

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BNSDOCID: <EP_____2026514A1_I_>

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 942 698 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
09.07.2008 Bulletin 2008/28

(51) Int Cl.:
H04Q 7/38 (2006.01)

(21) Application number: **08250053.9**

(22) Date of filing: **07.01.2008**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR
Designated Extension States:
AL BA MK RS

(30) Priority: **07.01.2007 US 879318 P**
22.06.2007 US 821598
22.06.2007 US 821597

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(54) Method and system for mobile device activation

(57) Methods, systems and graphical user interfaces that facilitate activation of mobile devices, such as communication devices or multi-function devices, via computers are disclosed. According to one embodiment, activation of a mobile device with respect to a wireless service provider can be performed by users through use of a computer (e.g., personal computer) that communicate with a remotely located activation server. According to another embodiment, graphical user interfaces can be presented to users so as to enable end users to easily activate mobile devices.

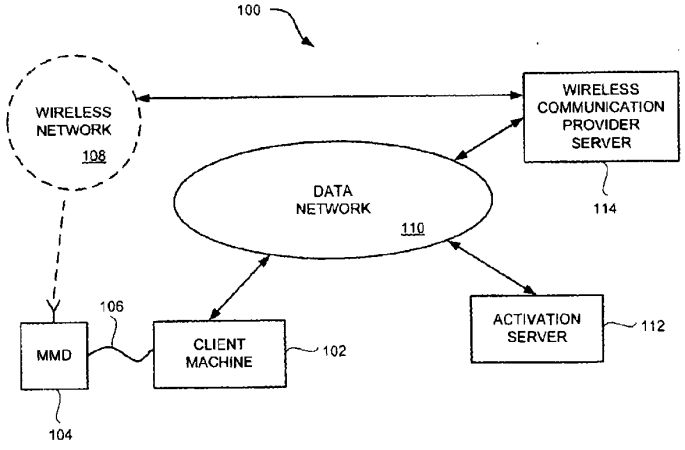


FIG. 1

Printed by Jouve, 75001 PARIS (FR)

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to mobile electronic devices and, more particularly, to activation of mobile electronic devices having wireless communication capabilities.

Description of the Related Art

[0002] Mobile phones are often used by individuals on a personal basis. When a mobile phone is newly acquired, the wireless network infrastructure (e.g., cellular phone network) of the appropriate wireless carrier or service provider needs to be setup to work with the mobile phone. Mobile phone setup is principally done at retail establishments that sell mobile phones and wireless service plans. Alternatively, mobile phones can be configured at a manufacturing or distribution site or at a service center. Unfortunately, however, mobile phone setup is time consuming and restrictive to consumers. Additionally, once a mobile phone and service plan have been setup for a consumer, the wireless network needs to be informed of the mobile phone and the mobile phone thereafter needs to register with the wireless network whenever being used. Registration requires a location update request be sent from the mobile phone to the wireless network. In the case of initial phone setup, since location update is triggered on power-up, typically the person configuring the mobile phone would be required to power-off and then power-on the mobile phone to render it active on the wireless network. There is thus a need to avoid the various inconveniences and inefficiencies of conventional mobile phone setup.

SUMMARY OF THE INVENTION

[0003] The invention pertains to methods, systems and graphical user interfaces that facilitate setup or activation of mobile devices, such as communication devices or multi-function devices, via computers. According to one embodiment, activation of a mobile device with respect to a wireless service provider can be performed by users through use of a computer (e.g., personal computer) that communicate with a remotely located activation server. According to another embodiment, graphical user interfaces can be presented to users so as to enable end users to easily activate mobile devices.

[0004] The invention can be implemented in numerous ways, including as a method, system, device, apparatus, graphical user interface, or computer readable medium. Several embodiments of the invention are discussed below.

[0005] As a computer-implemented method for activating wireless network service for an electronic device through use of a host device, where the electronic device is associated with a customer for wireless network service provided by a wireless network service provider, one embodiment can, for example, include at least the acts of: receiving device information from the electronic device when the electronic device is attached to the host device; acquiring customer information pertaining to the customer; receiving a service plan selection from the customer; receiving billing information for payment of the service plan; and initiating activation of a wireless service account for use of the electronic device with the wireless network service provided by the wireless network service provider. The wireless service account being activated can be based on the customer information, the service plan and the billing information.

[0006] As a computer-implemented method for activating an electronic device for wireless network service through use of a host device, where the electronic device is associated with a customer for wireless network service provided by a wireless network service provider, one embodiment can, for example, include at least the acts of: receiving device information from the electronic device while the electronic device is attached to the host device; acquiring customer information pertaining to the customer; offering the user one or more service plans; receiving a user selection of one of the service plans; and receiving billing information for payment of the selected service plan.

[0007] As a computer-implemented method for activating an electronic device for wireless network service from a host device, where the electronic device is associated with a customer for wireless network service provided by a wireless network service provider, one embodiment can, for example, include at least the acts of: receiving device information from the electronic device when the electronic device is attached to the host device; determining whether the electronic device has already been activated based on the device information; and automatically initiating activation of the electronic device when it is determined that the electronic device has not already been activated.

[0008] As a graphical user interface to assist an end user in activating an account for an electronic device having wireless communication capabilities, where the account is with respect to a wireless service provider providing wireless network service, one embodiment of the invention can, for example, include at least a plurality of displayable pages that are presented on a display device associated with a host computer. The displayable pages can, for example, include: an end user status page to facilitate selection of a type of activation; a service plan selection page to facilitate selection of a service plan for the wireless network service; a media account page for a media account associated with an online media store so that a user can create a new media account or login to an existing media account; an end user information entry page to facilitate entry of end user information; a billing information page to facilitate entry of billing infor-

mation for one or both the user media account and a wireless account; a terms and conditions page regarding legal agreements with the online media store and with the wireless service provider; and/or an activation page to inform the end user of activation information.

[0009] As a computer-implemented method for activating an electronic device for wireless network service, where the electronic device is associated with a customer of a wireless service provider associated with the wireless network service, one embodiment can, for example, include at least the acts of: informing an activation server of an electronic device having wireless communication device that is to be activated for wireless network service; displaying a customer status page to facilitate selection of a type of activation; specifying to the activation server a type of activation desired by the customer; displaying a service plan selection page to facilitate selection of a service plan for the wireless network service; informing the activation server of a selected service plan; displaying a customer account page to facilitate login to or creation of a user media account with an online media store; providing account information for the user media account for the customer; displaying a customer information entry page; providing customer information to the activation server; displaying a billing information page to facilitate entry of billing information for one or both the user media account and a wireless account; informing the activation server of the billing information; displaying a terms and conditions page regarding legal agreements with the online media store and with the wireless service provider; informing the activation server of acceptance of the legal agreements; displaying an information review page; informing the activation server of approval of the information provided on the information review page; displaying an activation completion page; and displaying a device preference page to assist the customer with setting one or more preferences or options to be applied to the operation of the electronic device.

[0010] As a computer readable medium including at least computer executable program code tangibly embodied therein for activating wireless network service for an electronic device through use of a client computing device, the electronic device being associated with a customer for wireless network service provided by a wireless network service provider, one embodiment can, for example, include at least: computer program code for receiving device information from the electronic device when the electronic device is attached to the host device; computer program code for acquiring customer information pertaining to the customer; computer program code for receiving a service plan selection from the customer; computer program code for receiving billing information for payment of the service plan; and computer program code for initiating activation of a wireless service account for use of the electronic device with the wireless network service provided by the wireless network service provider.

[0011] As a computer readable medium including at least computer executable program code tangibly embodied therein for activating an electronic device for wireless network service through use of a host device, the electronic device being associated with a customer for wireless network service provided by a wireless network service provider, one embodiment can, for example, include at least: computer program code for receiving device information from the electronic device while the electronic device is attached to the host device; computer program code for acquiring customer information pertaining to the customer; computer program code for offering the user one or more service plans; computer program code for receiving a user selection of one of the service plans; and computer program code for receiving billing information for payment of the selected service plan.

[0012] Other aspects and advantages of the invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings which illustrate, by way of example, the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The invention will be readily understood by the following detailed description in conjunction with the accompanying drawings, wherein like reference numerals designate like structural elements, and in which:

[0014] FIG. 1 is a block diagram of an activation system according to one embodiment of the invention.

[0015] FIG. 2A is a flow diagram of a system activation process according to one embodiment of the invention.

[0016] FIG. 2B is a flow diagram of a setup process according to one embodiment of the invention.

[0017] FIG. 3 is a flow diagram of a device operational process according to one embodiment of the invention.

[0018] FIG. 4 is a flow diagram of a device operation process according to another embodiment of the invention.

[0019] FIG. 5 is a system state diagram according to one embodiment of the invention.

[0020] FIGs. 6A-6C are flow diagrams of a network service setup process according to one embodiment of the invention.

[0021] FIG. 6D is a flow diagram of an alternative portion of the network service setup process according to one embodiment of the invention.

[0022] FIG. 7 is a flow diagram of a network service setup process according to one embodiment of the invention.

[0023] FIGs. 8A-8C are flow diagrams of an activation process according to one embodiment of the invention.

[0024] FIG. 9 is a flow diagram of an activation process according to another embodiment of the invention.

[0025] FIG. 10 is a flow diagram of an activation process according to another embodiment of the invention.

[0026] FIG. 11 is a flow diagram of an activation process according to another embodiment of the invention.

[0027] FIGs. 12A-12C are flow diagrams of a mobile

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device provisioning process according to one embodiment of the invention.

[0028] FIG. 13 is a screen shot of an exemplary initial registration page according to one embodiment of the invention.

[0029] FIG. 14 is a screen shot of an exemplary customer status page according to one embodiment of the invention.

[0030] FIG. 15 is a screen shot of an exemplary screen shot of a mobile number transfer page.

[0031] FIG. 16 is a screen shot of an exemplary screen shot of a landline number transfer page.

[0032] FIG. 17A and 17B are screen shots of an exemplary service plan selection page according to one embodiment of the invention.

[0033] FIG. 18 is a screen shot of an exemplary customer account page according to one embodiment of the invention.

[0034] FIG. 19 is a screen shot of a customer information entry page according to one embodiment of the invention.

[0035] FIG. 20 illustrates an exemplary billing information page according to one embodiment of the invention.

[0036] FIG. 21A is an exemplary screen shot of a first terms and conditions page according to one embodiment of the invention.

[0037] FIG. 21B is an exemplary screen shot of a second terms and conditions page according to one embodiment of the invention.

[0038] FIG. 22 is a screen shot of an exemplary review information page according to one embodiment of the invention.

[0039] FIG. 23 is an exemplary screen shot of a setup completion page according to one embodiment of the invention.

[0040] FIG. 24A is an exemplary screen shot of a setup completion page according to another embodiment of the invention.

[0041] FIG. 24B is an exemplary screen shot of a setup completion page according to still another embodiment of the invention.

[0042] FIG. 25 is an exemplary screen shot of a device preference page according to one embodiment of the invention.

[0043] FIG. 26 is a screen shot of an exemplary customer status page according to one embodiment of the invention.

[0044] FIG. 27 is a screen shot of an exemplary account information page according to one embodiment of the invention.

[0045] FIG. 28 is a screen shot of an exemplary customer status page according to one embodiment of the invention.

[0046] FIG. 29 is a screen shot of an exemplary account information page according to one embodiment of the invention.

[0047] FIG. 30 is a screen shot of an exemplary account type selection page according to one embodiment of the invention.

[0048] FIG. 31 is a screen shot of an exemplary customer status page according to one embodiment of the invention.

[0049] FIG. 32 is a screen shot of an exemplary account type selection page according to one embodiment of the invention.

[0050] FIG. 33 is a screen shot of an exemplary prepayment requirement page.

[0051] FIG. 34 is a block diagram of a mobile multi-function device according to one embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0052] The invention pertains to methods, systems and graphical user interfaces that facilitate setup or activation of mobile devices, such as communication devices or multi-function devices, via computers. According to one embodiment, activation of a mobile device with respect to a wireless service provider can be performed by users through use of a computer (e.g., personal computer) that communicate with a remotely located activation server. According to another embodiment, graphical user interfaces can be presented to users so as to enable end users to easily activate mobile devices.

[0053] Embodiments of the invention are discussed below with reference to FIGs. 1 - 34. However, those skilled in the art will readily appreciate that the detailed description given herein with respect to these figures is for explanatory purposes as the invention extends beyond these limited embodiments.

[0054] FIG. 1 is a block diagram of an activation system 100 according to one embodiment of the invention. The activation system 100 includes a client machine 102. The client machine 102 is, for example, a computing device, such as a personal computer. The client machine 102 can also be referred to as a host device. A mobile multi-function device 104 can be connected (e.g., temporarily connected) to the client machine 102. In one implementation, the mobile multi-function device 104 can be connected to the client machine 102 over a cable 106. As an example, the cable 106 can pertain to a peripheral bus (e.g., USB) connection. In another implementation, the mobile multi-function device 104 can connect to the client machine 102 over a wireless connection. The mobile multi-function device 104 operates to support a plurality of different functions. For example, the mobile multi-function device 104 can operate as a media playback device, such as an MP3 player, video player, game player, etc. In addition, the mobile multi-function device 104 can support wireless voice communications through a wireless network 108. The wireless voice communications through the wireless network 108 can enable a user of the mobile multi-function device to communicate with users of other mobile multi-function devices or other communication devices. Similarly, the mobile multi-function device 104 can support wireless data exchange (e.g.,

SMS messages) through the wireless network 108. Although FIG. 1 illustrates one client machine 102 and one mobile multi-function device 104, it should be noted that the activation system 100 can have multiple client machines 102 and multiple mobile multi-function devices 104. In addition, one or more of the mobile multi-function devices can connect to one or more client machines. In one implementation, the wireless network 108 can represent a cellular telephone network. In another implementation, the wireless network 108 can represent a local or regional wireless network (e.g., WiFi, WiMax). In still another implementation, the wireless network 108 can represent multiple wireless networks.

[0055] The activation system 100 also illustrates a data network 110. The data network is, for example, a local area network, a wide area network, or a global network, such as the Internet. The client machine 102 can couple to the data network 110. In addition, the activation system 100 includes an activation server 112 and a wireless communication provider server 114. In order to activate the mobile multi-function device 104, the mobile multi-function device 104 interacts with the activation server 112. To do so, the mobile multi-function device 104 communicates with the client machine 102 and the client machine 102 in turn communicates with the activation server 112 through the data network 110. In this regard, the activation server 112 can coordinate and control activation of the mobile multi-function device 104. In addition, the activation server 112 can communicate with the wireless communication provider server 114 so that an appropriate account to be utilized by the mobile multi-function device 104 can be established by the wireless communication provider that is operating on the wireless network 108.

[0056] FIG. 2A is a flow diagram of a system activation process 200 according to one embodiment of the invention. The system activation process 200 concerns activation of a mobile multi-function device (MMD). The system activation process 200 begins with a mobile multi-function device being obtained 202. For example, a user can obtain 202 a mobile multi-function device at a retail location or by mail order. In this embodiment, when the mobile multi-function device is obtained 202, it is not activated for use with any wireless network. As a result, the mobile multi-function device needs to go through an activation process in order to operate. In this regard, after the mobile multi-function device is obtained 202, a service plan and a payment arrangement need to be setup 204. After the service plan and payment arrangement have been successfully setup 204, the mobile multi-function device can be enabled 206. In addition, the mobile multi-function device can be registered with a network, namely, a wireless network. Here, the registration 208 with the network is performed to permit the mobile multi-function device to be utilized on the network.

[0057] Following successful enabling 206 and registration 208, the mobile multi-function device can operate 210 with or without utilization of the network. In this regard, since the mobile multi-function device supports multiple functions, the mobile multi-function device can be utilized in a non-network manner, such as playing local games, displaying local data, playing music from local storage, viewing local pictures, viewing locally stored electronic mail, etc. However, if the user of the mobile multi-function device desires to utilize the network (e.g., make or receive voice calls or electronic messages), network access is permitted in accordance with the service plan that has been setup 204, provided that the registration 208 was successful and provided that the network is available.

[0058] Once the mobile multi-function device is enabled 206 some or all of the functions or operations supported by the mobile multi-function device can be utilized. In one embodiment, once enabled 206, the mobile multi-function device can be utilized for all non-network functions or operations available from the mobile multi-function device, with network functions or operations becoming available following registration at block 208. In another embodiment, functions or operations of the mobile multi-function device can be prevented or restricted until completion of initial (i.e., first time) registration at block 208 at which point all functions or operations available from the mobile multi-function device can be utilized. In still another embodiment, certain, non-network functions or operations of the mobile multi-function device can be available even prior to the mobile multi-function device being enabled 206.

[0059] FIG. 2B is a flow diagram of a setup process 250 according to one embodiment of the invention. The setup process 250 operates to setup a service plan and/or payment arrangement with respect to one or more service providers. The setup process 250 is, for example, suitable for use as the setup 204 of a service plan and payment arrangement illustrated in FIG. 2A.

[0060] The setup process 250 retrieves 252 device information. Typically, the device information is retrieved 252 from the device itself. For example, the device can be referred to as a mobile multi-function device. Customer information can also be acquired 254, such as from the customer. The customer information can be acquired 254 so that the service provider can receive information regarding the customer that seeks to activate the mobile multi-function device. A service plan for the device is also set 256. The customer can be offered one or more service plans depending upon various different criteria, including customer's location, customer's credit history, customer's current service provider, etc. A service plan as used herein can also be referred to as a rate plan. Once a service plan to be utilized with the customer has been set 256, a billing account can be setup 258. The building account serves to facilitate billing the customer for the services provided by the service plan. Typically, the customer is billed monthly for the service plan. The setup 258 of the billing account acquires all the necessary information for billing the customer. As one example, the billing account can utilize a credit card whereby the cus-

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tomer is billed monthly via the credit card for the service plan. Subsequently, the customer account can be activated 260. In this regard, the setup process 250 can communicate with a computing device (e.g., activation server 112) associated with a service provider to activate a customer account so that the customer can utilize the mobile multi-function device with the at least one service provider in accordance with the service plan. The service provider is, for example, a wireless (communications) service provider. Additionally, an account with another service provider, such as an online media store, can be established. Following the block 260, the setup process 250 ends and subsequent processing can continue at block 206 of the system activation process 200 illustrated in FIG. 2A.

[0061] FIG. 3 is a flow diagram of a device operational process 300 according to one embodiment of the invention. The device operational process 300 is, for example, processing associated with a mobile multi-function device, such as the mobile multi-function device 104 illustrated in FIG. 1.

[0062] The device operational process 300 can begin when the mobile multi-function device is powered on. Hence, a decision 302 determines whether the mobile multi-function device has been powered on. When the mobile multi-function device has not been powered on, the device operational process 300 is not performed. On the other hand, when the decision 302 determines that the mobile multi-function device has been powered on, a decision 304 can determine whether the mobile multi-function device has been enabled. Here, it is assumed that the mobile multi-function device performing the device operational process 300 may or may not have been enabled to operate. Hence, when the decision 304 determines that the mobile multi-function device has not been enabled, the mobile multi-function device is eligible to operate 306 in a limited use mode. As an example, in the limited use mode, the mobile multi-function device can permit emergency communications (e.g., emergency telephone calls). However, the limited use mode may prevent other operations of the mobile multi-function device. For example, if the mobile multi-function device provides media playback or network browsing, then when in the limited use mode, media playback and/or network browsing can be prevented (or limited). In one implementation, while in the limited use mode, the mobile multi-function device can prevent all other operational uses except emergency communications.

[0063] On the other hand, when the decision 304 determines that the mobile multi-function device is enabled, the mobile multi-function device can operate in a full use mode. Following the blocks 306 and 308, a decision 312 can determine whether the mobile multi-function device is to be powered off. When the decision 312 determines that the mobile multi-function device should not be powered off, the mobile multi-function device continues to operate in the previously established operational mode (e.g., limited use mode or full use mode). On the other hand, when the decision 312 determines that the mobile multi-function device should be powered off, the mobile multi-functional device is powered down 314. Following the block 314, the device operational process 300 can end.

[0064] FIG. 4 is a flow diagram of a device operation process 400 according to another embodiment of the invention. The device operational process 400 is, for example, processing associated with a mobile multi-function device, such as the mobile multi-function device 104 illustrated in FIG. 1.

[0065] The device operational process 400 begins with a decision 402. The decision 402 determines whether the mobile multi-function device has been powered on. When the decision 402 determines that the mobile multi-function device has not been powered on, the device operational process 402 awaits power on of the mobile multi-function device. Once the decision 402 determines that the mobile multi-function device has been powered on, the device operational process 400 is effectively invoked. Once the decision 402 determines that the mobile multi-function device has been powered on, a decision 404 determines whether the mobile multi-function device has been enabled.

[0066] When the decision 404 determines that the mobile multi-function device has not yet been enabled, the device operational process 400 places 406 the mobile multi-function device in an emergency mode. In the emergency mode, the mobile multi-function device is permitted to make emergency calls only. Next, a decision 408 determines whether the mobile multi-function device is to be powered off. When the decision 408 determines that the mobile multi-function device is not to be powered off, the device operational process 400 returns to repeat the decision 404 to again evaluate whether the mobile multi-function device has been enabled. In an alternative embodiment, when the decision 408 determines that the mobile multi-function device is not to be powered off, the device operation process 400 can remain in the emergency mode and simply repeat the decision 404 until powered off.

[0067] Alternatively, when the decision 404 determines that the mobile multi-function device has been enabled, the mobile multi-function device is placed 410 in an active mode. Registration with a wireless network can also be requested 412. In one embodiment, a location update request can be used to request 412 registration with the wireless network. A decision 414 determines whether the registration with the wireless network has been successful. When the decision 414 determines that the registration has been successful, the device operational process 400 permits 416 the mobile multi-function device to perform network and/or non-network operations. Next, a decision 418 determines whether the mobile multi-function device is to be powered off. When the decision 418 determines that the mobile multi-function device has not been powered off, the device operational process 400 returns to repeat the block 416 so that the

mobile multi-function device can continue to perform 416 network and/or non-network operations.

[0068] On the other hand, when the decision 414 determines that registration with the wireless network has not been successful, then the user of the multi-function device can be notified 422 that the network is unavailable. In one implementation, the notification 422 can be displayed on a display screen for one or both of the multi-function device or a client device connected thereto. Further, the mobile multi-function device can be operated to permit 424 non-network operations. A decision 426 can then determine whether the mobile multi-function device is to be powered off. When the decision 426 determines that the mobile multi-function device is not to be powered off, the device operational process 400 returns to repeat the block 424 so that non-network operations can continue to be performed 424.

[0069] When any of the decisions 408, 418 or 426 determine that the mobile multi-function device is to be powered off, the mobile multi-function device can be powered down 420. After the mobile multi-function device has been powered down, the device operational process 400 ends.

[0070] FIG. 5 is a system state diagram 500 according to one embodiment of the invention. The system state diagram 500 illustrates a plurality of states associated with system activation of a mobile multi-function device (MMD) according to one embodiment. At state 502, a mobile multi-function device is obtained. At state 504, following the state 502, the mobile multi-function device is powered-on. Next, at state 506, the mobile multi-function device is connected to a computer, (e.g., personal computer). Thereafter, at state 508, one or more accounts can be arranged. These accounts can pertain to an account with an online media store and/or an account with a wireless service provider. Next, at state 510, a service plan can be selected. Typically, the service plans are associated with a wireless service provider that is providing wireless network access for the mobile multi-function device. In addition, payment can be arranged at state 512. It should also be noted that states 510 and/or 512 could be part of the state 508.

[0071] Following state 512, at state 514, the mobile multi-function device can be enabled. Once enabled, the mobile multi-function device is able to be fully utilized. Subsequently, the mobile multi-function device can be registered with a network (e.g., wireless network) at state 516. The registration with the network enables the mobile multi-function device to send and receive calls with respect to the network. Optionally, it should be noted that following the state 504, in the event that the mobile multi-function device was previously enabled, the mobile multi-function device can transition directly to state 516. In any case, once the mobile multi-function device has been registered with the network at state 516, the mobile multi-function device can be utilized with the network at state 518. Following the state 518, the mobile multi-function device can be powered off at state 520. Also, following the state 514, the mobile multi-function device can be disconnected from the computer at state 522 or the mobile multi-function device can be powered off at state 524.

[0072] In an alternative embodiment, at state 514, the mobile multi-function device can be enabled for only certain functions or operations. In this manner, the mobile multi-function device can have its available functions or operations controlled such that available functions or operations can be available (and others restricted) at (i) pre-enablement, (ii) post-enablement, and (iii) post-registration.

[0073] As such, activation can include one or more of account activation, device activation (i.e., enablement), and network activation (i.e., network setup). In one embodiment, the states 508, 510 and 512 can be considered account activation, and the state 514 can be considered device activation. Following state 512 or state 514 and prior to 516, the network can be setup (i.e., network activation) to support the account for the mobile multi-function device being activated.

[0074] FIGs. 6A-6C are flow diagrams of a network service setup process 600 according to one embodiment of the invention. For example, with reference to FIG. 1, the network service setup process 600 is processing performed when the mobile multi-function device 104 is connected to the client machine 102 illustrated in FIG. 1 so that interaction with the activation server 112 can be performed to setup service for the mobile multi-function device 104.

[0075] The network service setup process 600 can begin with a decision 602 that determines whether the mobile multi-function device is attached to the client machine (e.g., personal computer). When the decision 602 determines that the mobile multi-function device is not attached, then the network service setup process 600 is not performed. On the other hand, when the decision 602 determines that the mobile multi-function device is attached, the network service setup process 600 can be performed. In one embodiment, the network setup process 600 can be automatically initiated where the mobile multi-function device is attached to the client machine.

[0076] When the network setup process 600 is performed, mobile multi-function device (MMD) information is received 604 from the mobile multi-function device. Next, a decision 605 determines whether a user activation request has been received. When the decision 605 determines that a user activation request has not been received, the network service setup process 600 can await a user activation request. A user can request activation of the mobile multi-function device. In one example, the user can specify whether the activation of the mobile multi-function device is to be associated with a new account or an existing account. On the other hand, when the decision 605 determines that a user activation request has been received, a decision 606 can then determine whether the mobile multi-function device is to be subject to an existing account. The decision 606 can be based on the user activation request which can indicate

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whether the activation of the mobile multi-function device is to be associated with a new account or an existing account. When the decision 606 determines that the mobile multi-function device is not subject to an existing account, account setup information is requested 608. The account setup information is information used to setup a new account. The account setup information can, for example, be provided by user. A decision 610 then determines whether the account setup information has been received. When the decision 610 determines that the account setup information has not yet been received, the network service setup process 600 awaits such information. Once the decision 610 determines that the account setup information has been received, a user account can be setup 612. The user account can pertains to a user account with a wireless service provider, an online media store, and/or some other account. The user account contains information concerning the user and often includes personal information and financial information.

[0077] On the other hand, when the decision 606 determines that an existing account is associated with the mobile multi-function device, authentication information can be requested 614. A decision 616 can then determine whether the authentication information has been received. When the decision 616 determines that the authentication information has not yet been received, the network service setup process 600 can await such information. Alternatively, when the decision 616 determines that the authentication information has been received, a decision 618 can determine whether the user is authenticated for access to the existing account. When the decision 618 determines that the user has not been authenticated, an error indication 620 can be provided. Following the block 620, the network service setup process 600 can end with network setup not being completed.

[0078] Following the block 612 or following the decision 618 when the user has been properly authenticated, the user can be offered 622 one or more service plans. In one embodiment, the one or more service plans being offered 622 can depending on a credit evaluation (e.g., credit score) for the user. For example, a user having poor credit can be only offered service plans that require prepayment. A decision 624 then determines whether a plan has been selected but the user. When the decision 624 determines that a plan has not yet been selected, the network service setup process 600 awaits such a selection. Once the decision 624 determines that a plan has been selected, a decision 628 determines whether a new account is being processed. When the decision 628 determines that a new account is being processed, setup of a billing account can be requested 630. However, when the decision 628 determines that an existing account is being processed, the block 630 can be bypassed. The request 630 can include payment information, such as payment information provided by the user. In one embodiment, the network setup process 600 already received or has access to the payment information to be used for the account. As one example, the account setup information can include the billing account information. In another embodiment, the network setup process 600 can request and receive the payment information prior to the request 630. When the decision 628 determines that payment information has not yet been received, the network service setup process 600 can await receipt of the payment information. Once the decision 628 determines that the payment information has been received, setup of a billing account can be requested 630.

[0079] Thereafter, activation of the account for the user can be requested 631. A decision 632 can then determine whether activation confirmation and phone number for the account being established have been received. When the activation confirmation and phone number have not been received, the network service setup process 600 can await such information. Alternatively, when the decision 632 determines that the activation confirmation and phone number have been received, the user can be informed 634 of successful account setup and the appropriate phone number.

[0080] Following the block 634, the mobile multi-function device is enabled 636.

In one implementation, the client machine 102 can write certain information into data storage on the mobile multi-function device 104 to inform the mobile multi-function device 104 that the device is now enabled. The mobile multi-function device can then self-determine whether the device is enabled by reading the stored information. Following the block 636 the mobile multi-function device can be disconnected from the client machine.

[0081] In any case, following the block 636, a decision 638 determines whether network setup has been completed. When the decision 638 determines that network setup has been completed, the user can be notified 640 that network setup has completed. The notification can alert the user to perform an action with respect to the mobile multi-function device so that the mobile multi-function device can register with the network and thereafter be utilized thereon. As an example, the notification can be provided to the user by displaying an indication or by sending an electronic message (e.g., email or text message) to the associated client machine. For example, the user can be instructed by the notification to power cycle the mobile multi-function device or connect the mobile multi-function device to the client machine. Following the block 640, the network service setup process 600 ends.

[0082] On the other hand, when the decision 638 determines that the network setup is not complete, the network service setup process 600 can perform other processing 642 unassociated with the network setup. For example, the other processing 642 can pertain to the synchronization of data between the client machine 102 and the mobile multi-function device 104. The other processing 642 can also pertain to media playback at the mobile multi-function device, setting of preferences at the mobile multi-function device or at the client machine, etc. Following the block 642, a decision 644 can deter-

mine whether completion of the network setup for the mobile multi-function device should be re-checked. In one embodiment, the completion of the network setup can be re-checked periodically (e.g., every 2 minutes). Typically, if the network setup has not properly completed after a number of attempts or period of time, the network service setup process 600 could end and inform the use that the network service was not able to be setup. In any case, when the decision 644 determines that the network setup should be re-checked, the network service setup process 600 can repeat the decision 638 and subsequent blocks to again determine whether network setup has completed. Alternatively, when the decision 644 determines that the network setup should not be re-checked, the network service setup process 600 can repeat the block 642 so that other processing can optionally be performed.

[0083] FIG. 6D is a flow diagram of an alternative portion of the network service setup process 600 according to one embodiment of the invention. In particular, the blocks 646-660 illustrated in FIG. 6D represent an alternative embodiment for the portion of the network service setup process 600 illustrated in FIG. 6C, namely, blocks 636-644. Following the block 634, the mobile multi-function device is enabled 646. In one implementation, the client machine 102 can write certain information into data storage on the mobile multi-function device 104 to inform the mobile multi-function device 104 that the device is now enabled. The mobile multi-function device can then self-determine whether the device is enabled by reading the stored information. In any case, following the block 646, a decision 648 determines whether network setup has been completed. When the decision 648 determines that network setup has been completed, the mobile multi-function device can be instructed 650 to register with the network. The mobile multi-function device can be instructed 650 to register with the network by causing a location update to be issued from the mobile multi-function device. In one implementation, the client machine 102 can send a command to the mobile multi-function device 104 to initiate the location update. In another implementation, the client machine 102 can cause the mobile multi-function device 104 to reset its radio transmitter/receiver (i.e., a portion of its hardware) so as to trigger a location update.

[0084] On the other hand, when the decision 648 determines that the network setup is not complete, a decision 652 determines whether the mobile multi-function device has been disconnected from the client machine. When the decision 652 determines that the mobile multi-function device has not been disconnected, the network service setup process 600 can perform other processing 654 unassociated with the network setup. For example, the other processing 654 can pertain to the synchronization of data between the client machine 102 and the mobile multi-function device 104. The other processing can also pertain to media playback at the mobile multi-function device, setting of preferences at the mobile multi-function device or at the client machine, etc. Following the block 654, the network service setup process 600 returns to repeat the decision 648 to again determine whether network setup has completed.

[0085] Alternatively, when the decision 652 determines that the mobile multi-function device has been disconnected from the client machine, a decision 656 determines whether network setup has completed. When the decision 656 determines that network setup has not completed, other processing 658 can be performed until the network setup has completed. Alternatively, when the decision 656 determines that network setup has completed, the user can be notified 660 that network setup has completed. The notification can alert the user to perform an action with respect to the mobile multi-function device so that the mobile multi-function device can register with the network and thereafter be utilized thereon. As an example, the notification can be provided to the user by displaying an indication or by sending an electronic message (e.g., email or text message) to the user. The electronic message can, for example, be sent to the mobile multi-function device or the associated client machine. For example, the user can be instructed by the notification to power cycle the mobile multi-function device or connect the mobile multi-function device to the client machine. Following the blocks 650 and 660, the network service setup process 600 ends.

[0086] In one embodiment, the mobile multi-function device can store information that can be used to determine whether the mobile multi-function device is enabled. For example, the mobile multi-function device can stored an identifier (e.g., activation identifier) that is provided by a client machine once the mobile multi-function device is to be enabled. In one embodiment, the identifier is stored in a secured manner, such as through use of encryption, digital certificate or other cryptographic technique. The identifier can include or be based on a Subscriber Identity Module (SIM) that is included in the mobile multi-function device while activated. In one implementation, a SIM value, such as a SIM card identifier (e.g., ICCID), read from the SIM card itself within the mobile multi-function device is compared to the identifier stored in a data store (e.g., Flash memory) within the mobile multi-function device. If the identifier matches the read SIM value, then the mobile multi-function device has previously been enabled. As such, the mobile multi-function device can self-determine whether it has been enabled. This enablement verification can, for example, prevent different SIM cards from being used with a mobile multi-function device that has been previously activated while using a different SIM card. An alternative to a SIM is a Universal Subscriber Identity Module (USIM). SIM cards are used with GSM type wireless networks. Other types of networks, such as CMDA, can use other identifiers. Often the identifiers in other networks are not removable from the multi-function device by users. In such cases, the identifier is stored within the device itself such that the identifier is not removable from the device. In such

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cases, the mobile multi-function device can simply store a flag that indicates whether or not the mobile multi-function device is enabled.

[0087] FIG. 7 is a flow diagram of a network service setup process 700 according to one embodiment of the invention. The network service setup process 700 is, for example, processing performed when activating a Mobile Multi-function Device (MMD). For example, the network service setup process 700 can be associated with processing performed when the mobile multi-function device 104 is connected to the client machine 102 illustrated in FIG. 1 so that interaction with the activation server 112 can be performed via the client machine 102 to setup service for the mobile multi-function device 104.

[0088] The network service setup process 700 can begin with a decision 702 that determines whether the mobile multi-function device is attached to the client machine (e.g., personal computer). When the decision 702 determines that the mobile multi-function device is not attached, the network service setup process 700 is not performed. On the other hand, when the decision 702 determines that the mobile multi-function device is attached, the network service setup process 700 can be performed. Once the decision 702 determines that the mobile multi-function device is attached, Mobile Multi-function Device (MMD) information can be read 704 from the multi-function device. In one embodiment, the MMD information can be encrypted so as to prevent unauthorized access. For additional details on preventing unauthorized access to device information, such as the MMD information, see, for example, U.S. Patent Application No. 11/767,447, filed June 22, 2007, and entitled "DEVICE ACTIVATION AND ACCESS," which is hereby incorporated by reference herein. After the MMD information has been read 704, a decision 706 determines whether the mobile multi-function device has already been activated. When the decision 706 determines that the mobile multi-function device has already been activated, then other processing 708 can be performed In other words, in one embodiment, the mobile multi-function device can perform various other processing 708 supported by the device given that the device has been activated. In this regard, the mobile multi-function device can utilize network service. Following the block 708, since the mobile multi-function device has already been activated, the network service setup process 700 can end.

[0089] When the decision 706 determines that the mobile multi-function device has not already been activated, a decision 710 determines that a user activation request has been received. When the decision 710 determines that a user activation request has not been received, the network service setup process 700 awaits a user activation request. Alternatively, when the decision 710 determines that a user activation request has been received, a decision 712 determines whether the user is a new customer. When the decision 712 determines that the user is a new customer, a decision 714 determines whether the customer desires an individual plan or a family plan. When the decision 714 determines that the customer desires an individual plan, processing proceeds to FIGs. 8A-8C where an activation process for an individual plan is described. On the other hand, when the decision 714 determines that the customer desires a family plan, processing proceeds to FIG. 9 where an activation process for a family plan is described.

[0090] On the other hand, when the decision 712 determines that the user is not a new customer, but is instead an existing customer, then a decision 716 determines whether the mobile multi-function device is a new device being substituted for a previously activated device. When the decision 716 determines that the mobile multi-function device is a new device, then processing proceeds to FIG. 10 where an activation process for an existing account is described. Alternatively, when the decision 716 determines that the mobile multi-function device is not new, a decision 718 can determine whether a new line is to be added to an existing account. When the decision 718 determines that a new line is to be added to an existing account, then processing proceeds to FIG. 11 where an activation process for a new line is described. Alternatively, when the decision 718 determines that a new line is not to be provided, then activation can be deemed 720 unavailable. Following the block 720, the network service setup process 700 can end.

[0091] FIGs. 8A-8C are flow diagrams of an activation process 800 according to one embodiment of the invention. The activation process 800 corresponds to activation of a mobile multi-function device with respect to an individual user plan.

[0092] The activation process 800 can begin with a decision 802 that determines whether a phone number is to be transferred. A phone number that can be transferred can be associated with another service provider. Typically, the phone number eligible to be transferred is from another wireless service provider.

However, more generally, the phone number eligible to be transferred can correspond to either a wireless account or a land line account. In any case, when the decision 802 determines that a phone number is to be transferred, an existing phone number and account information for another service provider are provided 804. Typically, the customer will interact with a graphical user interface to provide the information regarding the existing phone number and account information.

[0093] Following the block 804 as well as directly following the decision 802 when a phone number is not to be transferred, customer information can be requested 806. The customer information can include name, address, date of birth, security question(s), e-mail address, account identifier, etc. The customer information can be utilized for one or more accounts that are to be established with one or more service providers. A decision 808 determines whether the customer information has been received. When the decision 808 determines that the customer information has not been received, the activation

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process 800 can await the customer information.

[0094] After the decision 808 determines that the customer information has been received, a decision 810 can determine whether the location of the customer is supported. Here, the service provider typically only supports specific geographical locations. Hence, the customer location can be examined to determine whether it is within a geographical location supported by the system. Hence, when the decision 810 determines that the customer location is not supported by the system of the service provider, the customer can be informed 812 that activation is unavailable. Following the block 812, the activation process 800 can end without activating the mobile multi-function device.

[0095] On the other hand, when the decision 810 determines that the customer location is supported by the system of the service provider, one or more service plans to be offered to the customer can be determined 814. Next, the one or more service plans are offered 816 to the customer. A decision 818 then determines whether the customer has selected one of the service plans. When the decision 818 determines that a service plan has not yet been selected, the activation process 800 can await a plan selection. Alternatively, when the decision 818 determines that a service plan has been selected, billing information can be requested 820. The billing information can be utilized by one or more service providers. A decision 822 determines whether the billing information has been received. When the decision 822 determines that the requested billing information has not been received, the activation process 800 can await the billing information. Once the decision 822 determines that the billing information has been received, account information approval is requested 824. The account information approval can pertain to approval of the customer for the account to be activated. In one example, the account information would be presented to the customer for review and approval. A decision 826 determines whether the account information has been approved. When the decision 826 determines that the account information has not yet been approved, the activation process 800 can await such approval.

[0096] Once the decision 826 determines that the account information has been approved, the activation process 800 requests 828 approval of one or more service agreements. In one example, the one or more service agreements would be presented to the customer for review and acceptance. A decision 830 then determines whether the one or more service agreements had been approved. When the decision 830 determines that the one or more service agreements have not been approved, then the activation process 800 can await such approval. Once the decision 830 determines that the one or more service agreements have been approved, setup of a billing account can be requested 832. A remote server associated with a service provider can receive and process the request to setup a billing account for the customer. The setup of the billing account can utilize the customer information and/or the billing information that has been previously obtained by the activation process 800. Billing accounts can be setup in this manner for one or more service providers.

[0097] Additionally, the activation process 800 can request activation of an account. In other words, the activation being requested 834 can correspond to an account activation process. The account activation can be perform by a remote server, e.g., activation server, associated with a service provider. Following the request 834 for activation of an account, a decision 836 can determines whether the account has been activated. When the decision 836 determines that the account has not yet been activated, a decision 838 can determine whether the account activation has failed. When the decision 838 determines that the account activation has not failed, the activation process 800 can return to repeat the decision 836. Alternatively, when the decision 838 determines that the account information has failed, the customer can be informed 840 of unsuccessful activation. Following the block 840, the activation process 800 ends.

[0098] On the other hand, when the decision 836 determines that the account associated with the customer has been activated, the customer can be informed 842 of the successful activation. Thereafter, the mobile multi-function device can be activated 844. The activation 844 of the mobile multi-function device can, for example, be processing described above with reference to FIGs. 6C or 6D.

[0099] FIG. 9 is a flow diagram of an activation process 900 according to another embodiment of the invention. The activation process 900 is, for example, processing associated with activating a mobile multi-function device for use on a family plan.

[0100] The activation process 900 can begin with a decision 902 that determines whether the mobile multi-function device is to be activated as a family plan. When the decision 902 determines that the mobile multi-function device is not to be activated as a family plan then the mobile multi-function device can alternatively be activated 904 on an individual plan basis. When the decision 902 determines that the mobile multi-function device is to be activated as a family plan, an activation process 906 can be carried out for a family plan. The activation process for a family plan is generally similar to the processing illustrated in FIGs. 8A-8C; however, the account being established is a family account not an individual account and also the service plans normally differ because they pertain to family plans. Following the blocks 904 and 906, the activation process 900 for a family plan is complete.

[0101] FIG. 10 is a flow diagram of an activation process 1000 according to another embodiment of the invention. The activation process 1000 is, for example, processing associated with activation of a new mobile multi-function device by an existing customer of the service provider.

[0102] The activation process 1000 can request 1002

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current account information. Typically, the current account information would be requested 1002 from a customer attempting to activate a mobile multi-function device. A decision 1004 then determines whether the current account information has been received. In one embodiment, the current account information is received from the customer through interaction with a graphical user interface. The current account information is requested so that the customer's current account can be identified. When the decision 1004 determines that the current account information has not been received, the activation process 1000 can await the current account information.

[0103] Once the decision 1004 determines that the current account information has been received, a decision 1006 determines whether the user is authenticated. The authentication of the customer (user) can be achieved in a variety of different ways, including use of a user name, password, and/or a security question, etc. Hence, authenticating the user typically requires user data entry. When the decision 1006 determines that the customer (user) is authorized with respect to the current account, a subscriber status for the current account can be checked 1008. A decision 1010 can then determine whether the account for the subscriber is active. When the decision 1010 determines that the account for the subscriber is active, then processing associated with blocks 814-844 are the activation process 800 illustrated in FIG. 8A-8C can be performed 1012 to activate an account (new or update to existing account) and also activate the mobile multi-function device. On the other hand, when the decision 1006 determines that the user is not authenticated or when the decision 1010 determines that the account is not active, an error indication can be presented 1014. As an example, the error indication can be presented 1014 by a graphical user interface that informs the customer that activation is not available. Following the block 1012 or the block 1014, the activation process 1000 can end.

[0104] FIG. 11 is a flow diagram of an activation process 1100 according to another embodiment of the invention. The activation process 1100 is concerned with adding an additional line to an existing account with a network service provider.

[0105] The activation process 1000 can request 1102 current account information. Typically, the current account information would be requested 1102 from a customer attempting to activate a mobile multi-function device. A decision 1104 determines whether the current account information associated with the customer has been received. In one embodiment, the current account information is received from the customer through interaction with a graphical user interface.

When the decision 1104 determines that the current account information has not been received, the activation process 1100 can await the current account information. Alternatively, when the decision 1104 determines that the current account information has been received, a decision 1106 can determine whether the customer (user) is authorized to access the client account (or its information). When the decision 1106 determines that the customer (user) is authenticated and able to access the account, a subscriber status for the account is checked 1108. A decision 1110 can then determine whether the account associated with the subscriber (customer) is active. When the decision 1110 determines that the account associated with the subscriber is inactive (i.e., not active), an error indication can be presented 1112. In the event that the account associated with the subscriber is inactive, the error indication being presented 1112 can inform the customer that they are unable to add a new line to an existing account because the account is inactive.

[0106] On the other hand, when the decision 1110 determines that the account associated with the subscriber is active, the activation process 1100 can determine 1114 whether an additional line is available to the subscriber. In one embodiment, a subscriber can be allocated up to a determined of number lines for which they may activate. The number of lines available to the subscriber can be determined based on the subscriber's credit history, service plan, anticipated or actual use, etc. When the decision 1116 determines that an additional line is not available to the subscriber, then the subscriber can be informed 1118 that the additional line is not available. In one implementation, such as illustrated in FIG. 11, when an additional line can still be available if the subscriber provides a deposit (e.g., security deposit), the subscriber can be so informed 1118. Alternatively, when the decision 1116 determines that the additional line is available, the activation process 1100 can perform various previously described operations to activate the mobile multi-function device at block 1120. In one embodiment, the activation operations are associated with blocks 802, 804 and 810-844 of the activation process 800 illustrated in FIGs. 8A-8C. Following the blocks 1112, 1118 and 1120, the activation process 1100 can end.

[0107] Another aspect of the invention pertains to online provisioning methods and graphical user interfaces therefore. The provisioning methods enable an end user to activate a mobile communication device (e.g., mobile phone). In one embodiment, an end user can connect a mobile communication device to a computing device, such as a personal computer, and then perform an online activation process with a wireless service provider. The invention can provide automation and flexibility to activation of wireless communication devices.

[0108] FIGs. 12A-12C are flow diagrams of a mobile device provisioning process 1200 according to one embodiment of the invention. The mobile device provisioning process 1200 is, for example, performed by a server, such as the activation server 112 of the activation system 100 illustrated in FIG. 1.

[0109] The mobile device provisioning process 1200 can begin with a decision 1202. The decision 1202 can determine whether a new mobile device needs to be provisioned (or activated). The new mobile device, for ex-

ample, can refer to a mobile device that requires provisioning in order to utilize a wireless network for voice (and/or data) communications. The new mobile device can, for example, be recognized by a client machine, such as the client machine 102 illustrated in FIG. 1, when the mobile device connects with the client machine. The client machine can then in turn interact with the activation server to present suitable graphical user interfaces that assist the user of the mobile device in provisioning (or activating) the mobile device. Hence, when the decision 1202 determines that a new mobile device is not present, then the mobile device provisioning process 1200 awaits the presence of a new mobile device. In other words, until a new mobile device is present, the mobile device provisioning process 1200 simply waits to recognize a new mobile device. On the other hand, once the decision 1202 determines that a new mobile device has been recognized, an initial registration page is displayed 1204. The initial registration page can provide initial information to a user regarding registration of a mobile device.

[0110] FIG. 13 is a screen shot of an exemplary initial registration page 1300 according to one embodiment of the invention. The initial registration page 1300 illustrated in FIG. 13 provides initial registration information regarding a device entitled "Debbie's iPhone" which in this example pertains to a mobile phone. In one embodiment, the mobile phone is a multi-function device. After the initial registration page is displayed 1204, a decision 1206 can determine whether a user continues with the mobile device provisioning process 1200. When the decision 1206 determines that the user has not yet elected to continue, the mobile device provisioning process 1200 can await such a request. Alternatively, the user could instead request to cancel the mobile device provisioning process 1200, in which case the mobile device provisioning process 1200 could end.

[0111] On the other hand, when the decision 1206 determines that the user has requested to continue with the mobile device provisioning process 1200, a customer status page can be displayed 1208. In general, the customer status page can allow a customer (user) to specify whether or not they are an existing customer to the wireless network provider, in this example, AT&T Wireless. Additionally, the customer status page may enable the customer to specify whether they are activating on an individual plan or a group plan, or whether they wish to keep their current phone number (i.e., transferring the phone number) or create a new phone number.

[0112] FIG. 14 is a screen shot of an exemplary customer status page 1400 according to one embodiment of the invention. The customer status page 1400 allows a new wireless network service customer to activate a new phone on an individual plan. Here, the customer may or may not desire to transfer their current mobile phone number. Further, the customer status page 1400 can allow an existing wireless network service customer to either keep their current phone number or create a new phone number for the particular mobile device being provisioned.

[0113] After the customer status page is displayed 1208, a decision 1210 determines whether the customer is a new customer. As an example, this determination can be made following submission of the customer status page 1400 which enables the user to indicate whether or not they are an existing customer.

[0114] Although not illustrated in FIGs. 12A-12C, the mobile device provisioning process 1200 can further display a number transfer page. The number transfer page can assist a user in transferring an existing number from another service provider to be used with the particular mobile device being provisioned.

[0115] FIG. 15 is a screen shot of an exemplary screen shot of a mobile number transfer page 1500. The mobile number transfer page 1500 includes a data entry region 1502 that enables a user to provide existing account information in the case where an existing mobile number is to be transferred. FIG. 16 is a screen shot of an exemplary screen shot of a landline number transfer page 1600. The landline number transfer page 1600 includes a data entry region 1602 that enables a user to provide existing account information in the case where an existing landline number is to be transferred.

[0116] When the decision 1210 determines that the user is a new customer, a service plan selection page can be displayed 1212. In general, the service plan selection page provides one or more available service plans to the customer. A customer can then select one of the available service plans.

[0117] FIG. 17A and 17B are screen shots of an exemplary service plan selection page 1700 according to one embodiment of the invention. The service plan selection page 1000 allows the customer to select from one of six service plans 1702-1712, each of which can offer a different package of services at different rates. A first three of the service plans are illustrated in FIG. 17A, and a second three of the service plans are illustrated in FIG. 17B.

[0118] Following the display 1212 of the service plan selection page, a decision 1214 can determine whether a service plan has been selected. When the decision 1214 determines that a service plan has not yet been selected, the mobile device provisioning process 1200 can await such a selection. On the other hand, once the decision 1214 determines that a service plan has been selected, as well as following the decision 1210 when the customer is not a new customer, a customer account page can be displayed 1216. The customer account page can allow an existing customer to login to their account. The account is, for example, associated with an on-line media store, such as the iTunes® media store.

[0119] FIG. 18 is a screen shot of an exemplary customer account page 1100 according to one embodiment of the invention. The customer account page 1100 includes a sign-in section 1802 that allows an existing account holder to sign-in, with an identifier (e.g., Apple ID) and password.

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[0120] After the customer account page has been displayed 1216, a decision 1218 can determine whether the customer is an existing account holder. When the decision 1218 determines that the customer has an existing account, the customer can login 1220 to the account. Alternatively, when the decision 1218 determines that the customer does not have an existing account, or following the block 1220 after a successful login to an account, a customer information entry page is displayed 1222. The customer information entry page can facilitate a user in entering customer information that is to be utilized by either the wireless network service provider or the media asset provider (e.g., on-line media store). For a customer with an existing account, the customer information can be pre-entered and/or the certain subsequent portions of the remaining processing for the mobile device provisioning process 1200 could be simplified or eliminated. For a customer without an existing account with the on-line media store, the customer information entry page can also allow the customer to create a new account with the on-line media store.

[0121] FIG. 19 is a screen shot of a customer information entry page 1900 according to one embodiment of the invention. The customer information entry page 1900 allows entry of basic customer information to be utilized in creating one or more accounts. The customer information can, for example, include information pertaining to the customer, such as e-mail address, password, security question and answer, and date of birth.

[0122] Once the customer has entered the requested customer information, the mobile device provisioning process 1200 can continue. A decision 1224 determines whether customer information has been received. When the decision 1224 determines that the customer information has been received, such as by completion of the customer information entry page, a billing information page can be displayed 1226. The billing information page enables a customer to provide billing information to be utilized to pay for the service plan that was previously selected by the customer. The billing information can also be used by another service provider, such as an online media store. It should be noted that sharing of customer information and/or billing information between two or more service providers provides an efficient and user friendly system is provided.

[0123] FIG. 20 illustrates an exemplary billing information page 2000 according to one embodiment of the invention. The billing information page 2000 provides a means for the customer to enter various billing information, such as name, billing address, phone number, social security number, credit card number, security code, and expiration date. The billing information can be used by one or more service providers, in this example, AT&T Wireless as the wireless service provider and iTunes® media store as an online media service provider.

[0124] After the billing information page is displayed 1226, a decision 1228 determines whether billing information has been received. When the decision 1228 determines that billing information has not been received, then the mobile device provisioning process 1200 awaits such billing information. On the other hand, when the decision 1228 determines that billing information has been received, a terms and condition page can be displayed 1230. The terms and conditions page can provide the customer with the terms and conditions of the one or more legal agreements that are being established with the customer.

[0125] FIG. 21A is an exemplary screen shot of a first terms and conditions page 2100 according to one embodiment of the invention. In this example, the customer is required to read and agree to a software license/usage agreement 2102 with respect to Apple Computer, Inc. for use of the iTunes® media store. FIG. 21B is an exemplary screen shot of a second terms and conditions page 2150 according to one embodiment of the invention. In this example, the customer is required to read and agree to a wireless service agreement 2502 with a wireless service provider. The terms and conditions pages 2100 and 2150 require that the user accept the respective terms and conditions of these agreements in order to continue.

[0126] Following the display 1230 of the terms and conditions page, a decision 1232 determines whether the customer has accepted the various terms and conditions. When the decision 1232 determines that the customer has not accepted the terms and conditions, then the mobile device provisioning process 1200 awaits such acceptance. Once the decision 1232 determines that the customer has accepted the various terms and conditions, a review information page can be displayed 1234. The review information page allows a user to finally review the information regarding the service plan (i.e., wireless network service) being established for the mobile device for the customer information, and the associated billing information.

[0127] FIG. 22 is a screen shot of an exemplary review information page 2200 according to one embodiment of the invention. The review information page 2200 summarizes the billing and plan information concerning the mobile device being activated. For example, as shown in FIG. 22, the review information page 2200 can specify the billing amount and the manner in which the customer is to be billed, a service plan and a brief description thereof, additional fees and explanation of additional costs.

[0128] After the review information page has been displayed, a decision 1236 can determine whether the mobile device provisioning process 1200 should continue. When the decision 1236 determines that the customer has decided to continue the mobile device provisioning process 1200, one or more setup completion pages can be displayed 1238. The one or more setup completion pages can inform the customer that the setup (or activation) of their mobile device is processing and/or has successfully completed. The setup completion page may also provide a phone number for the mobile device to the customer or indicate that the existing phone number is being transferred. The setup completion page may also

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permit the customer to provide a name for the mobile device.

[0129] FIG. 23 is an exemplary screen shot of a setup completion page 2300 according to one embodiment of the invention. The setup completion page 2300 informs the customer that activation of the mobile device is being processed. FIG. 24A is an exemplary screen shot of a setup completion page 2400 according to another embodiment of the invention. The setup completion page 2400 provides the customer with a phone number 2402. FIG. 24B is an exemplary screen shot of a setup completion page 2450 according to still another embodiment of the invention. The setup completion page 2450 informs the customer that transfer of the existing phone number is ongoing. In one embodiment, the setup completion page 2400 and the setup completion page 2450 are alternative pages that are chosen dependent on whether a new phone number is being assigned or whether an existing phone number is being transferred.

[0130] After the setup completion page has been displayed 1238, a decision 1240 determines whether the customer desires to continue on with the mobile device provisioning process 1200. When the decision 1240 determines that the customer has not yet decided to continue, the mobile device provisioning process 1200 awaits the request to continue. Once the decision 1240 determines that the customer has requested to continue, a device preference page is displayed 1242. The device preference page can, for example, be provided by a media management application. In this regard, the media management application can assist the customer with the setting of one or more preferences concerning the mobile device that has just been provisioned (or activated). Alternatively, the customer can choose not to continue to the device preference page and instead end the mobile device provisioning process 1200. In any case, following the block 1242 (or alternatively following the block 1238), the mobile device provisioning process 1200 can end as the provisioning of the mobile device has been initiated and perhaps completed. Following the mobile device provisioning process 1200, the mobile device can thereafter be controlled or managed by the media management application. To the extent that the customer has set one or more preferences concerning the mobile device, the media management application can thereafter operate in accordance with the one or more preferences when interacting with or on behalf of the mobile device.

[0131] FIG. 25 is an exemplary screen shot of a device preference page 2500 according to one embodiment of the invention. The device preference page 2500 includes a source region 2501 and a preference information region 2502. A visual selector 2503 indicates selection of a device referred to as "Debbie's iPhone". For this selected device, the preference information area 2502 displays information 2506 regarding preferences associated with the particular device. In this specific example, a summary tab 2504 is active so that a summary preference window is displayed in the preference information area 2502. The summary preference window includes information describing the particular device, such as name, size, software version and serial number. The summary preference window also provides version information 2508 indicating whether or not an updated version of any software components might be available. Further, the summary preference window includes an options section 2510 that allows a customer to select one or more predetermined options regarding the mobile device. Device preferences can be set by a user for a plurality of different types of media. The device preferences can also be set differently for different types of media. The device preference page 2500 includes other tabs for distinct media types, including music, movies, TV shows, podcasts, photos, personal and games. These device preferences can be synchronization preferences used when synchronizing the media device with the client machine. For additional information on synchronization and synchronization preferences see (i) U.S. Provisional Patent Application No. 60/879,319, filed January 7, 2007, and entitled "MULTI-DEVICE DATA SYNCHRONIZATION OR BACKUP VIA A HOST DEVICE," which is hereby incorporated herein by reference; and (ii) U.S. Patent Application No. 11/679,082, filed February 26, 2007, and entitled "DATA SYNCHRONIZATION WITH HOST DEVICE IN ACCORDANCE WITH SYNCHRONIZATION PREFERENCES," which is hereby incorporated herein by reference.

[0132] As noted above, the provisioning method can also be used by existing customers. For example, an existing customer may get a new wireless communication device (e.g., mobile phone, multi-function device, etc.) that they want to use in place of their current wireless communication device. In one embodiment, the service plan (or rate plan) offered to the end user can have a predetermined minimum term (e.g., 2 years) or cancellation penalty duration. In one implementation, the user's new service plan will reset such minimum period(s) regardless of whether the user has already exceed the minimum period(s) for the user's existing plan.

[0133] FIG. 26 is a screen shot of an exemplary customer status page 2600 according to one embodiment of the invention. The customer status page 2600 allows a new wireless network service customer to activate a new mobile phone (i.e., mobile device) on pre-existing account in place of an existing mobile phone, whereby the phone number for the new mobile phone is the same as the phone number previously used for the existing mobile phone. Since the customer is an existing customer, an account information page can also be displayed. The account information page can permit the user to enter account information concerning their account with the wireless service provider. The account information serves to identify the pre-existing account of the user. As such, an activation server can locate the user account and associate the new mobile phone with the pre-existing account. FIG. 27 is a screen shot of an exemplary ac-

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count information page 2700 according to one embodiment of the invention. The account information page 2700 includes an account information entry area 2702 allows a user to enter account information.

[0134] An existing customer can also use the computer-assisted provisioning process to add an additional line to an existing account. FIG. 28 is a screen shot of an exemplary customer status page 2800 according to one embodiment of the invention. The customer status page 2800 allows an existing wireless network service customer to activate a new mobile phone on pre-existing account. Since the customer is an existing customer, an account information page can also be displayed. The account information page can permit the user to enter account information concerning their account with the wireless service provider. The account information serves to identify the pre-existing account of the user. As such, an activation server can locate the user account and associate the new mobile phone with the pre-existing account. FIG. 29 is a screen shot of an exemplary account information page 2900 according to one embodiment of the invention. The account information page 2900 includes an account information entry area 2902 allows a user to enter account information. Still further, in this scenario the pre-existing account is assumed to be an individual account. Hence, in one embodiment, an account type selection page can be displayed. FIG. 30 is a screen shot of an exemplary account type selection page 3000 according to one embodiment of the invention. The account type selection page 3000 allows the customer to choose to activate the new mobile phone on an individual plan or to instead convert to a family plan. Typically, with a family plan, the various mobile phones within the group can share service time (e.g., share plan minutes).

[0135] A new customer can also use the computer-assisted provisioning process to activate multiple mobile devices. FIG. 31 is a screen shot of an exemplary customer status page 3100 according to one embodiment of the invention. The customer status page 3100 allows a new customer for wireless network service to activate one mobile phone or multiple mobile phones. In one embodiment, when two or more mobile phones are to be activated an account type selection page can be displayed to enable the customer to choose between individual plans or family plans. FIG. 32 is a screen shot of an exemplary account type selection page 3200 according to one embodiment of the invention. The account type selection page 3200 allows the customer to choose to activate each of the multiple new mobile phones on individual plans or to instead activate all of the multiple new mobile phones on a family plan. Typically, with a family plan, the various mobile phones within the group can share service time (e.g., share plan minutes). In this example, the conversion to a family plan requires calling customer support; however, in other embodiments such can be part of the computer-assisted provisioning.

[0136] Mobile device provisioning can also enable remote provisioning of multiple wireless communication devices. For example, wireless service providers often refer to multiple devices on a primary account as a "family plan". Activation of multiple devices for such a primary account can require additional operations. In one embodiment, a first mobile device is connected to the host computer, such as using a USB connection, and then for the subsequent one or more mobile device to be also activated for the primary account can be identified to the provisioning server by having an end-user manually enter an identifier that is provided with another mobile device. For example, the identifier can be provided on or within a package containing the another mobile device. Hence, in would be possible for an end-user to activate a mobile device without it being present.

[0137] In one embodiment, the activation process uses two identifiers, IMEI and ICCID, when activating a mobile device. However, neither of these identifiers have built-in error correct or validation. Hence, manual entry of these identifiers by end-users could lead to failed or improper activation. One embodiment to enhance activation in such situations is to provide end-users with a computed identifier that uniquely maps to the needed IMEI and ICCID identifiers. The computed identifier can be more compact (i.e., less digits) and thus easier for manual entry. Moreover, the computed identifier can include error correction to guard against improper entry of the computed identifier.

[0138] Mobile device provisioning can also restrict payment options to those consumers that have low credit scores. For example, a wireless service provider may not desire to activate a wireless service plan to those customers that have poor credit. Hence, in one embodiment, the wireless service provider can offer different payment options to different customers dependent on at least credit information (e.g., credit score). For example, customers with poor credit can be required to pay a deposit or to pre-pay for such service.

[0139] In some cases, a new customer can be limited to service plans that require prepayment. In one embodiment, the provisioning process can decide whether prepayment is required based on the credit history of the customer. The credit history can, for example, result from a credit report on the customer. FIG. 33 is a screen shot of an exemplary prepayment requirement page 3300. The exemplary prepayment requirement page 3300 can present the customer with one or more option on activating wireless service. The exemplary prepayment requirement page 3300 allows the customer to (i) provide a pre-approval credit check code and continue activation, (ii) agree to a prepaid plan (e.g., with advance monthly payment via credit or debit card) and continue activation, or (iii) restart/cancel the activation process.

[0140] As noted above, the provisioning method can also be used by existing customers. For example, an existing customer may get a new wireless communication device (e.g., mobile phone, multi-function device, etc.) that they want to use it in place of their current wireless communication device. In one embodiment, the

service plan offered to the end user can have a predetermined minimum term (e.g., 2 years) or cancellation penalty duration. In one implementation, the user's new service plan will reset such minimum period regardless of whether the user has already exceed the minimum period for the user's existing plan.

[0141] FIG. 34 is a block diagram of a mobile multi-function device 3400 according to one embodiment of the invention. The mobile multi-function device 3400 can include the circuitry of the mobile multi-function device 104 illustrated in FIG. 1 and/or can perform the operations described with reference to FIGs. 3 and 4. The mobile multi-function device 3400 includes hardware and software components to provide at least two functions, namely, a media playback function and a wireless voice communications function. When providing media playback, the mobile multi-function device 3400 can operate as a media player capable of playing (including displaying) media items. The media items can, for example, pertain to audio items (e.g., audio files or songs), videos (e.g., movies) or images (e.g., photos). When providing wireless voice communications, the mobile multi-function device 3400 can operate a mobile telephone (e.g., cellular phone).

[0142] The mobile multi-function device 3400 includes a processor 3402 that pertains to a microprocessor or controller for controlling the overall operation of the mobile multi-function device 3400. The mobile multi-function device 3400 stores media data pertaining to media items in a file system 3404 and a cache 3406. In one embodiment, the file system 3404 is implemented by a storage disk or a plurality of disks. In another embodiment, the file system 3404 is implemented by EEPROM or Flash type memory. The file system 3404 typically provides high capacity storage capability for the mobile multi-function device 3400. However, since the access time to the file system 3404 is relatively slow, the mobile multi-function device 3400 can also include a cache 3406. The cache 3406 is, for example, Random-Access Memory (RAM) provided by semiconductor memory. The relative access time to the cache 3406 is substantially shorter than for the file system 3404. However, the cache 3406 does not have the large storage capacity of the file system 3404. Further, the file system 3404, when active, consumes more power than does the cache 3406. The power consumption is often a concern when the mobile multi-function device 3400 is a portable mobile multi-function device that is powered by a battery 3424. The mobile multi-function device 3400 also includes a RAM 3420 and a Read-Only Memory (ROM) 3422. The ROM 3422 can store programs, utilities or processes to be executed in a non-volatile manner. The ROM 3422 can be implemented by an EEPROM or Flash type memory so as to provide writable non-volatile data storage. The RAM 3420 provides volatile data storage, such as for the cache 3406.

[0143] In one embodiment, to support wireless voice communications, the mobile multi-function device 3400 includes a transceiver 3426 and a SIM card 3428. The transceiver 3426 supports wireless communication with a wireless network (such as a wireless cellular network). The SIM card 3428 includes an identifier (e.g., SIM identifier) can be used by the mobile multi-function device 3400 to gain access and utilize the wireless network. In other embodiments, a SIM card 3428 is not utilized.

[0144] The mobile multi-function device 3400 also includes a user input device 3408 that allows a user of the mobile multi-function device 3400 to interact with the mobile multi-function device 3400. For example, the user input device 3408 can take a variety of forms, such as a button, keypad, dial, etc. Still further, the mobile multi-function device 3400 includes a display 3410 (screen display) that can be controlled by the processor 3402 to display information to the user. A data bus 3411 can facilitate data transfer between at least the file system 3404, the cache 3406, the processor 3402, and the CODEC 3412.

[0145] In one embodiment, the mobile multi-function device 3400 serves to store a plurality of media items (e.g., songs) in the file system 3404. When a user desires to have the mobile multi-function device play a particular media item, a list of available media items is displayed on the display 3410. Then, using the user input device 3408, a user can select one of the available media items. The processor 3402, upon receiving a selection of a particular media item, supplies the media data (e.g., audio file) for the particular media item to a coder/decoder (CODEC) 3412. The CODEC 3412 then produces analog output signals for a speaker 3414. The speaker 3414 can be a speaker internal to the mobile multi-function device 3400 or external to the mobile multi-function device 3400. For example, headphones or earphones that connect to the mobile multi-function device 3400 would be considered an external speaker.

[0146] The mobile multi-function device 3400 also includes a bus interface 3416 that couples to a data link 3418. The data link 3418 allows the mobile multi-function device 3400 to couple to a host device (e.g., host computer or power source). The data link 3418 can also provide power to the mobile multi-function device 3400.

[0147] The various aspects, embodiments, implementations or features of the invention can be used separately or in any combination.

[0148] The invention can be implemented by software, hardware or a combination of hardware and software. The invention can also be embodied as computer readable code on a computer readable medium. The computer readable medium is any data storage device that can store data which can thereafter be read by a computing device (e.g., computer system). Examples of the computer readable medium include read-only memory, random-access memory, CD-ROMs, DVDs, magnetic tape, optical data storage devices, and carrier waves. The computer readable medium can also be distributed over network-coupled computer systems so that the computer readable code is stored and executed in a distributed

fashion.

[0149] The advantages of the invention are numerous. Different aspects, embodiments or implementations may, but need not, yield one or more of the following advantages. One advantage of the invention is that mobile devices can be setup or activated to operate on wireless networks by end users. Another advantage of the invention is that setup or activation can be substantially automated and controlled by a computer-implemented system to facilitate setup or activation with a service provider (e.g., wireless service provider). Another advantage of the invention is that graphical user interfaces can be presented to users so as to enable end users to easily activate mobile devices. Still another advantage of the invention is that more than one account for different service providers can be concurrently arranged in an efficient and user friendly manner. Yet still another advantage of the invention is that mobile devices can be largely disabled until properly activated with a service provider.

[0150] The many features and advantages of the present invention are apparent from the written description. Further, since numerous modifications and changes will readily occur to those skilled in the art, the invention should not be limited to the exact construction and operation as illustrated and described. Hence, all suitable modifications and equivalents may be resorted to as falling within the scope of the invention.

Claims

1. A computer-implemented method for activating wireless network service for an electronic device through use of a host device, the electronic device being associated with a customer for wireless network service provided by a wireless network service provider, said method comprising:

   receiving device information from the electronic device when the electronic device is attached to the host device;
   acquiring customer information pertaining to the customer;
   receiving a service plan selection from the customer;
   receiving billing information for payment of the service plan; and
   initiating activation of a wireless service account for use of the electronic device with the wireless network service provided by the wireless network service provider, wherein the wireless service account being activated is based on the customer information, the service plan and the billing information.

2. A computer-implemented method as recited 1, wherein said method further comprises:

   enabling, following said activating, the electronic device for usage of at least one operation that was previously restricted prior to said enabling.

3. A computer-implemented method as recited 1, wherein said method further comprises:

   obtaining a credit indication for the customer; and
   determining one or more service plans that are made available to the customer based at least in part on the credit indication for the customer,

   wherein the service plan selection is one of the one or more service plans.

4. A computer-implemented method as recited in claim 1, wherein said method further comprises:

   requiring formation of a media account with the online media store when the customer does not already have a media account with the online media store.

5. A computer-implemented method as recited in claim 1, wherein said method further comprises:

   thereafter initiating activation of the wireless network service for the electronic device associated with the customer.

6. A computer-implemented method as recited in claim 1, wherein said method further comprises:

   presenting account information for approval; and
   receiving approval from the customer for the account information.

7. A computer-implemented method as recited in claim 1, wherein said method further comprises:

   presenting at least one service agreement for approval; and
   receiving approval of the at least one service agreement.

8. A computer-implemented method as recited in any of claims 1-7, wherein the host device is a personal computer, and wherein said method is performed by an application program operating on the personal computer.

9. A computer-implemented method as recited in claim 8, wherein the application program is a media management application.

10. A computer-implemented method for activating an

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electronic device for wireless network service through use of a host device, the electronic device being associated with a customer for wireless network service provided by a wireless network service provider, said method comprising:

receiving device information from the electronic device while the electronic device is attached to the host device;
acquiring customer information pertaining to the customer;
offering the user one or more service plans;
receiving a user selection of one of the service plans; and
receiving billing information for payment of the selected service plan.

11. A computer-implemented method as recited in claim 10, wherein said method further comprises:

offering the user a plurality of payment options; and
receiving a user selection of one of the payment options.

12. A computer-implemented method as recited in claim 10, wherein said method further comprises:

initiating activation of an account for the customer whereby the electronic device is provided with access to wireless network service in accordance with the selected service plan.

13. A computer-implemented method as recited in claim 10, wherein said method further comprises:

activating the electronic device for use with the wireless network service in accordance with the selected service plan.

14. A computer-implemented method as recited in claim 10, wherein said activating comprises:

enabling the electronic device; and
initiating setup of the wireless network service to permit usage by the electronic device.

15. A computer-implemented method as recited in claim 10, wherein the user is an end user and wherein the user selections are made by the user by a computer program operating on the host device.

16. A computer-implemented method as recited in claim 10, wherein said method is performed by an activation server that is operatively connected to the host device via a network.

17. A computer-implemented method as recited in claim 10, wherein said method is performed by the host device.

18. A computer-implemented method as recited in claim 10, wherein said method further comprises:

establishing wireless service account for the user, the wireless service account pertaining to the selected service plan and being paid for in accordance with the billing information.

19. A computer-implemented method as recited in claim 18, wherein said method further comprises:

thereafter activating the wireless network service for the electronic device associated with the user.

20. A computer-implemented method as recited in claim 10, wherein the electronic device is a multi-function device.

21. A computer-implemented method as recited in claim 10, wherein the electronic device comprises a mobile phone.

22. A computer-implemented method as recited in claim 10-21, wherein said method further comprises:

determining whether the user has a media account with an online media store.

23. A computer-implemented method as recited in claim 22, wherein said method further comprises:

requiring formation of a media account with the online media store when said determining determines that the user does not have a media account with the online media store.

24. A computer-implemented method as recited in claim 23, wherein said method further comprises:

establishing wireless service account for the user, the wireless service account pertaining to the selected service plan and being paid for in accordance with the billing information.

25. A computer-implemented method as recited in claim 24, wherein said method further comprises:

thereafter activating the wireless network service for the electronic device associated with the user.

26. A computer-implemented method as recited in claim 25, wherein said offering of one or more payment options is dependent on the credit worthiness of the

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user.

27. A computer-implemented method for activating an electronic device for wireless network service from a host device, the electronic device being associated with a customer for wireless network service provided by a wireless network service provider, said method comprising:

receiving device information from the electronic device when the electronic device is attached to the host device;
determining whether the electronic device has already been activated based on the device information; and
automatically initiating activation of the electronic device when said determining determines that the electronic device has not already been activated.

28. A computer-implemented method as recited in claim 27, wherein the host device is a personal computer, and wherein said method is performed by an application program operating on the personal computer.

29. A computer-implemented method as recited in claim 28, wherein the electronic device is a multi-function device, and wherein one function of the multi-function device is a wireless phone function, and another function of the multi-function device is a media playback function.

30. A computer-implemented method as recited in claim 29, wherein the application program is a media management application.

31. A computer readable medium including at least computer executable program code tangibly embodied therein for activating wireless network service for an electronic device through use of a client computing device, the electronic device being associated with a customer for wireless network service provided by a wireless network service provider, said computer readable medium comprising:

computer program code for receiving device information from the electronic device;
computer program code for acquiring customer information pertaining to the customer;
computer program code for receiving a service plan selection from the customer;
computer program code for receiving billing information for payment of the service plan; and
computer program code for initiating activation of a wireless service account for use of the electronic device with the wireless network service provided by the wireless network service provider.

32. A computer readable medium as recited in claim 31, wherein said computer readable medium further comprises:

computer program code for detecting connection of the electronic device to the host device; and

wherein said computer program code for receiving device information receives, the device information from the electronic device without user interaction once the electronic device is connected to the host device.

33. A computer readable medium including at least computer executable program code tangibly embodied therein for activating an electronic device for wireless network service through use of a host device, the electronic device being associated with a customer for wireless network service provided by a wireless network service provider, said computer readable medium comprising:

computer program code for receiving device information from the electronic device while the electronic device is attached to the host device;
computer program code for acquiring customer information pertaining to the customer;
computer program code for offering the user one or more service plans;
computer program code for receiving a user selection of one of the service plans; and

computer program code for receiving billing information for payment of the selected service plan.

34. A computer readable medium as recited in claim 33, wherein said computer readable medium further comprises:

computer program code for offering the user a plurality of payment options; and
computer program code for receiving a user selection of one of the payment options.

35. A computer readable medium as recited in claim 33, wherein said computer readable medium further comprises:

computer program code for initiating activation of an account for the customer whereby the electronic device is provided with access to wireless network service in accordance with the selected service plan.

36. A computer readable medium as recited in claim 33, wherein said computer readable medium further comprises:

computer program code for activating the electronic device for use with the wireless network service in accordance with the selected service plan.

37. A computer readable medium as recited in claim 33, wherein said computer program code for activating comprises:

computer program code for enabling the electronic device; and
computer program code for initiating setup of the wireless network service to permit usage by the electronic device.

38. A computer readable medium as recited in claim 33, wherein the user is an end user and wherein the user selections are made by the user by a computer program operating on the host device.

39. A computer readable medium as recited in claim 33, wherein said computer readable medium further comprises:

computer program code for establishing wireless service account for the user, the wireless service account pertaining to the selected service plan and being paid for in accordance with the billing information.

40. A computer readable medium as recited in claim 39, wherein said computer readable medium further comprises:

computer program code for thereafter activating the wireless network service for the electronic device associated with the user.

41. A computer-implemented method as recited in claim 33, wherein the electronic device is a multi-function device.

42. A computer-implemented method as recited in claim 33, wherein the electronic device comprises a mobile phone.

43. A computer-implemented computer readable medium as recited in any of claims 23-42, wherein said computer readable medium further comprises:

computer program code for determining whether the user has a media account with an online media store.

44. A computer readable medium as recited in claim 43, wherein said computer readable medium further comprises:

computer program code for requiring formation of a media account with the online media store when said determining determines that the user does not have a media account with the online media store.

45. A computer readable medium as recited in claim 44, wherein said computer readable medium further comprises:

computer program code for establishing wireless service account for the user, the wireless service account pertaining to the selected service plan and being paid for in accordance with the billing information.

46. A computer readable medium as recited in claim 45, wherein said computer readable medium further comprises:

computer program code for activating the wireless network service for the electronic device associated with the user.

47. A computer readable medium as recited in claim 46, wherein said computer program code for offering of one or more payment options is dependent on the credit worthiness of the user.

48. A graphical user interface to assist an end user in activating an account for an electronic device having wireless communication capabilities, the account being with respect to a wireless service provider providing wireless network service, said graphical user interface comprising:

a plurality of display screens that are presented on a display device associated with a host computer, said display screens includes at least:

an end user status page to facilitate selection of a type of activation;
a service plan selection page to facilitate selection of a service plan for the wireless network service;
a media account page for a media account associated with an online media store so that a user can create a new media account or login to an existing media account;
an end user information entry page to facilitate entry of end user information;
a billing information page to facilitate entry of billing information for one or both the user media account and a wireless account;
a terms and conditions page regarding legal agreements with the online media store and with the wireless service provider; and
an activation page to inform the end user of

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activation information.

49. A graphical user interface as recited in claim 48, wherein said display screens further comprises:

a final review and submit page to initiate activation of the account for the electronic device with respect to the wireless service provider.

50. A graphical user interface as recited in claim 48, wherein the final review and submit page can further initiate creation of the new media account for the user not having the existing media account.

51. A graphical user interface as recited in claim 48, wherein said plurality of display screens further comprises:

a device preference page to assist the end user with setting one or more preferences or options to be applied to the operation of the electronic device.

52. A graphical user interface as recited in claim 48, wherein the end user status page enables a user to select from a plurality of types of activation.

53. A graphical user interface as recited in claim 52, wherein the types of activation include an individual plan and a family plan.

54. A graphical user interface as recited in claim 52, wherein the types of activation include a new individual plan, an existing individual plan, a new family plan, and an existing family plan.

55. A graphical user interface as recited in claim 48, wherein the electronic device is a multi-function device, and wherein the multi-function device supports at least wireless voice communication and media playback.

56. A graphical user interface as recited in claim 48, wherein said plurality of display screens further comprises:

a media account page for identifying a media account for the end user.

57. A graphical user interface as recited in claim 48, wherein the type of activation pertains to individual plan activation or family plan activation.

58. A graphical user interface as recited in claim 48, wherein one of the types of activation pertains to use of an existing phone number or a new phone number.

59. A graphical user interface as recited in claim 48, wherein said service plan selection page presents information on a plurality of service plans and their costs and enables the end user to select from the service plans.

60. A graphical user interface as recited in claim 48, wherein the billing information provided via said billing information page includes information pertaining to name and billing address for the end user and credit card number.

61. A graphical user interface as recited in claim 48, wherein the activation completion page informs the end user of a phone number associated with the electronic device being activated.

62. A graphical user interface as recited in claim 48, wherein said plurality of display screens further comprises:

a device preference page to assist the customer with setting one or more preferences or options to be applied to the operation of the electronic device.

63. A graphical user interface as recited in claim 48, wherein said graphical user interface comprises:

a transfer number page for identifying a phone number and an existing account, wherein the phone number to be transferred is to be used with the account being activated and associated with the electronic device.

64. A graphical user interface as recited in claim 48, wherein said graphical user interface is presented on a display device associated with a computing device, and wherein the electronic device is electrically coupled to the computing device.

65. A graphical user interface as recited in claim 64, wherein the electronic device is a multi-function device, and wherein one function of the multi-function device is a wireless phone function, and another function of the multi-function device is a media playback function.

66. A graphical user interface as recited in claim 65, wherein the application program is a media management application.

67. A computer-implemented method for activating an electronic device for wireless network service, the electronic device being associated with a customer of a wireless service provider associated with the wireless network service, said method comprising:

informing an activation server of an electronic

device having wireless communication device that is to be activated for wireless network service;
displaying a customer status page to facilitate selection of a type of activation;
specifying to the activation server a type of activation desired by the customer;
displaying a service plan selection page to facilitate selection of a service plan for the wireless network service;
informing the activation server of a selected service plan;
displaying a customer account page to facilitate login to or creation of a user media account with an online media store;
providing account information for the user media account for the customer;
displaying a customer information entry page;
providing customer information to the activation server;
displaying a billing information page to facilitate entry of billing information for one or both the user media account and a wireless account;
informing the activation server of the billing information;
displaying a terms and conditions page regarding legal agreements with the online media store and with the wireless service provider;
informing the activation server of acceptance of the legal agreements;
displaying an information review page;
informing the activation server of approval of the information provided on the information review page;
displaying an activation completion page; and
displaying a device preference page to assist the customer with setting one or more preferences or options to be applied to the operation of the electronic device.

68. A method as recited in claim 67, wherein said displaying by said method is on a display device associated with a client computing device having the electronic device operatively coupled thereto.

BNSDOCID: <EP_____1942698A1_I_>

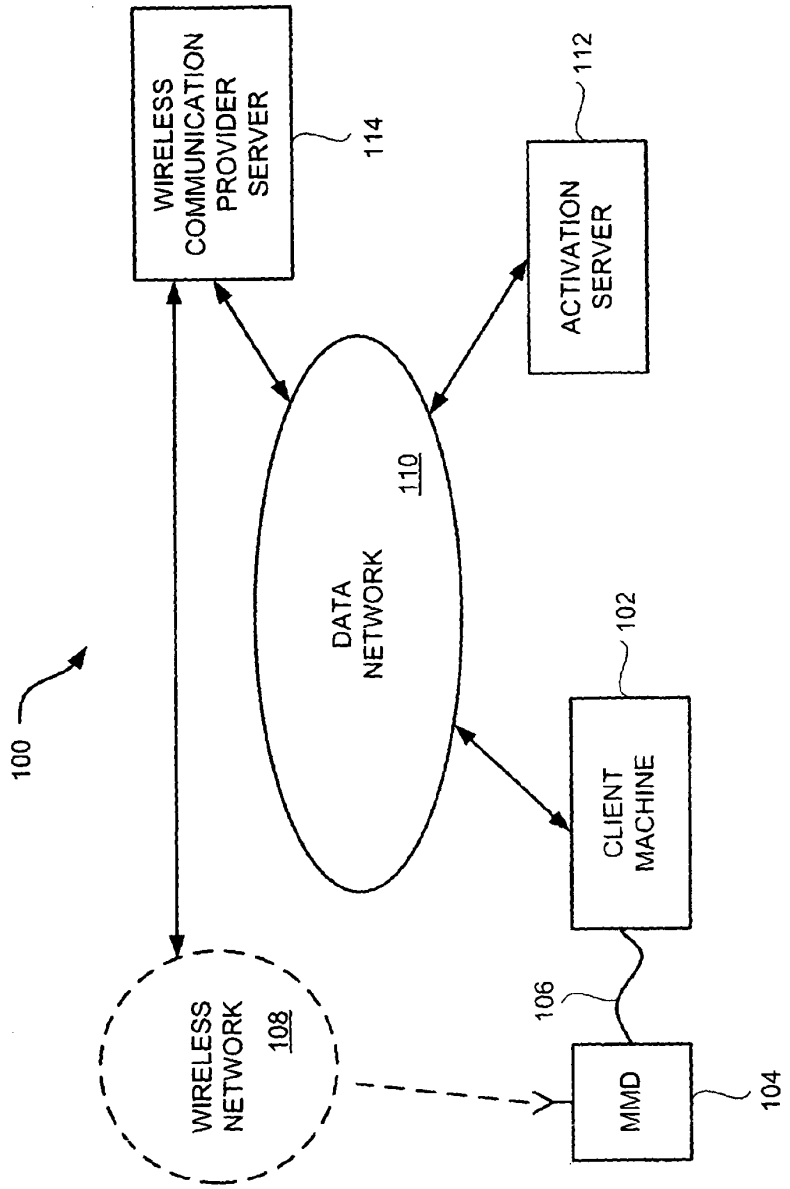


FIG. 1

EPNSDOCID: <EP 1942698A1 | >

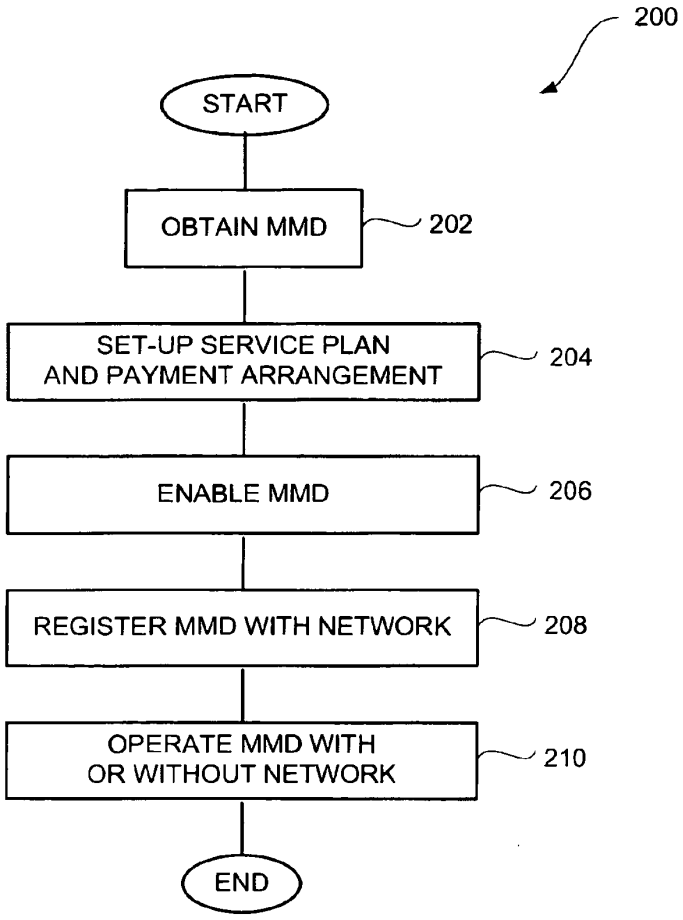


FIG. 2A

BNSDOCID: <EP_____1942698A1_I_>

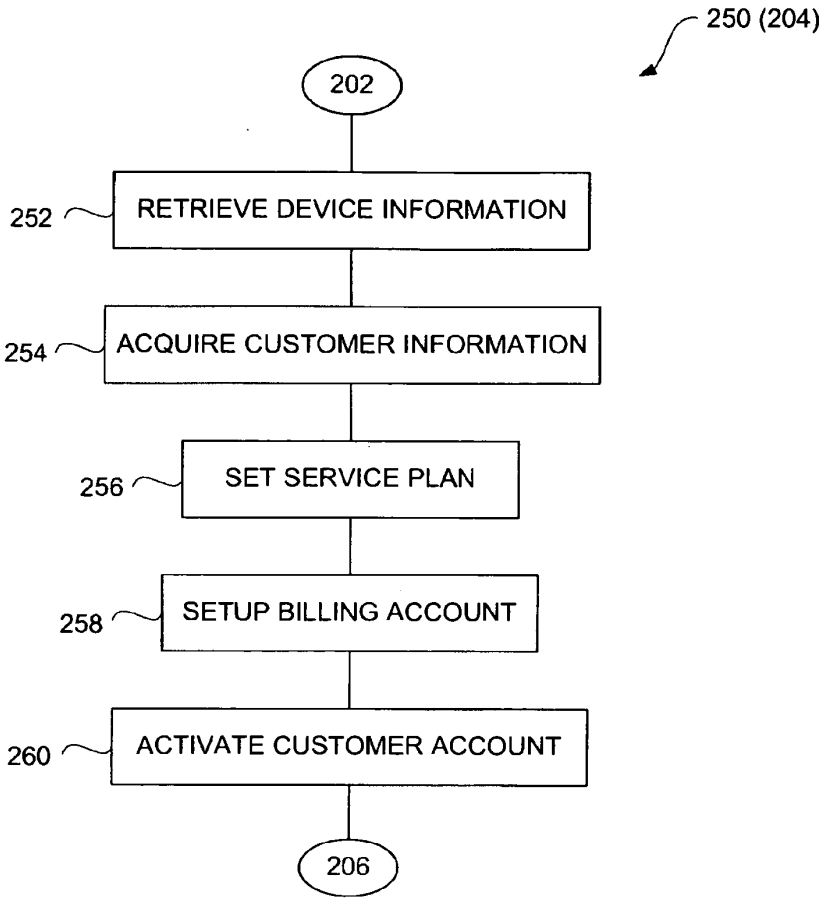

250 (204)
202
252
RETRIEVE DEVICE INFORMATION
254
ACQUIRE CUSTOMER INFORMATION
256
SET SERVICE PLAN
258
SETUP BILLING ACCOUNT
260
ACTIVATE CUSTOMER ACCOUNT
206

FIG. 2B

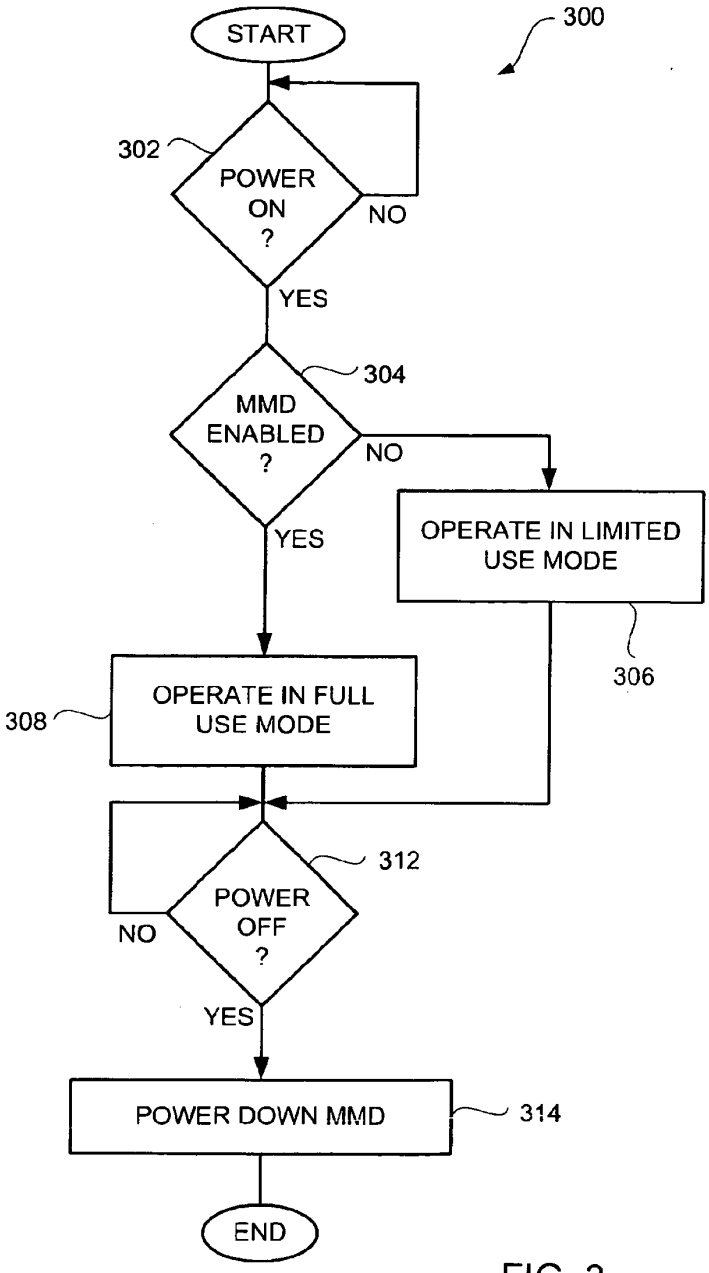


FIG. 3

BNSDOCID: <EP_____1942698A1_I_>

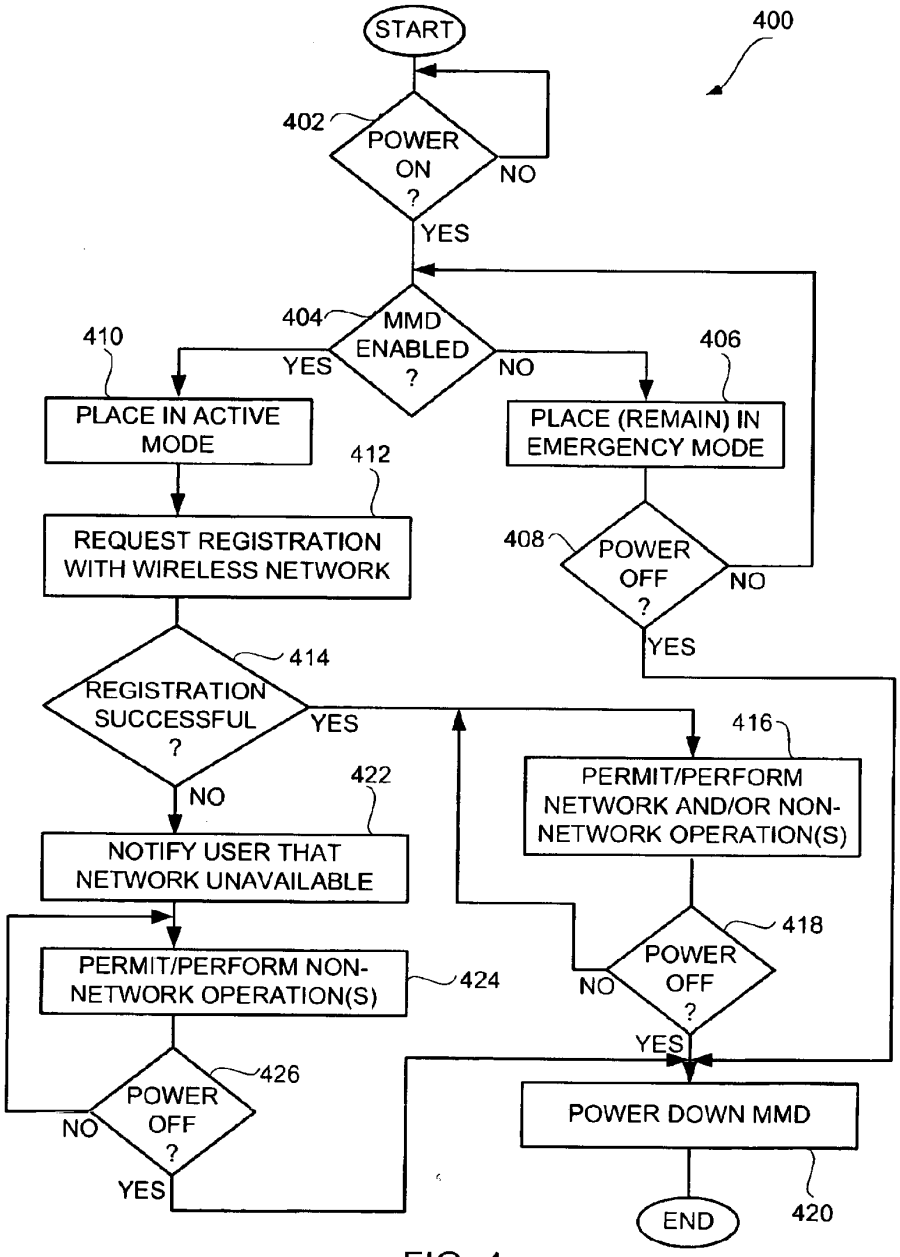


FIG. 4

BNSDOCID: <EP_____1942698A1_I_>

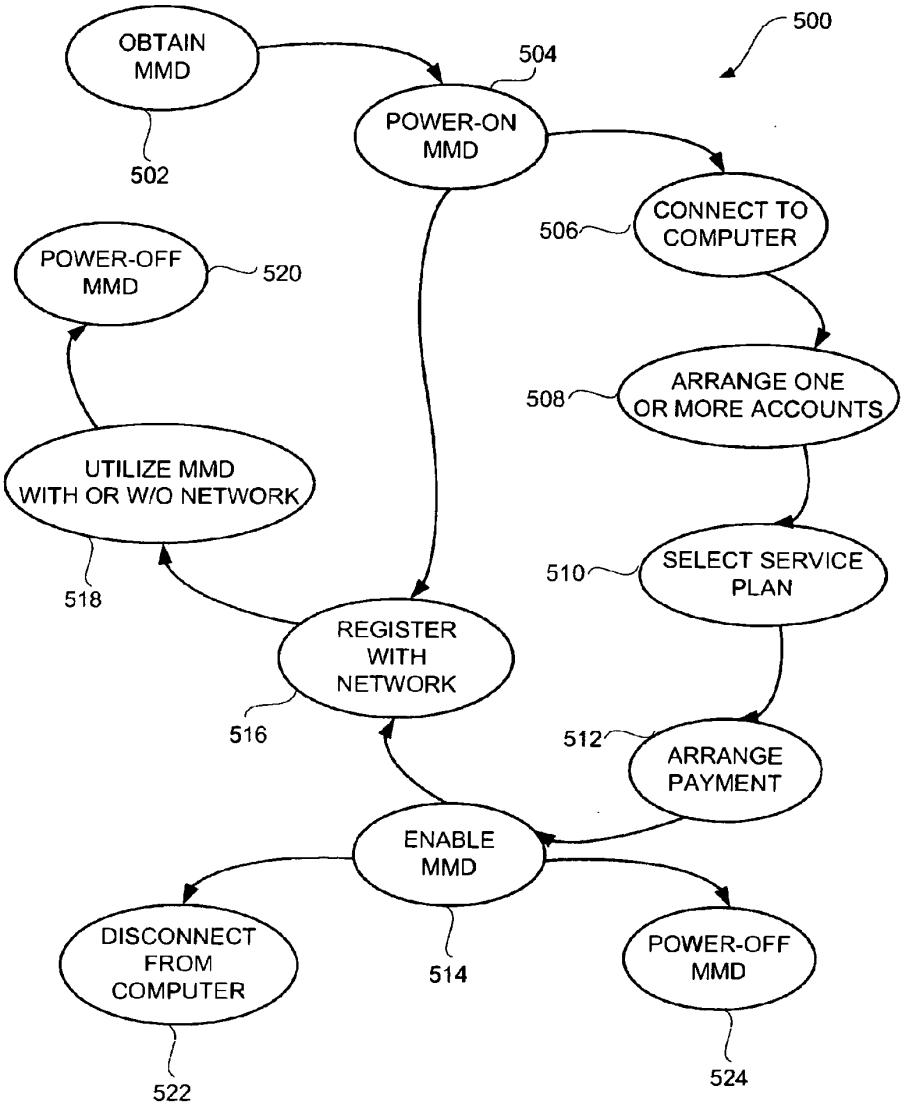


FIG. 5

BNSDOCID: <EP_____1942698A1_I_>

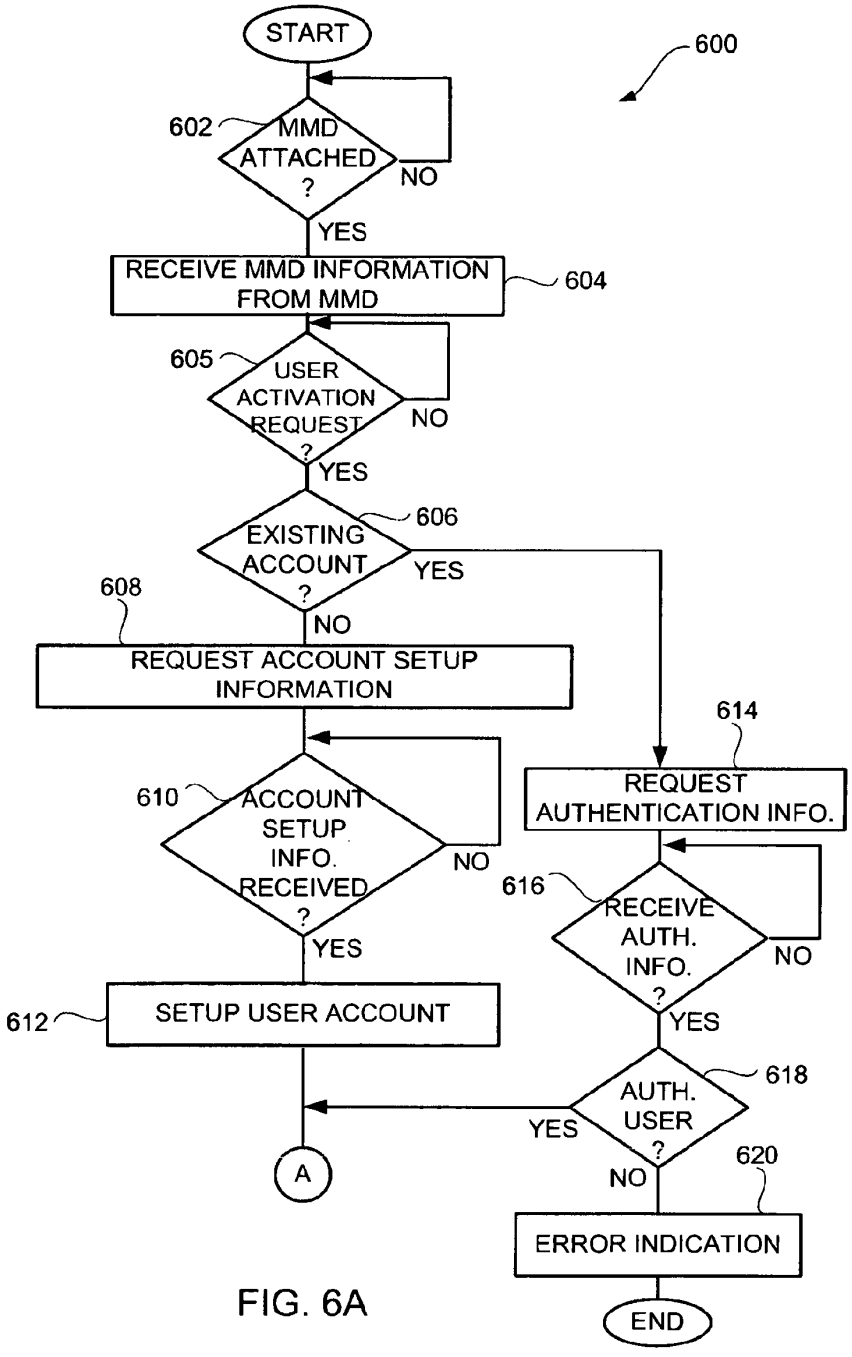


FIG. 6A

EPNSDOCID: <EP 1942698A1 | >

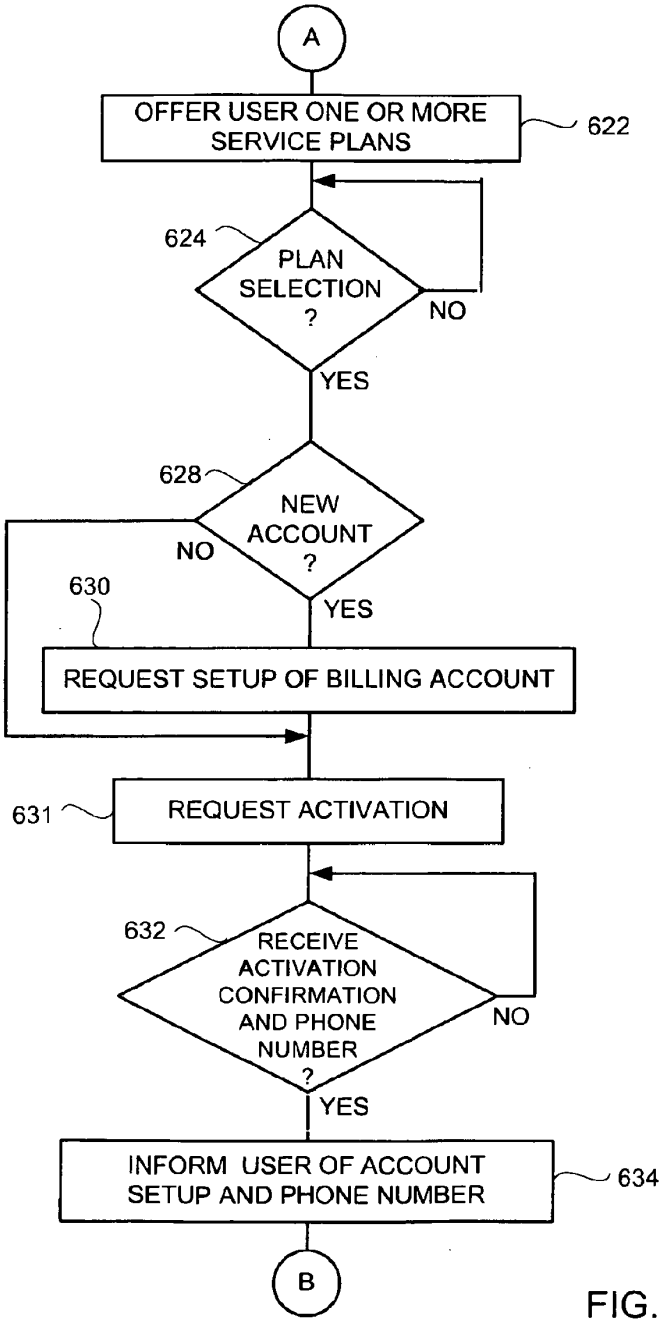


FIG. 6B

BNSDOCID: <EP_____1942698A1_I_>

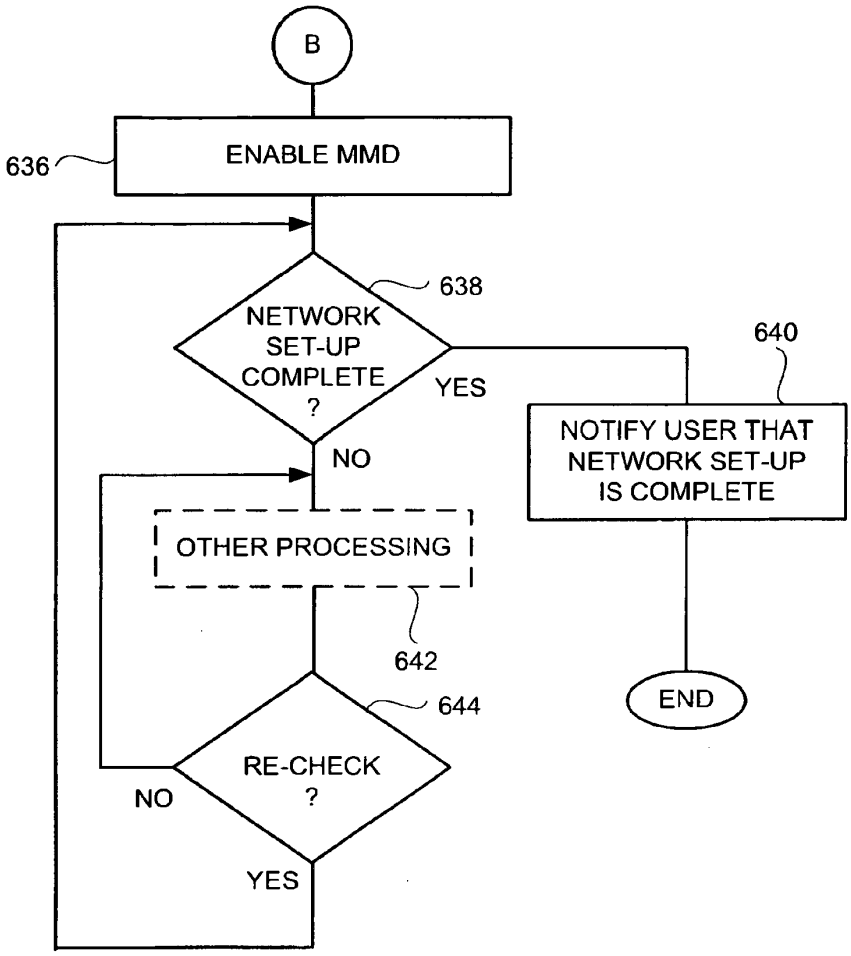


FIG. 6C

BNSDOCID: <EP_____1942698A1_I_>

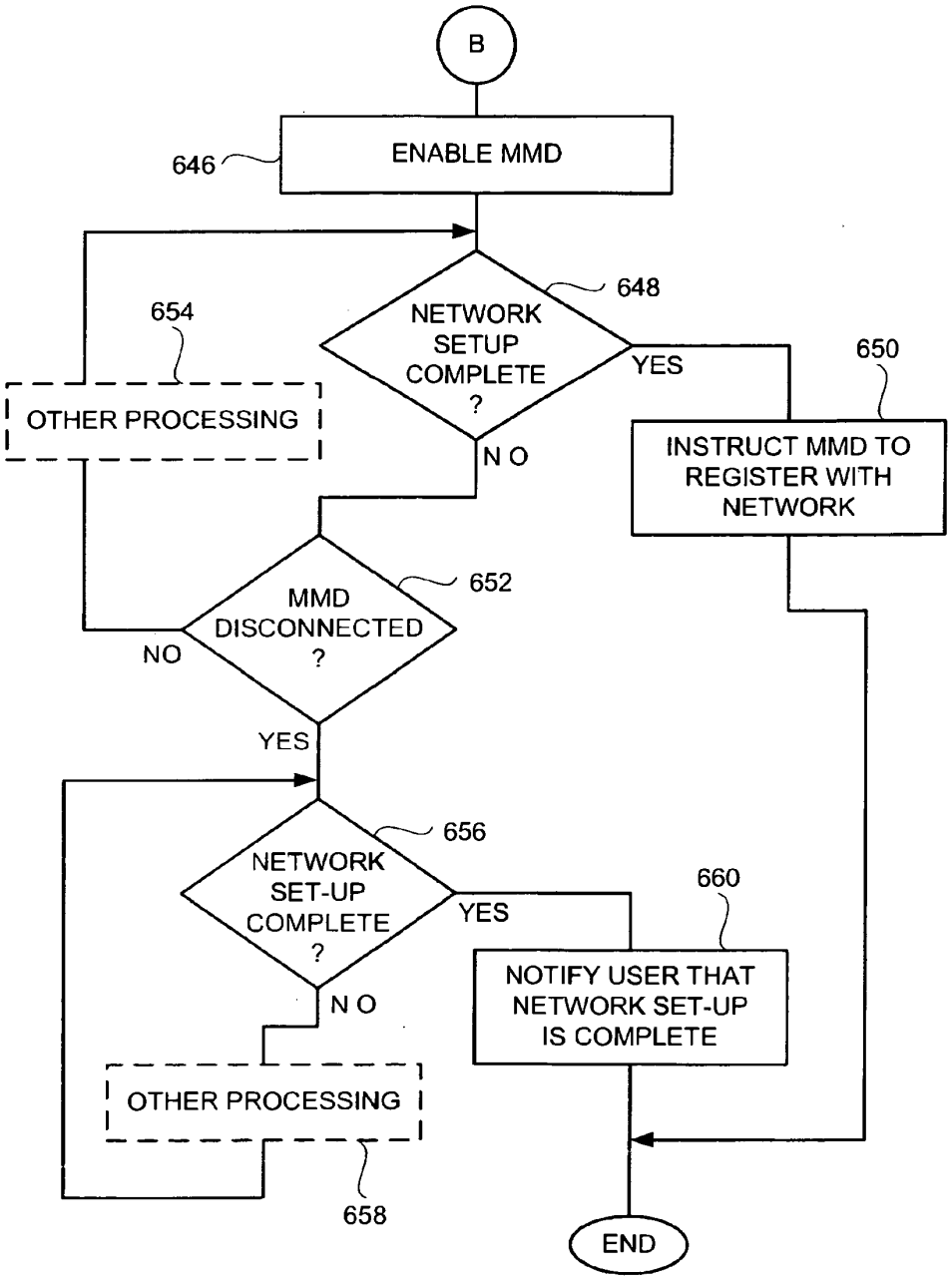


FIG. 6D

BNSDOCID: <EP_____1942698A1_I_>

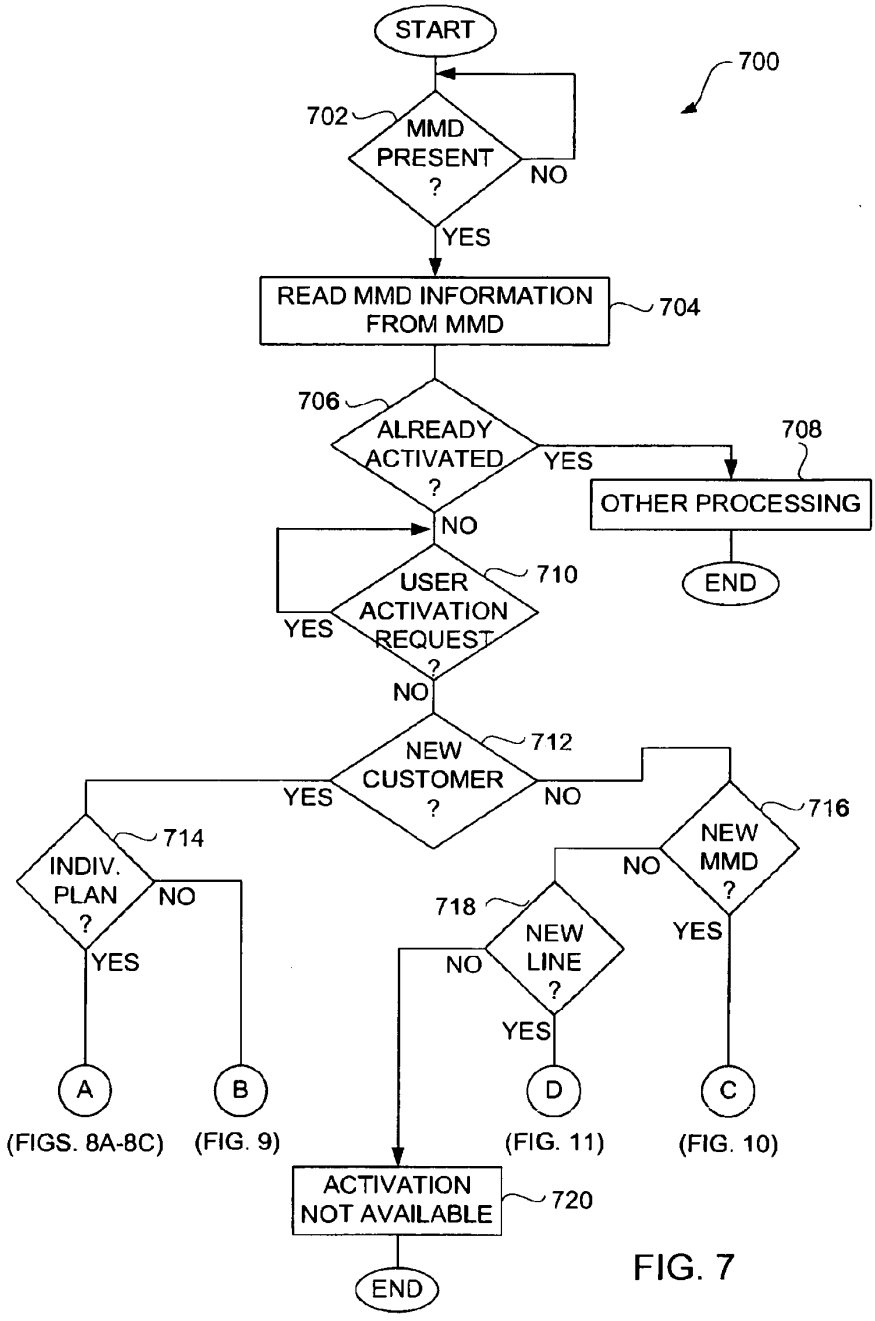

START
700
702
MMD PRESENT ?
NO
YES
READ MMD INFORMATION FROM MMD
704
706
ALREADY ACTIVATED ?
YES
708
OTHER PROCESSING
END
NO
USER ACTIVATION REQUEST ?
710
YES
NO
NEW CUSTOMER ?
712
YES
NO
INDIV. PLAN ?
714
NO
YES
NEW MMD ?
716
NO
YES
718
NEW LINE ?
NO
YES
A
B
D
C
(FIGS. 8A-8C)
(FIG. 9)
(FIG. 11)
(FIG. 10)
ACTIVATION NOT AVAILABLE
720
END

FIG. 7

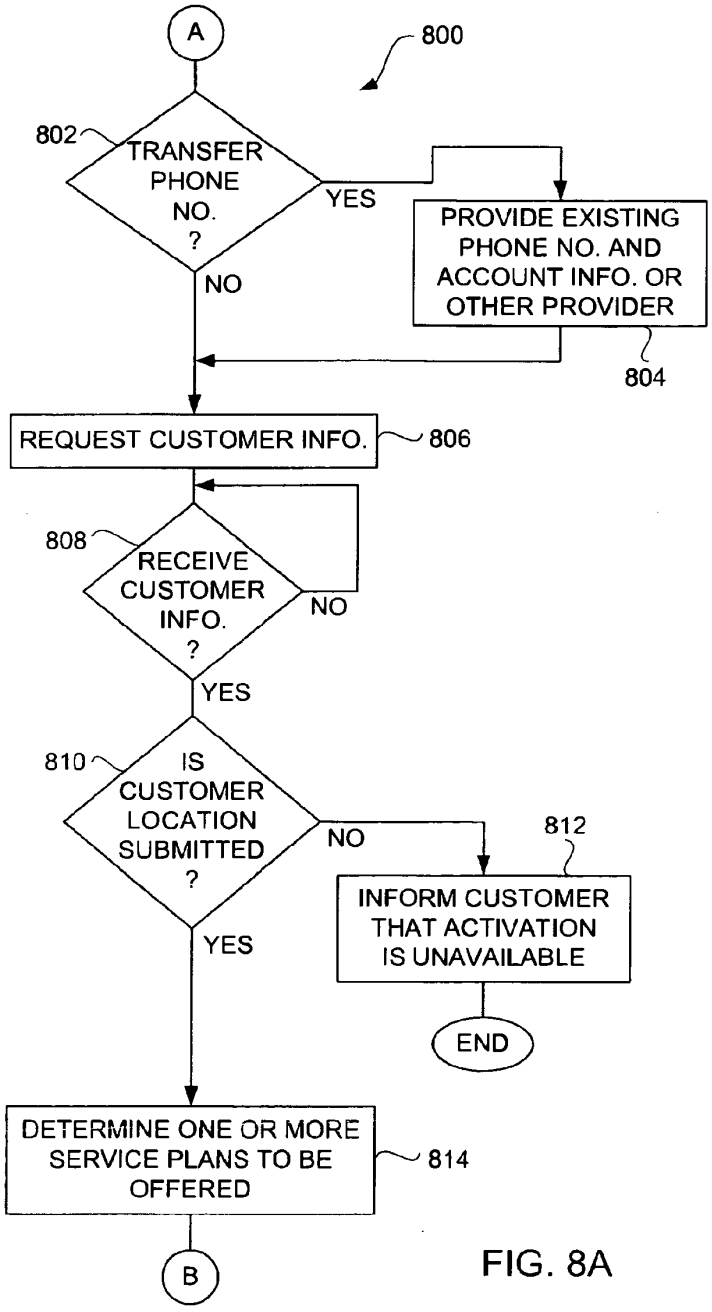


FIG. 8A

BNSDOCID: <EP_____1942698A1_I_>

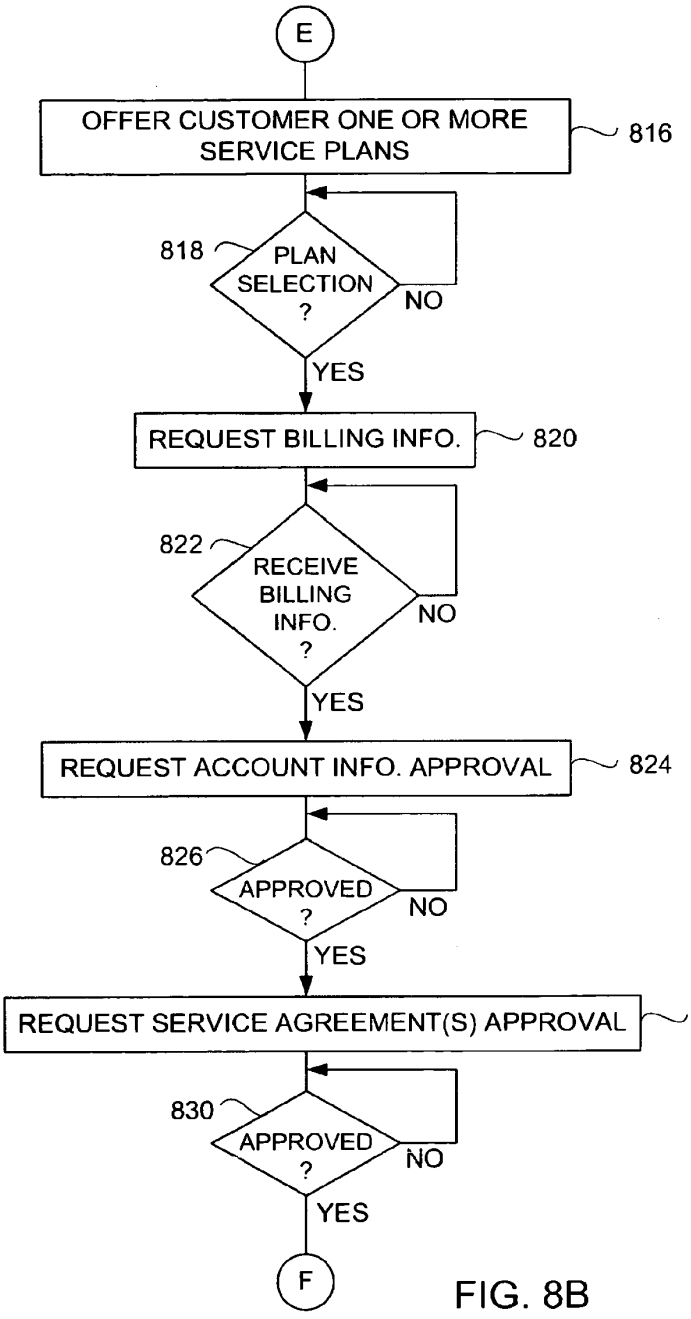


FIG. 8B

BNSDOCID: <EP 1942698A1 >

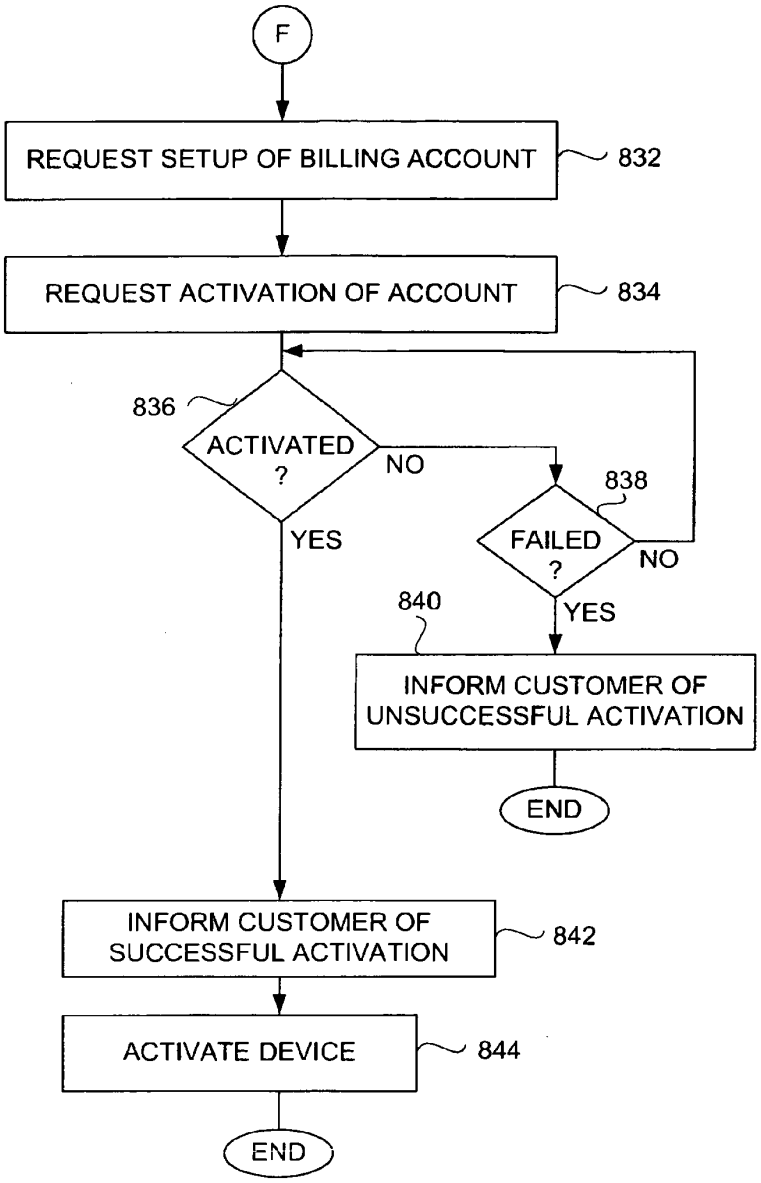


FIG. 8C

BNSDOCID: <EP_____1942698A1_I_>

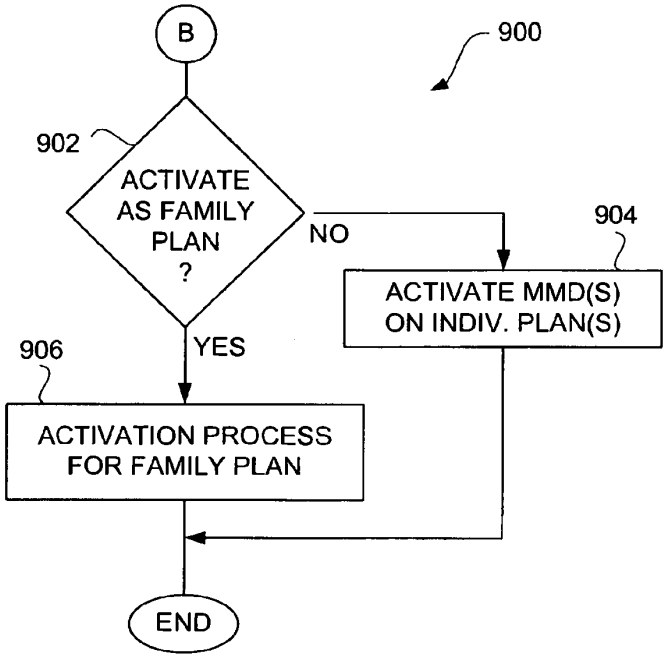


FIG. 9

EPNSDOCID: <EP 1942698A1 | >

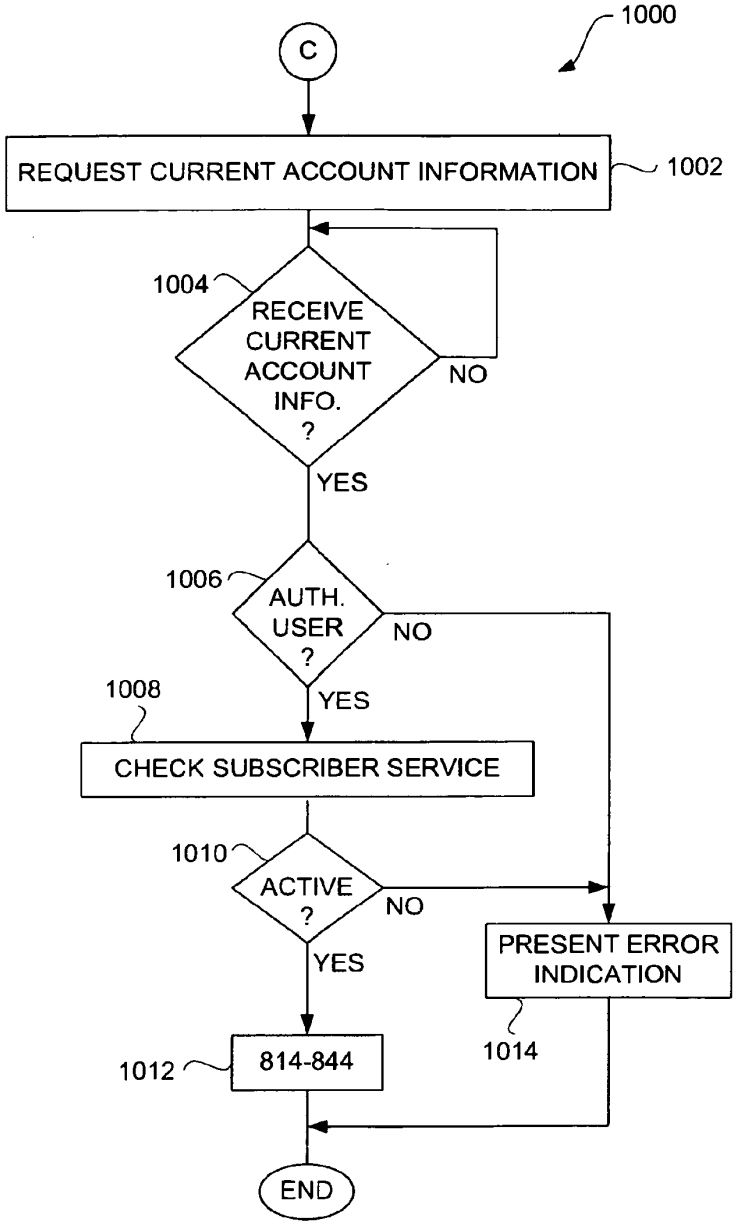


FIG. 10

BNSDOCID: <EP_____1942698A1_I_>

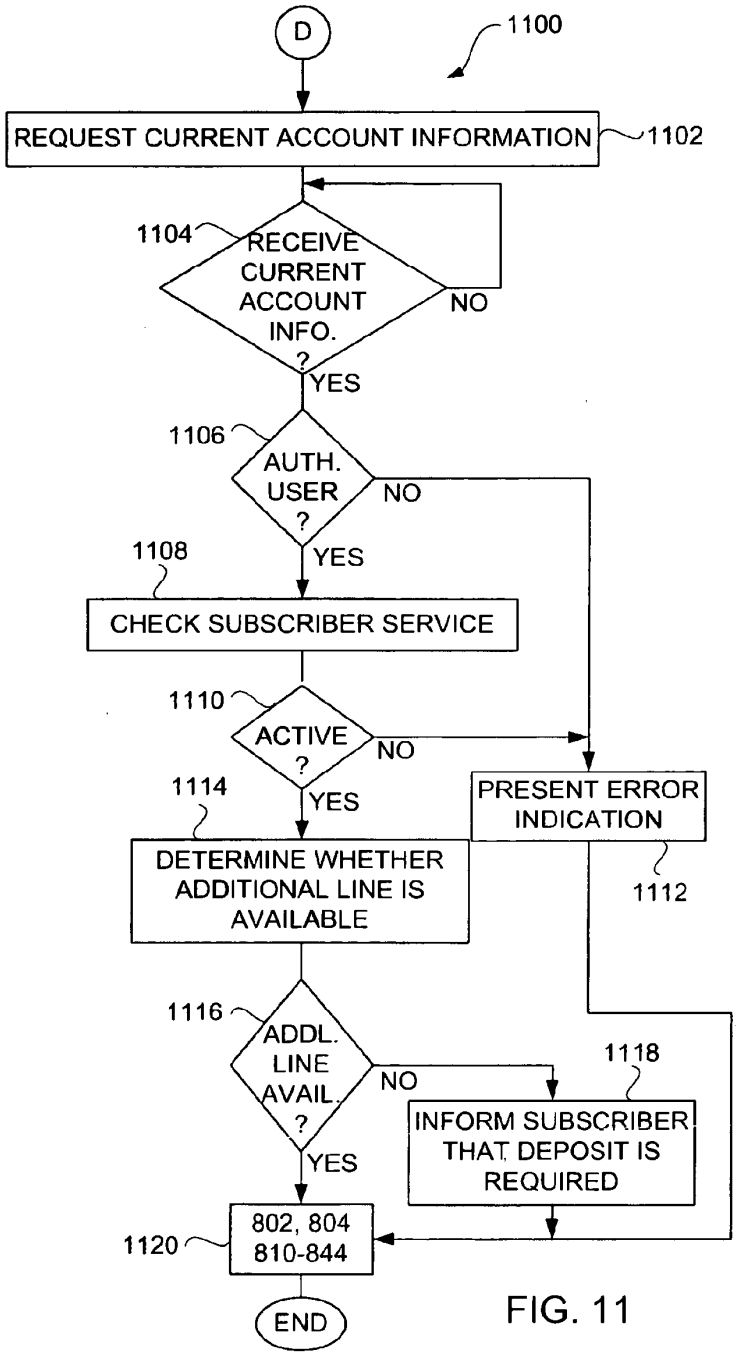

D
1100
REQUEST CURRENT ACCOUNT INFORMATION
1102
1104
RECEIVE CURRENT ACCOUNT INFO. ?
NO
YES
1106
AUTH. USER ?
NO
YES
1108
CHECK SUBSCRIBER SERVICE
1110
ACTIVE ?
NO
YES
1114
PRESENT ERROR INDICATION
1112
DETERMINE WHETHER ADDITIONAL LINE IS AVAILABLE
1116
ADDL. LINE AVAIL. ?
NO
YES
1118
INFORM SUBSCRIBER THAT DEPOSIT IS REQUIRED
802, 804 810-844
1120
END

FIG. 11

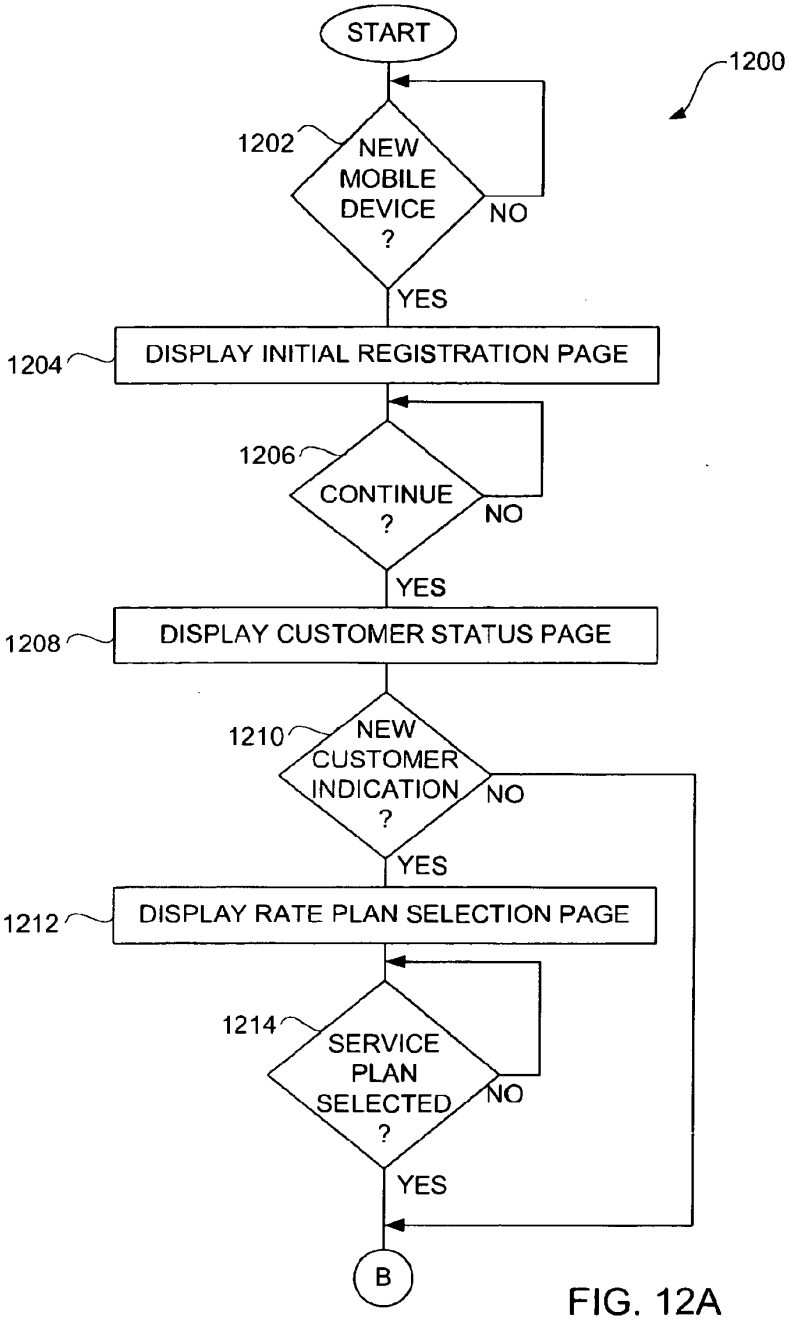


FIG. 12A

BNSDOCID: <EP_____194269BA1_I_>

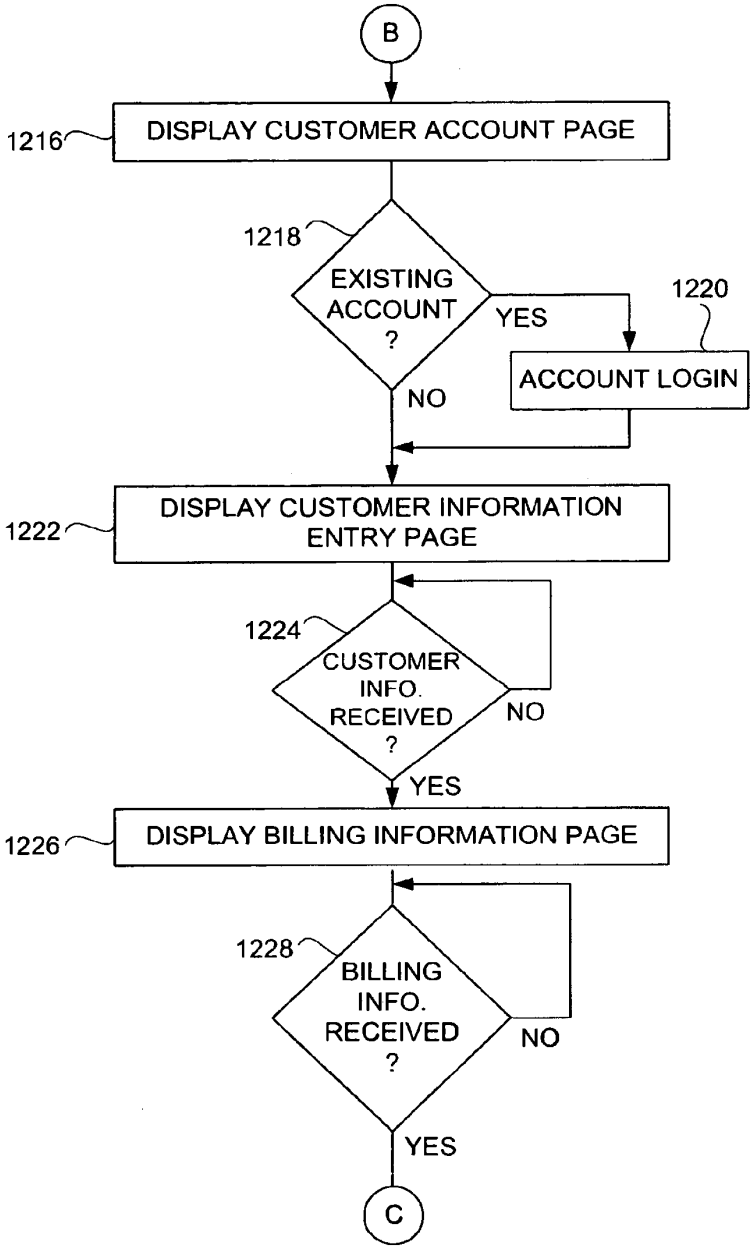

B
1216
DISPLAY CUSTOMER ACCOUNT PAGE
1218
EXISTING ACCOUNT ?
YES
1220
ACCOUNT LOGIN
NO
1222
DISPLAY CUSTOMER INFORMATION ENTRY PAGE
1224
CUSTOMER INFO. RECEIVED ?
NO
YES
1226
DISPLAY BILLING INFORMATION PAGE
1228
BILLING INFO. RECEIVED ?
NO
YES
C

FIG. 12B

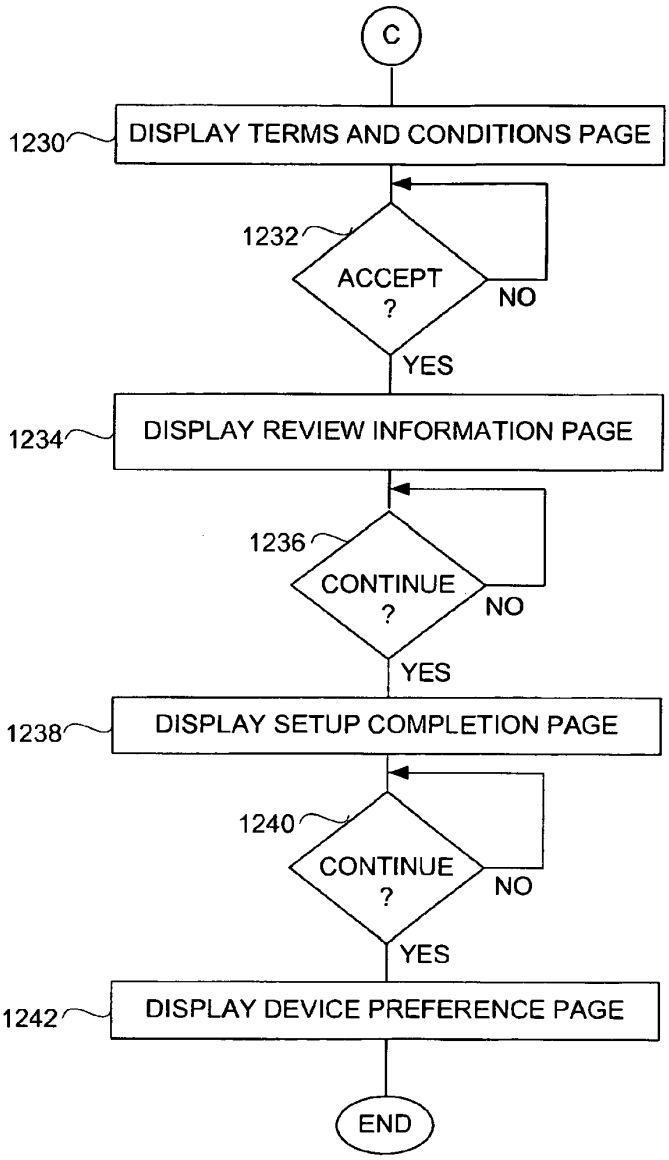


FIG. 12C

BNSDOCID: <EP_____1942698A1_I_>

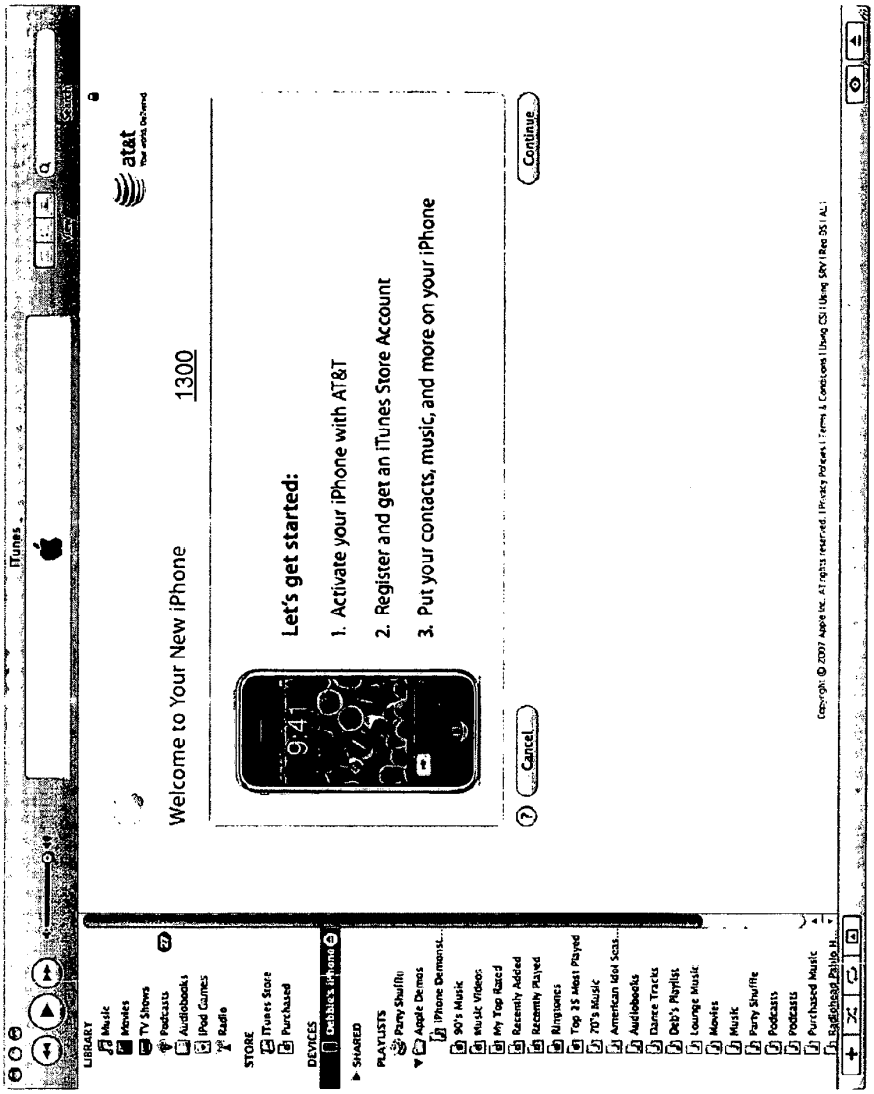


FIG. 13

BNSDOCID: <EP 1942698A1 | >

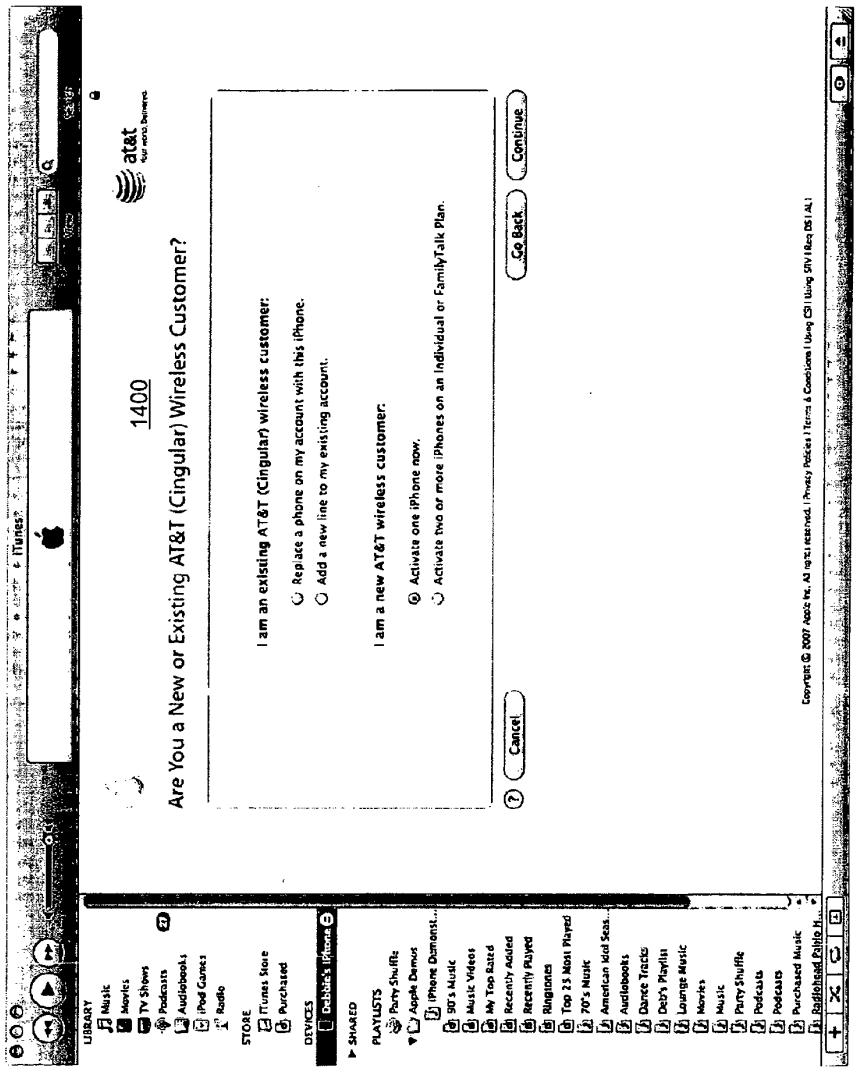


FIG. 14

BNSDOCID: <EP_____1942698A1_I_>

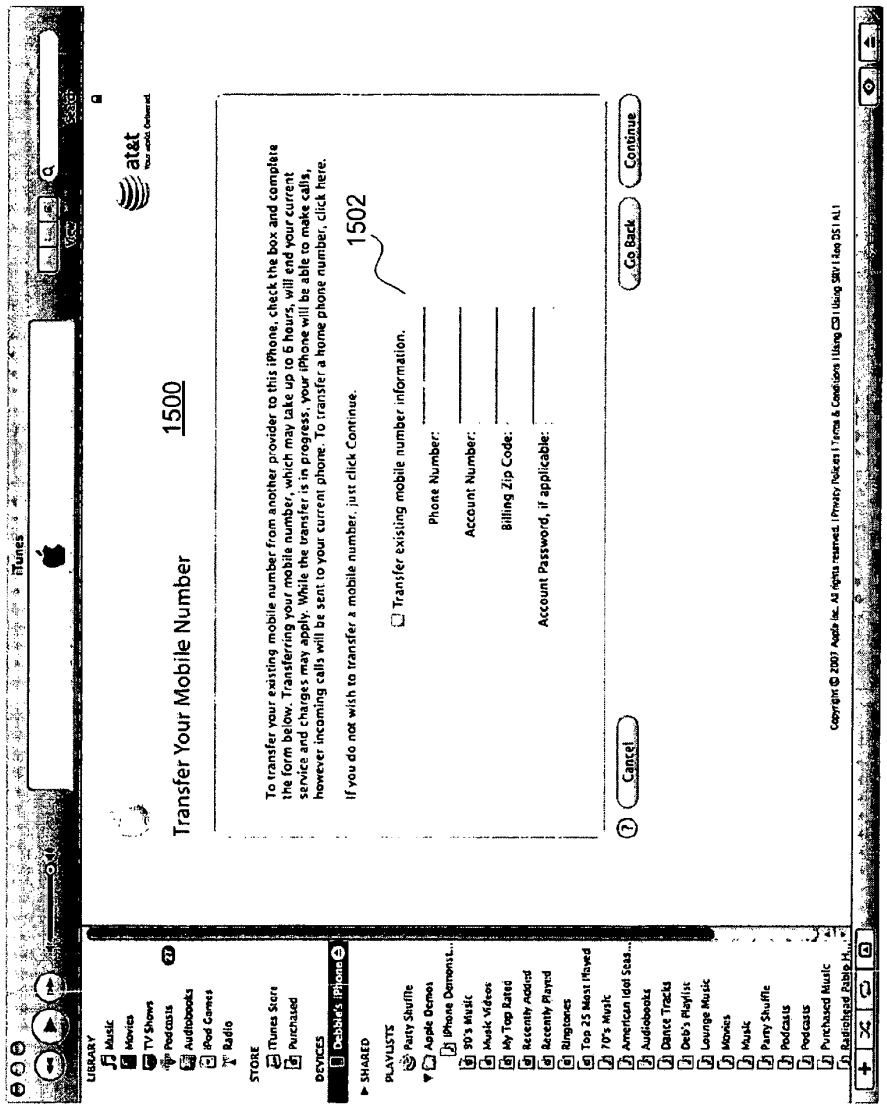

iTunes
LIBRARY
Music
Movies
TV Shows
Podcasts
Audiobooks
iPod Games
Radio
STORE
iTunes Store
Purchased
DEVICES
Debbie's iPhone
SHARED
PLAYLISTS
Party Shuffle
Apple Demos
iPhone Demonst...
90's Music
Music Videos
My Top Rated
Recently Added
Recently Played
Ringtones
Top 25 Most Played
70's Music
American Idol Seas...
Audiobooks
Dance Tracks
Deb's Playlist
Lounge Music
Movies
Music
Party Shuffle
Podcasts
Podcasts
Purchased Music
Radiohead Table M...
at&t
Transfer Your Mobile Number
1500
To transfer your existing mobile number from another provider to this iPhone, check the box and complete the form below. Transferring your mobile number, which may take up to 6 hours, will end your current service and charges may apply. While the transfer is in progress, your iPhone will be able to make calls, however incoming calls will be sent to your current phone. To transfer a home phone number, click here.
If you do not wish to transfer a mobile number, just click Continue.
1502
Transfer existing mobile number information.
Phone Number:
Account Number:
Billing Zip Code:
Account Password, if applicable:
Cancel
Go Back
Continue
Copyright © 2007 Apple Inc. All rights reserved. | Privacy Policy | Terms & Conditions | Using GSM | Using CDMA | Using EDGE | AU

FIG. 15

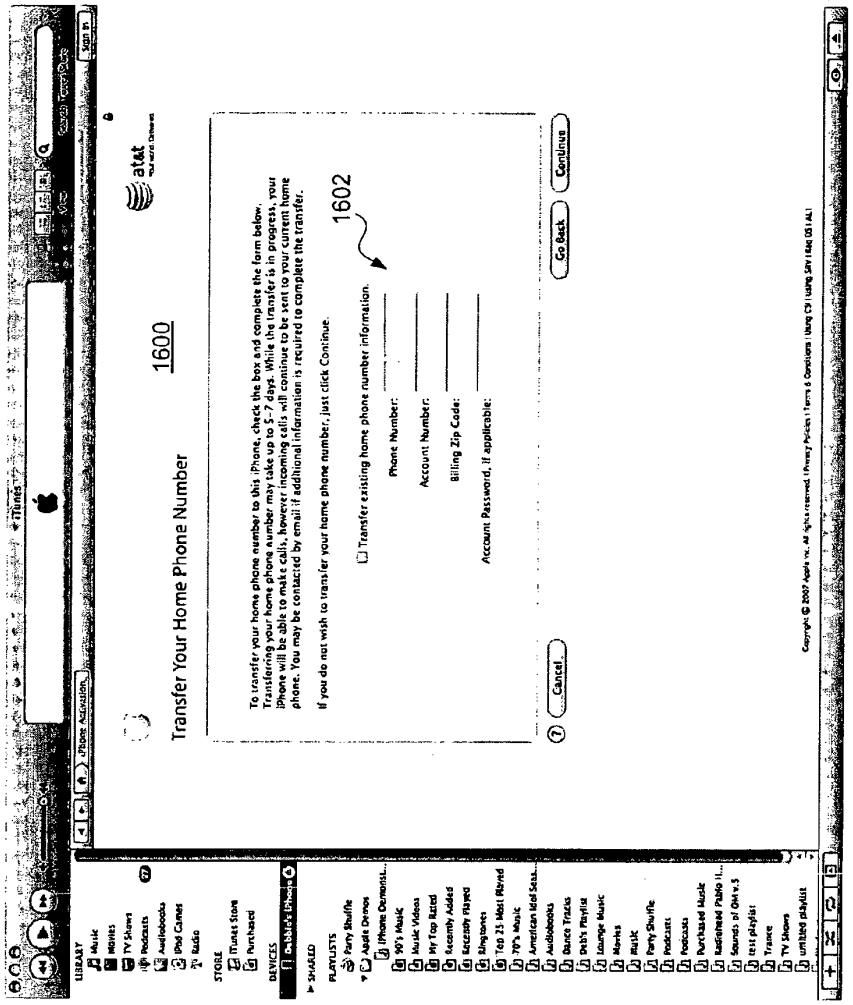


FIG. 16

BNSDOCID: <EP_____1942698A1_I_>

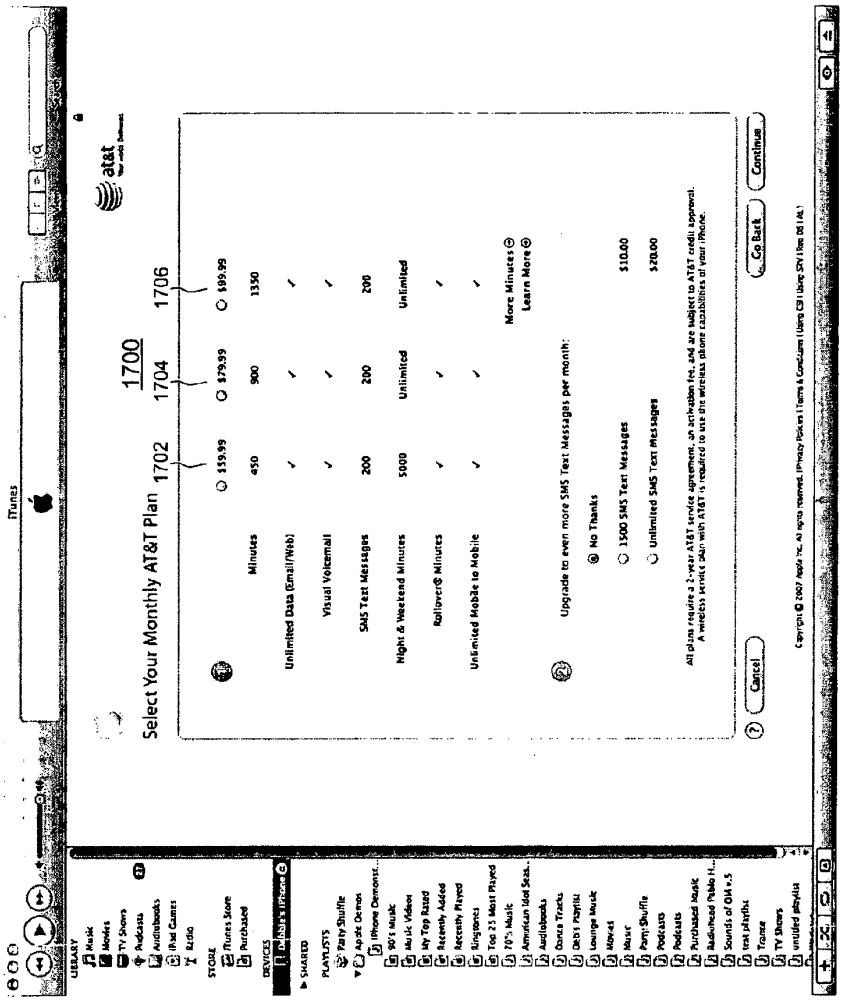


FIG. 17A

BNSDOCID: <EP_____1942698A1_I_>

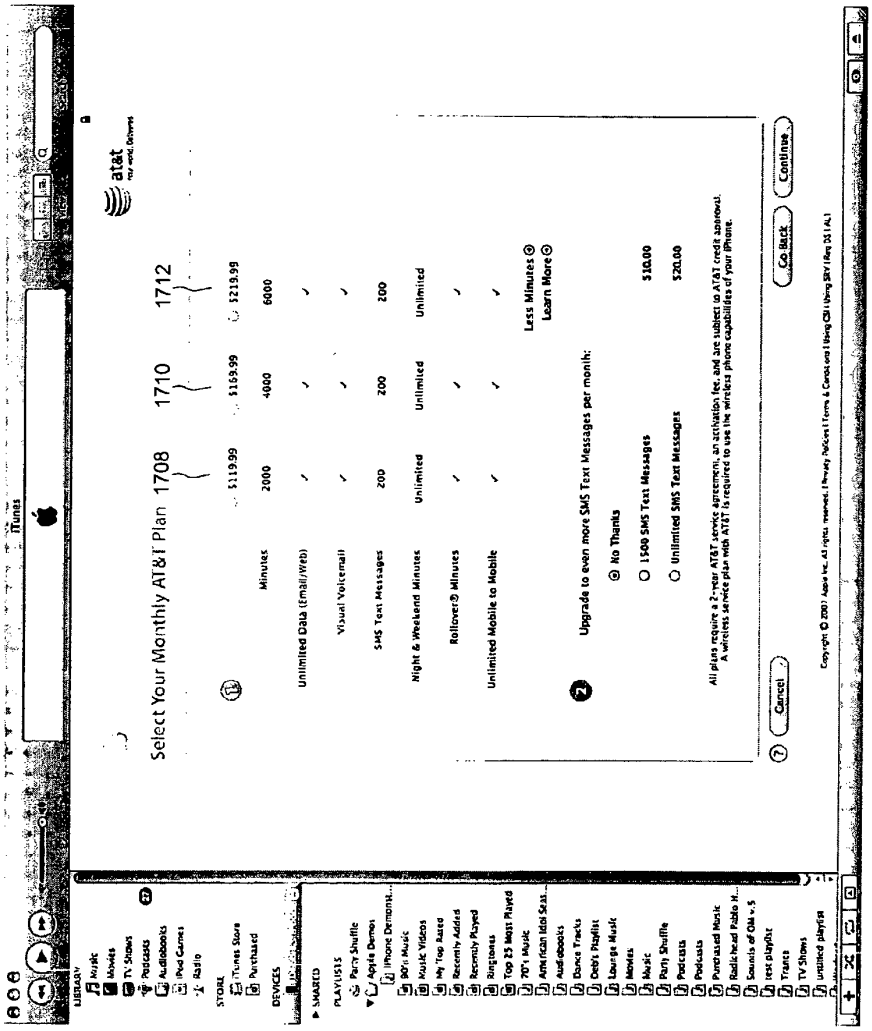


FIG. 17B

BNSDOCID: <EP_____1942698A1_I_>

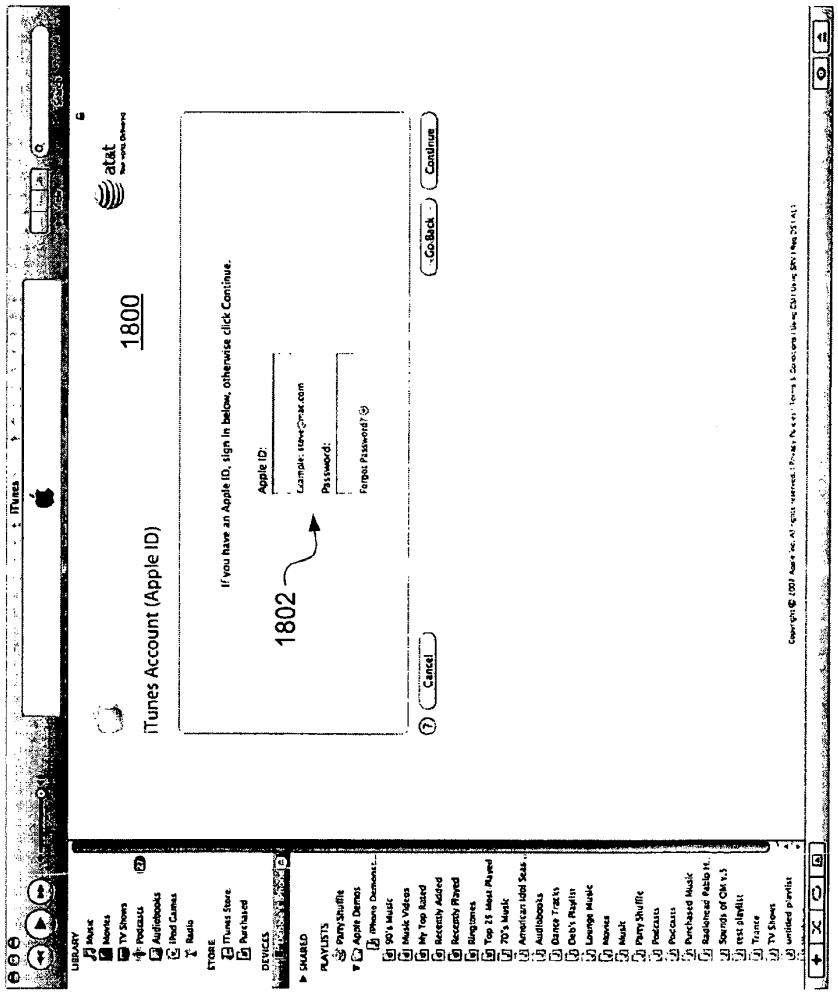


FIG. 18

EPODOC

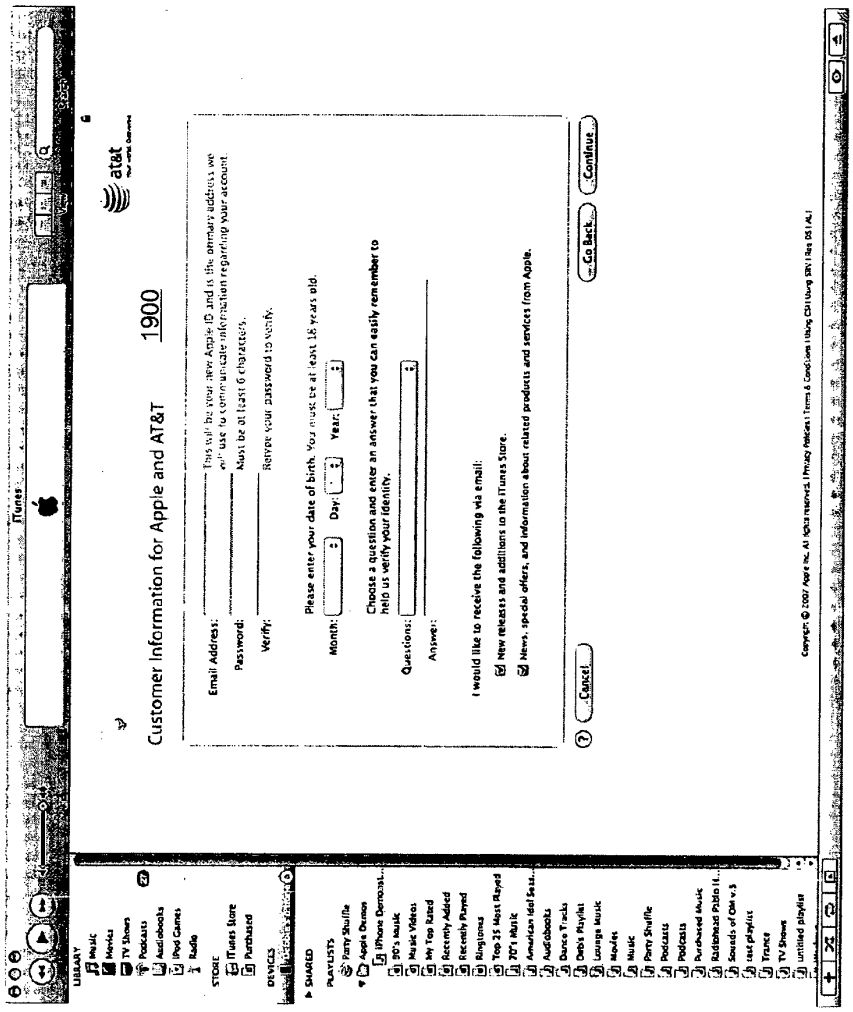


FIG. 19

BNSDOCID: <EP_____1942698A1_I_>

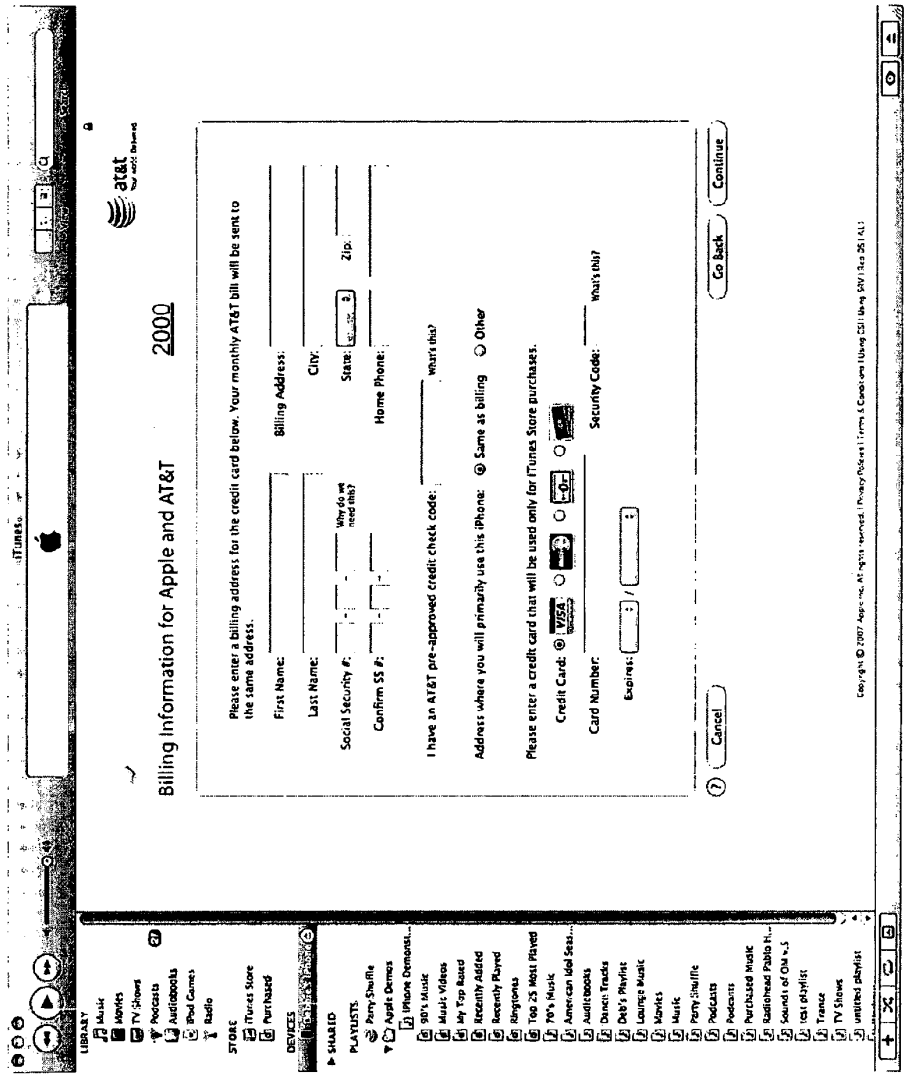

Billing Information for Apple and AT&T
2000
Please enter a billing address for the credit card below. Your monthly AT&T bill will be sent to the same address.
First Name:
Billing Address:
Last Name:
City:
Social Security #:
Why do we need this?
State:
Zip:
Confirm SS #:
Home Phone:
I have an AT&T pre-approved credit check code:
What's this?
Address where you will primarily use this iPhone: Same as billing Other
Please enter a credit card that will be used only for iTunes Store purchases.
Credit Card:
Card Number:
Security Code:
What's this?
Expires:
Cancel
Go Back
Continue

FIG. 20

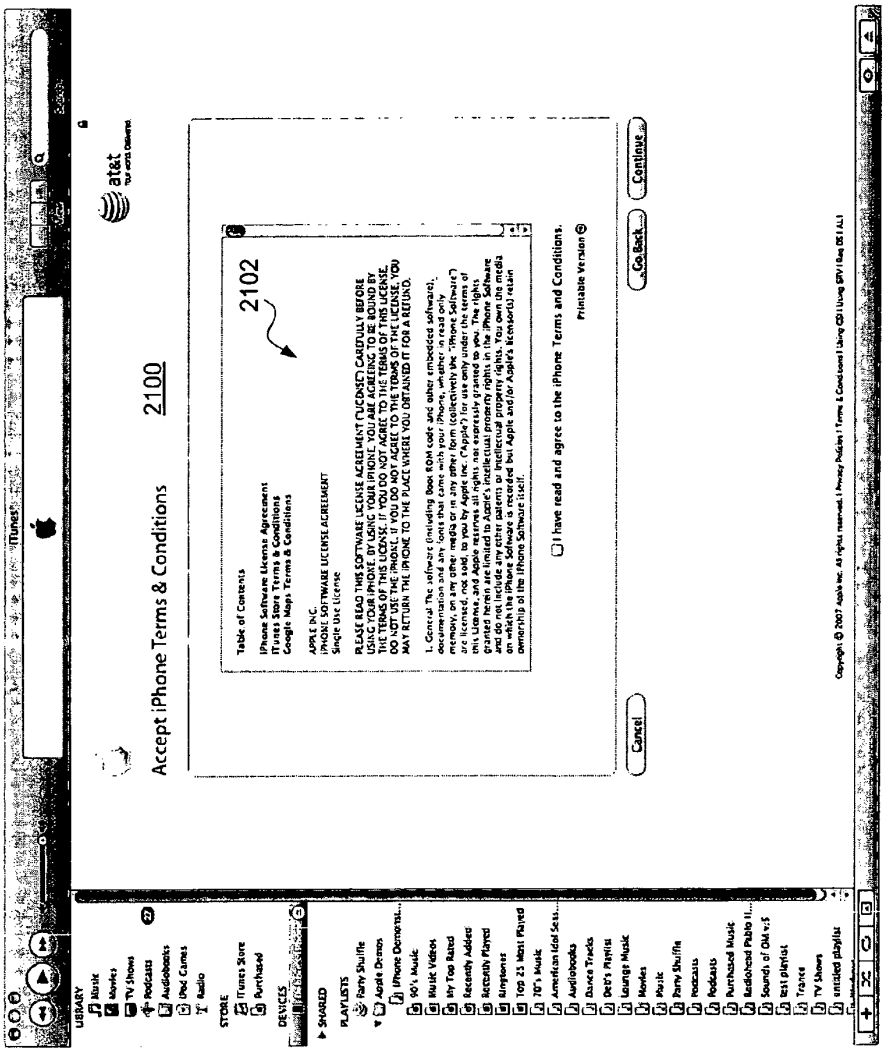


FIG. 21A

BNSDOCID: <EP_____1942698A1_I_>

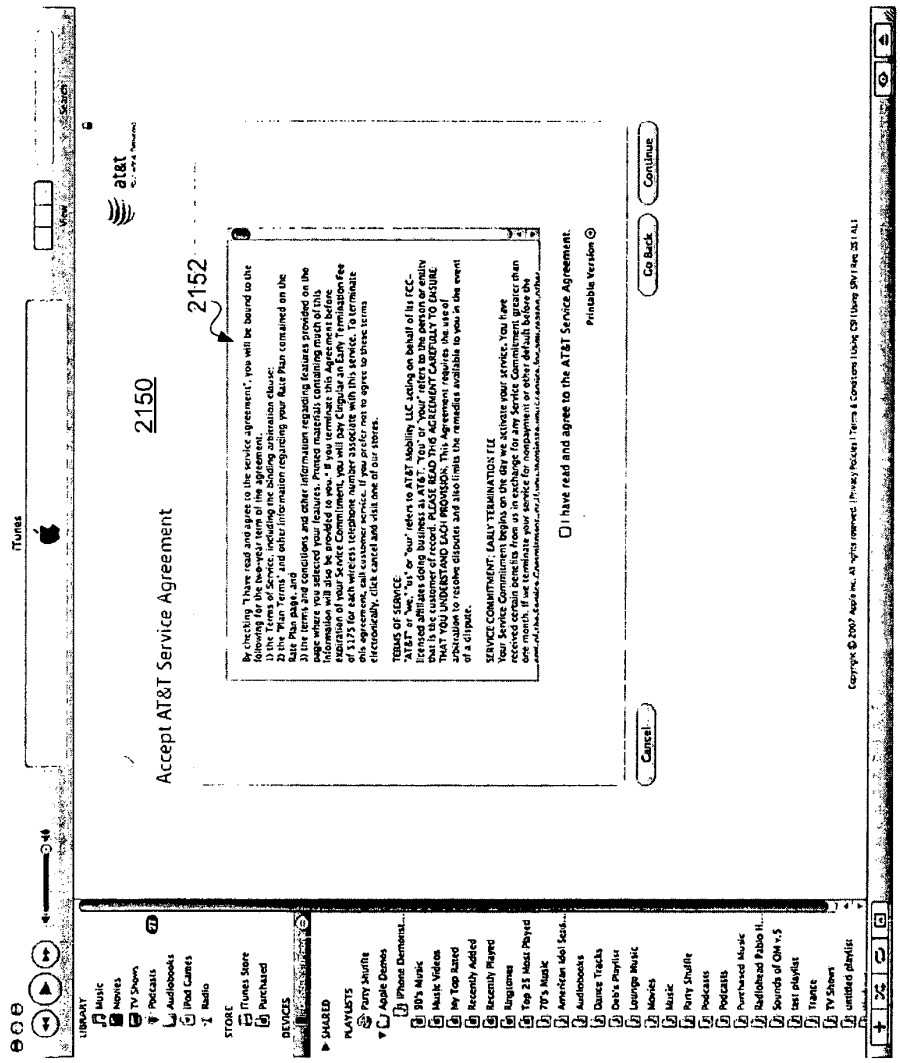


FIG. 21B

BNSDOCID: <EP_____1942698A1_I_>

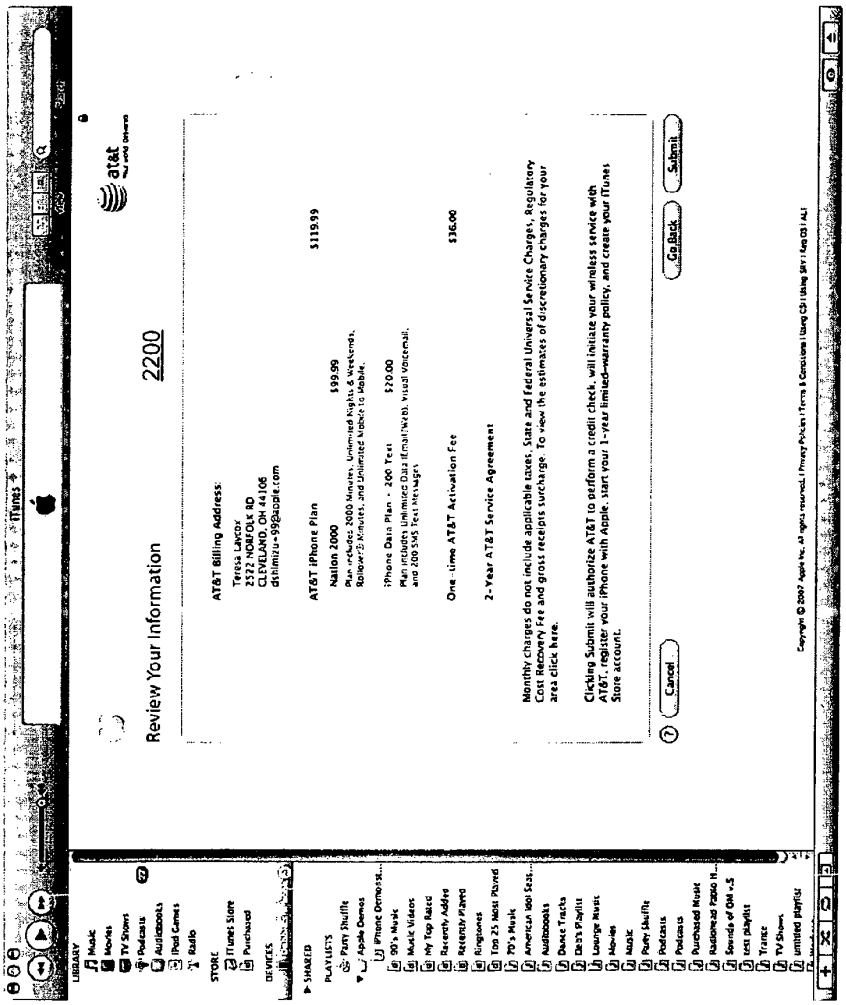


FIG. 22

BNSDOCID: <EP_____1942698A1_I_>

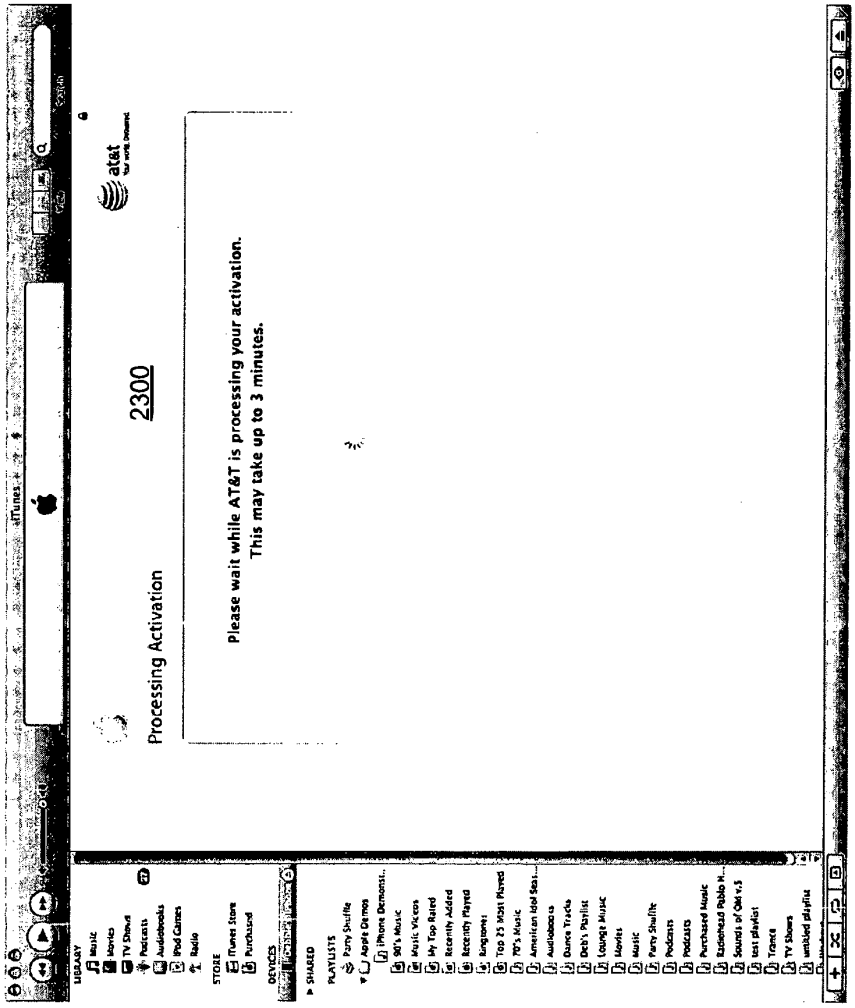


FIG. 23

BNSDOCID: <EP_____1942698A1_I_>

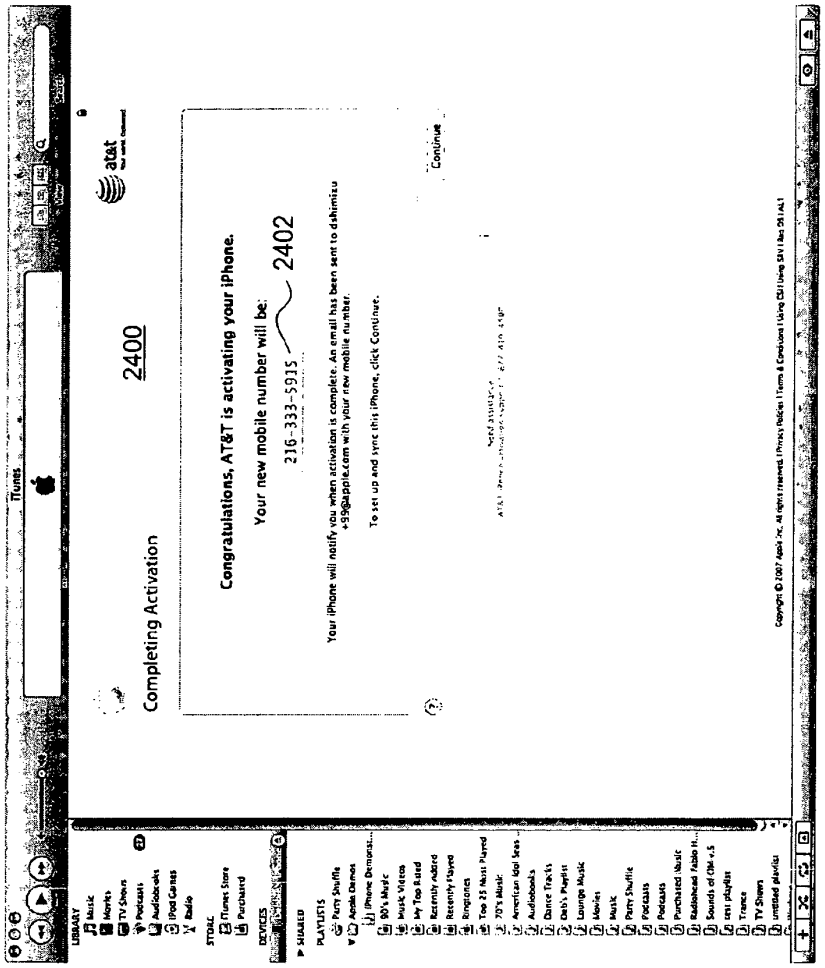


FIG. 24A

BNSDOCID: <EP_____1942698A1_I_>

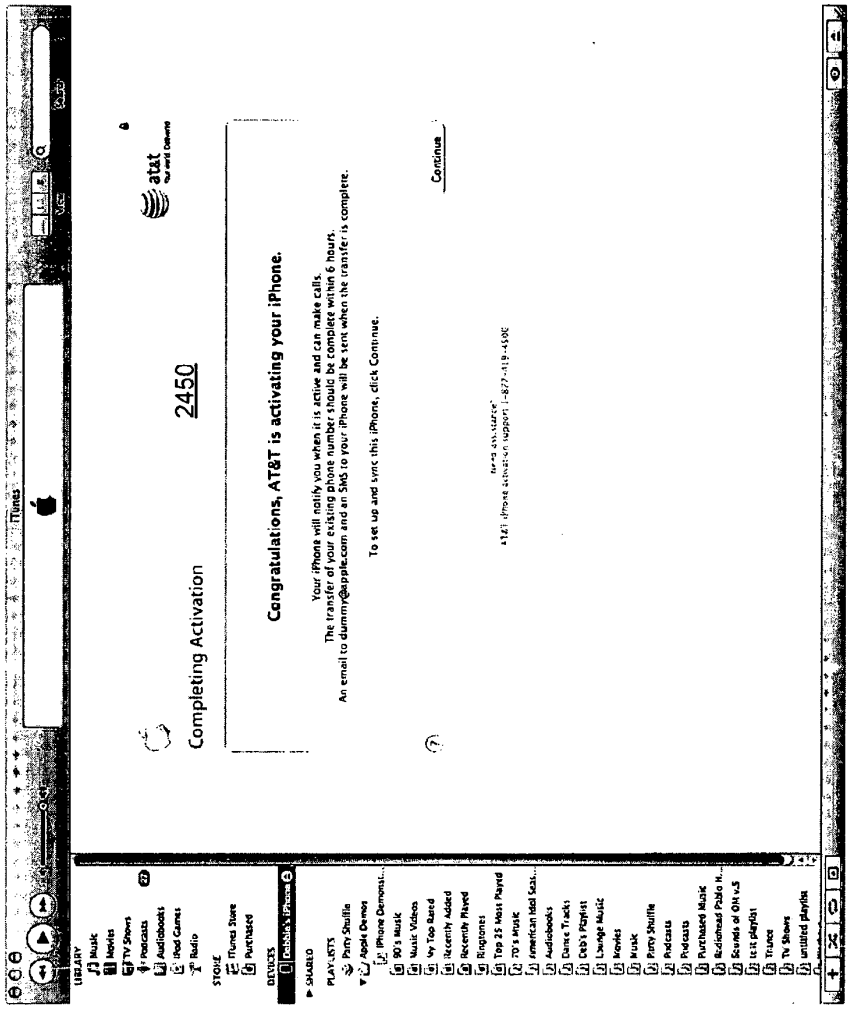


FIG. 24B

EPNSDOCID: <EP 1942698A1 | >

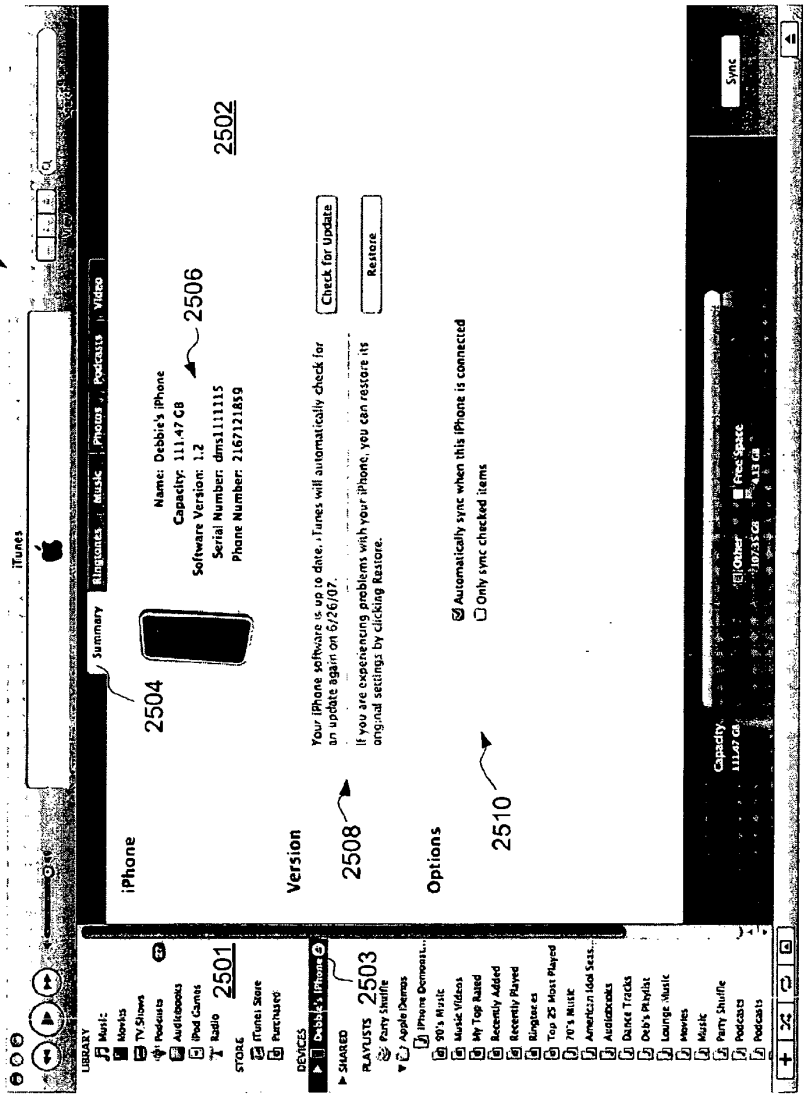


FIG. 25

BNSDOCID: <EP_____1942698A1_I_>

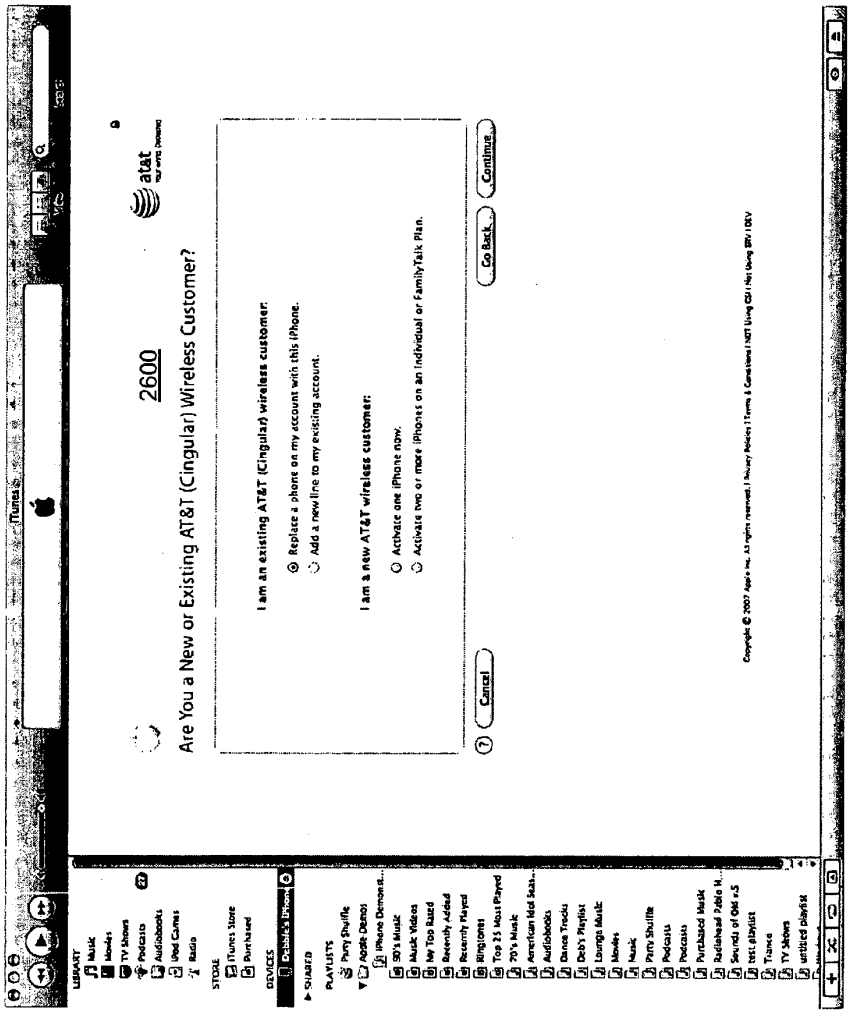

iTunes
LIBRARY
Music
Movies
TV Shows
Podcasts
Audiobooks
iPod Games
Radio
STORE
iTunes Store
Purchased
DEVICES
SHARED
PLAYLISTS
Party Shuffle
Apple Demos
90's Music
Music Videos
My Top Rated
Recently Added
Recently Played
Ringtones
Top 25 Most Played
70's Music
Audiobooks
Dance Tracks
Deb's Playlist
Lounge Music
Movies
Music
Party Shuffle
Podcasts
Purchased Music
Sounds of 60s v.5
test playlist
Trance
TV Shows
2600
Are You a New or Existing AT&T (Cingular) Wireless Customer?
I am an existing AT&T (Cingular) wireless customer:
Replace a phone on my account with this iPhone.
Add a new line to my existing account.
I am a new AT&T wireless customer:
Activate one iPhone now.
Activate two or more iPhones on an individual or FamilyTalk Plan.
Cancel
Go Back
Continue

FIG. 26

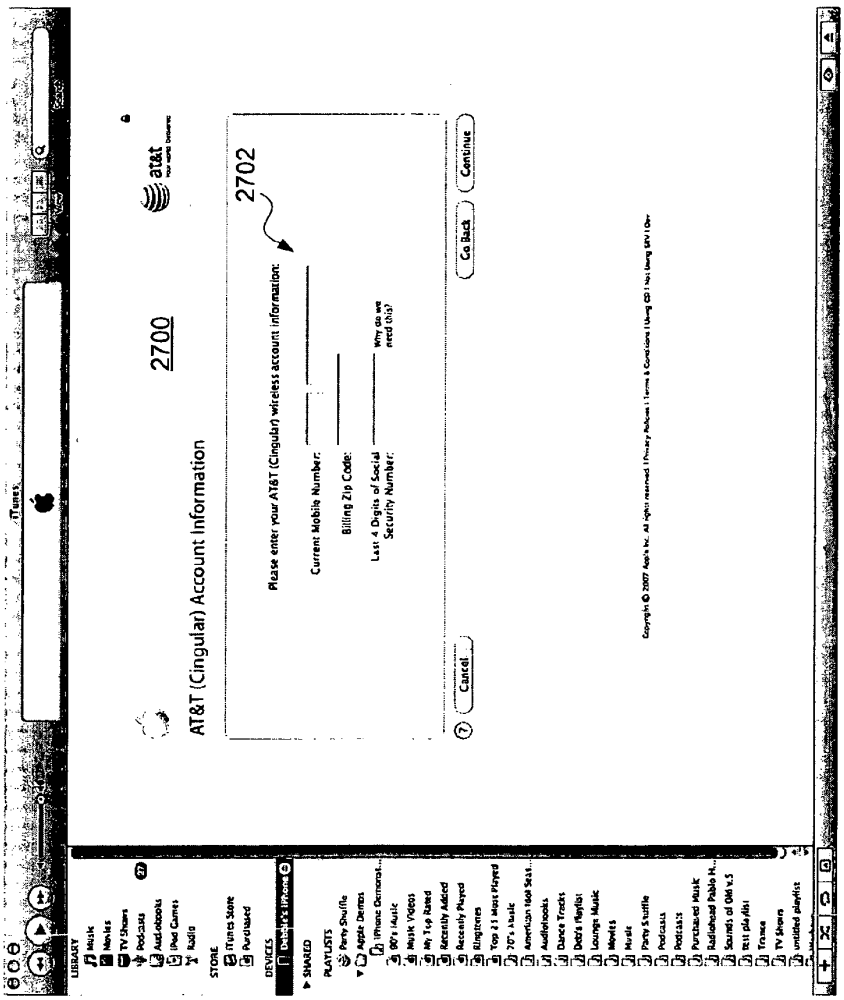


FIG. 27

BNSDOCID: <EP_____1942698A1_I_>

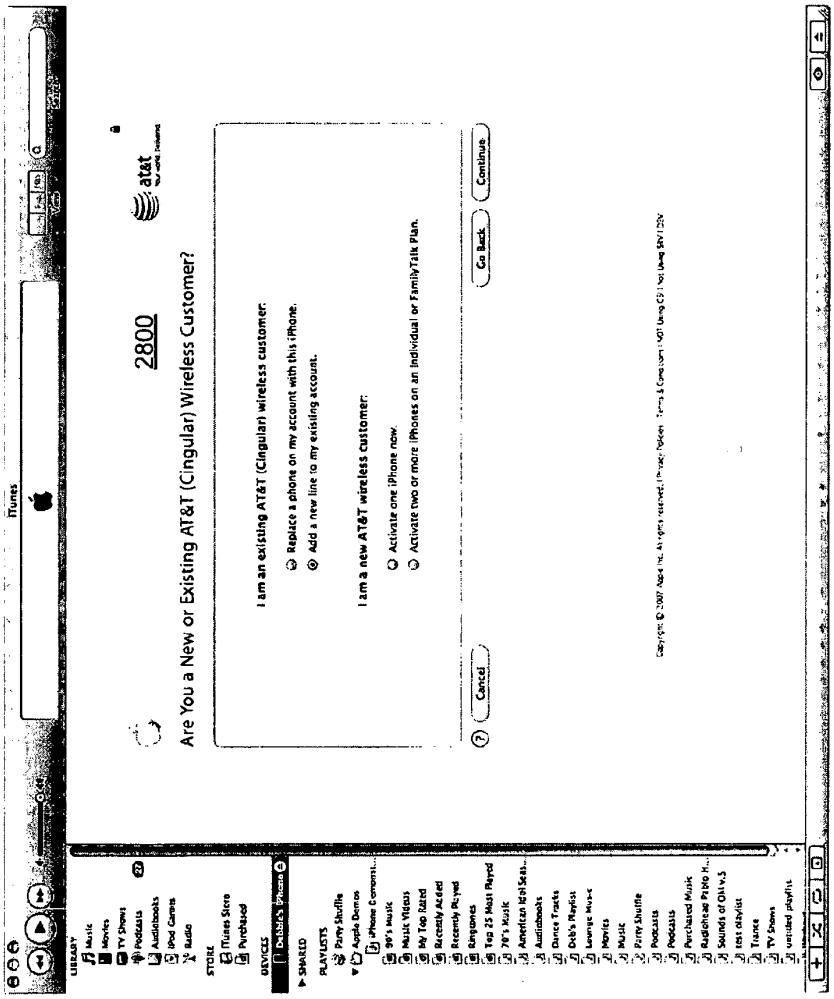

iTunes
2800
Are You a New or Existing AT&T (Cingular) Wireless Customer?
I am an existing AT&T (Cingular) wireless customer:
Replace a phone on my account with this iPhone.
Add a new line to my existing account.
I am a new AT&T wireless customer:
Activate one iPhone now.
Activate two or more iPhones on an individual or FamilyTalk Plan.
Cancel
Go Back
Continue

FIG. 28

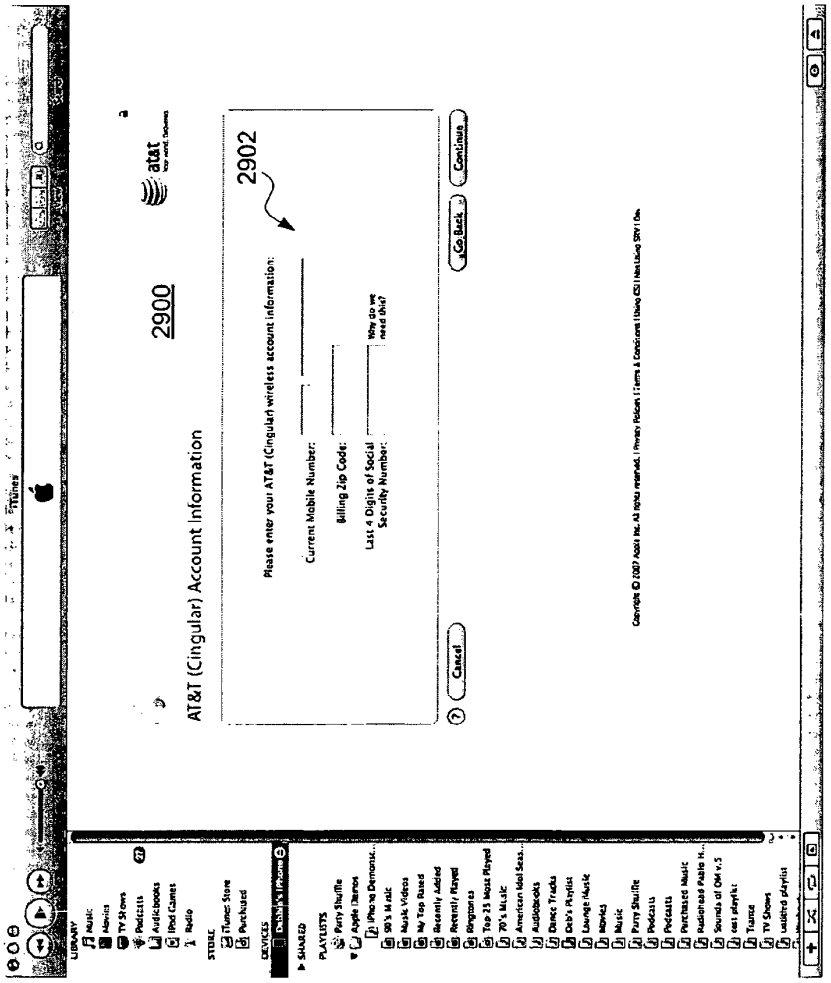


FIG. 29

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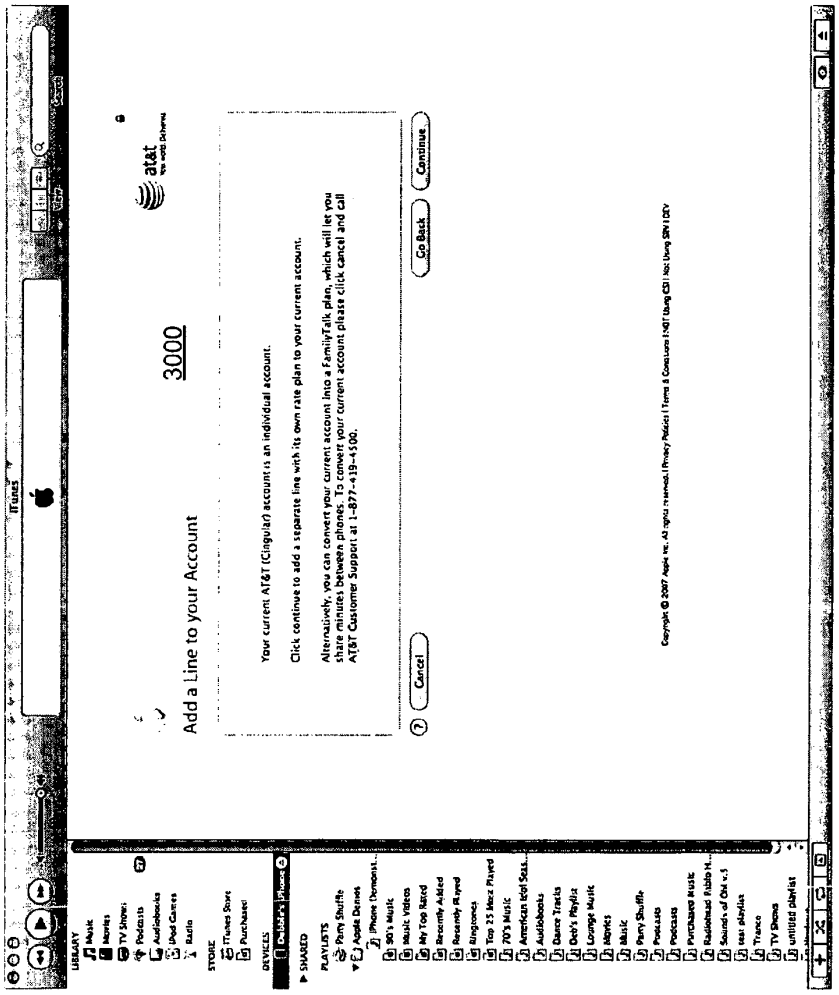

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Audiobooks
iPod Games
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iTunes Store
Purchased
DEVICES
SHARED
PLAYLISTS
Party Shuffle
Apple Demos
90's Music
Music Videos
My Top Rated
Recently Added
Recently Played
Ringtones
Top 25 Most Played
70's Music
Audiobooks
Dance Tracks
Deb's Playlist
Lounge Music
Metric
Music
Party Shuffle
Podcasts
Podcasts
Purchased Music
Radiohead Radio M...
Sounds of Old v.5
test playlist
Trance
TV Shows
untitled playlist
Add a Line to your Account
3000
Your current AT&T (Cingular) account is an individual account.
Click continue to add a separate line with its own rate plan to your current account.
Alternatively, you can convert your current account into a FamilyTalk plan, which will let you share minutes between phones. To convert your current account please click cancel and call AT&T Customer Support at 1-877-419-4500.
Cancel
Go Back
Continue

FIG. 30

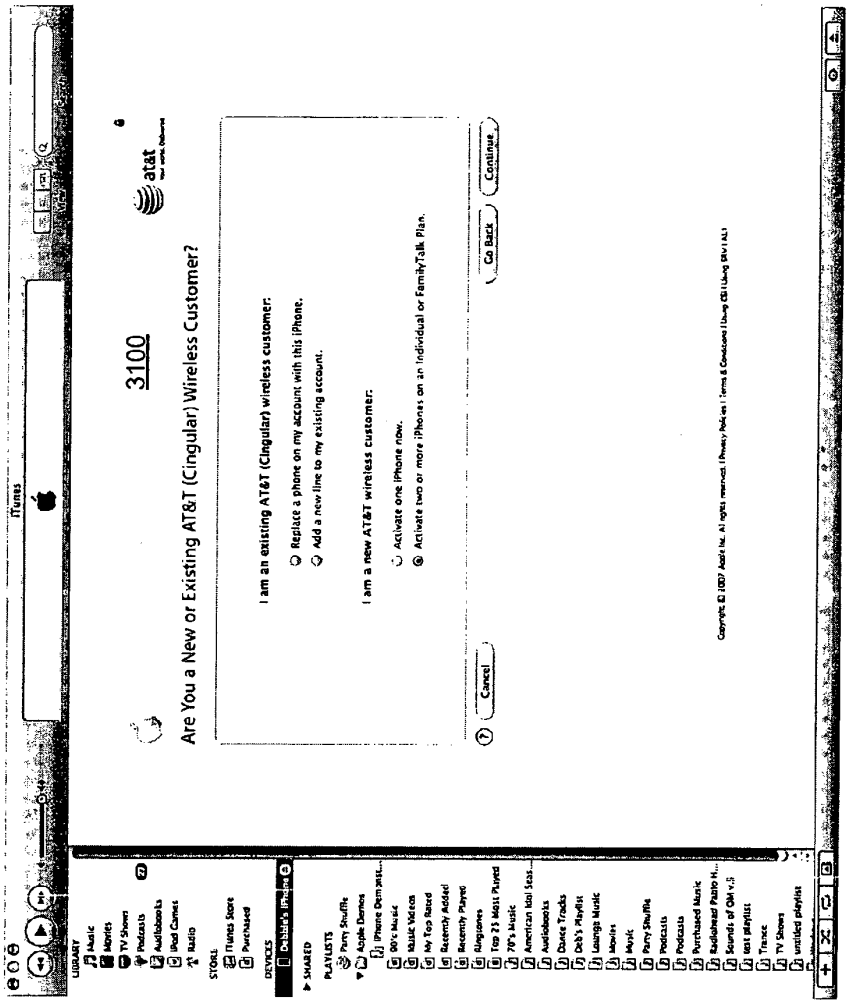


FIG. 31

BNSDOCID: <EP_____1942698A1_I_>

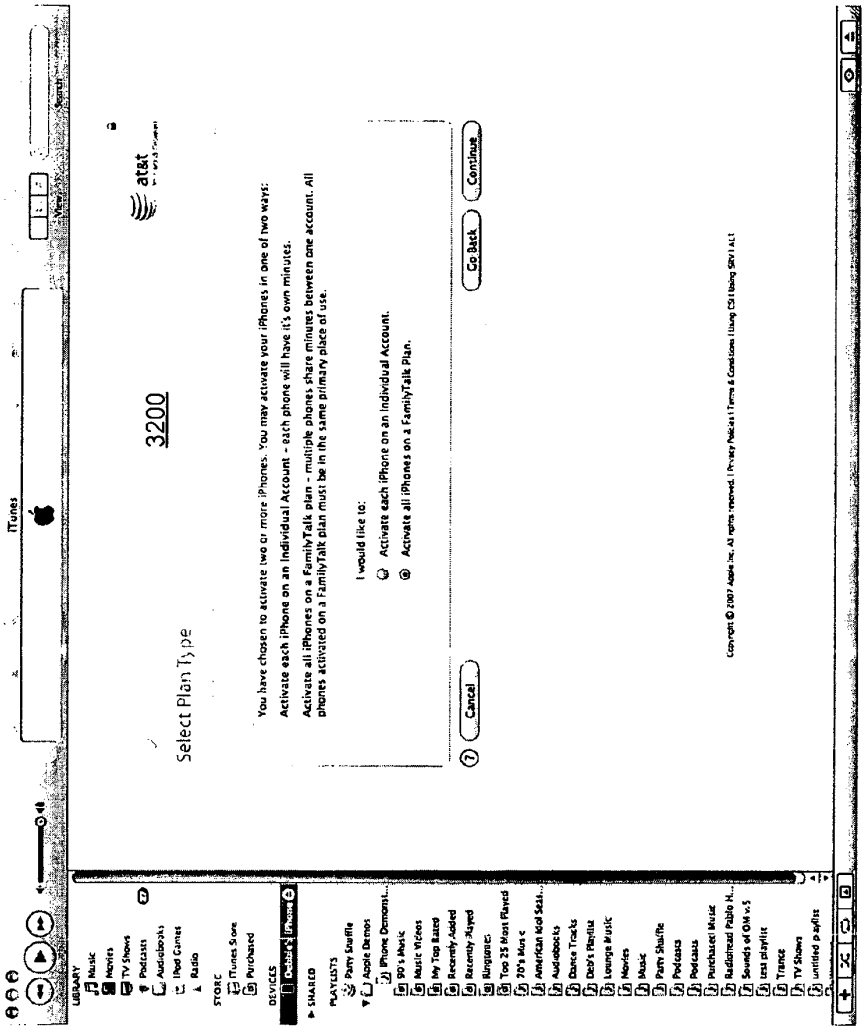


FIG. 32

BNSDOCID: <EP_____1942698A1_I_>

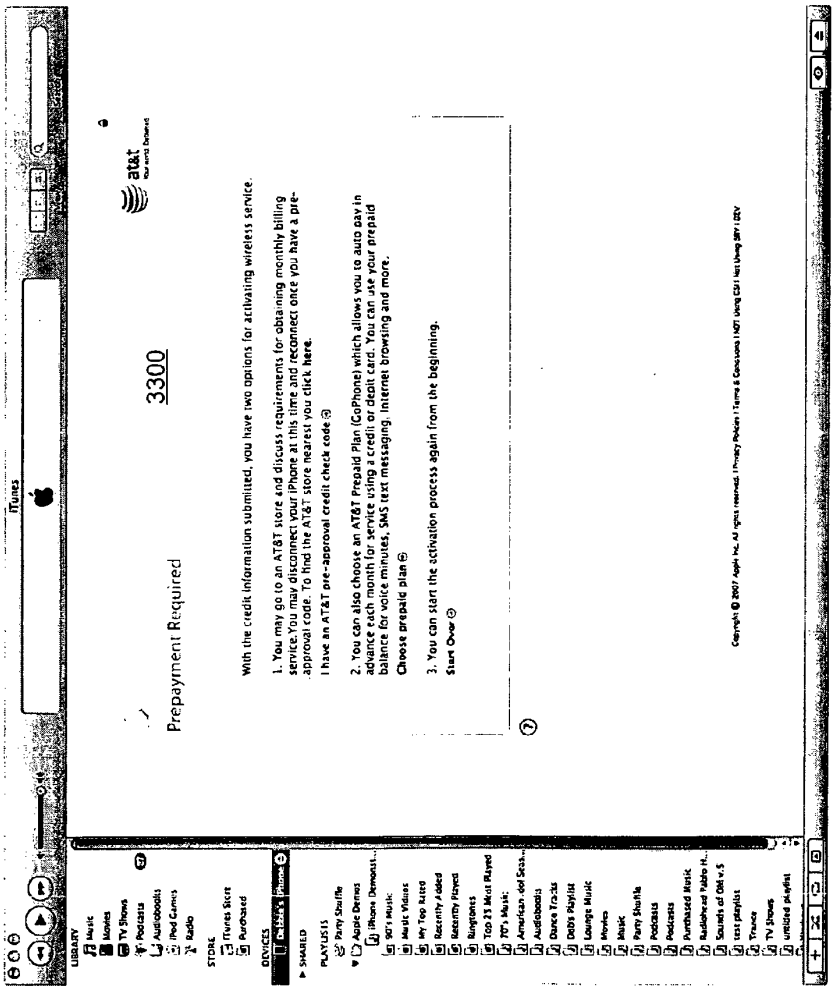


FIG. 33

BNSDOCID: <EP_____1942698A1_I_>

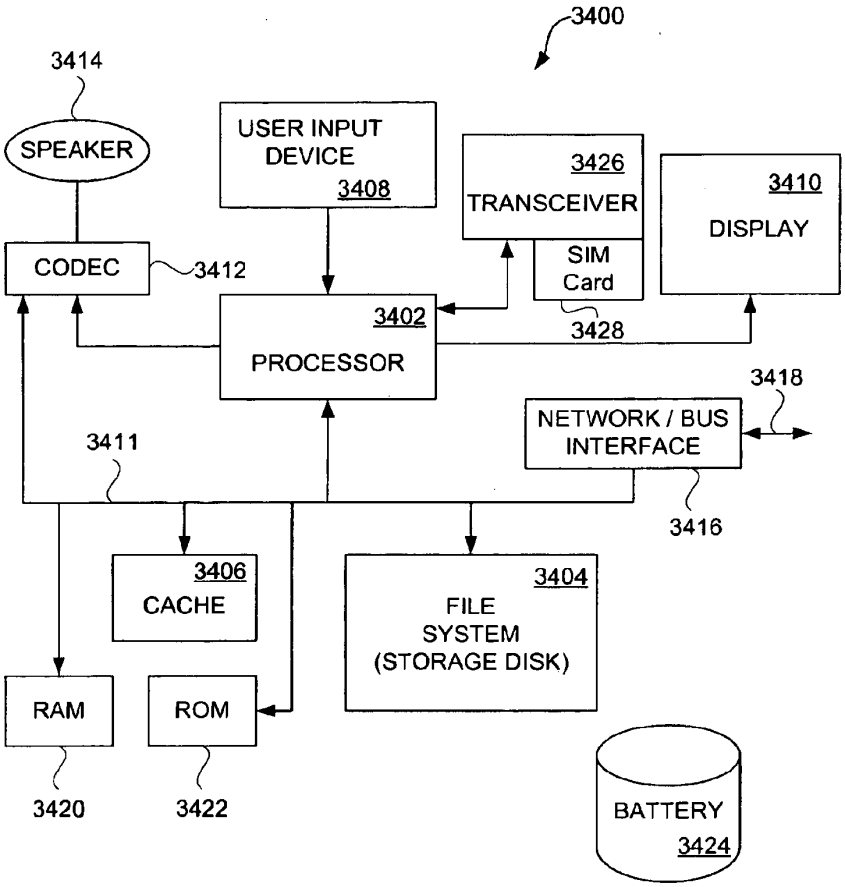


FIG. 34

BNSDOCID: <EP_____1942698A1_I_>

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 08 25 0053

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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X	US 5 386 455 A (COOPER GERSHON N [US]) 31 January 1995 (1995-01-31) * column 1, line 38 - column 2, line 15 * * column 3, line 38 - column 5, line 49 * * figure 3 *	1-68	TECHNICAL FIELDS SEARCHED (IPC) H04Q H04M H04L
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A	US 2004/235458 A1 (WALDEN CHARLES LEE [US] ET AL) 25 November 2004 (2004-11-25) * paragraphs [0005], [0006] * * paragraph [0011] * * paragraphs [0021] - [0023] * * claim 24 *	1-68	

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	16 April 2008	Hegeman, Hans

CATEGORY OF CITED DOCUMENTS

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European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 08 25 0053

DOCUMENTS CONSIDERED TO BE RELEVANT

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	16 April 2008	Hegeman, Hans

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P : intermediate document

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(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
11 November 2010 (11.11.2010)

PCT

(10) International Publication Number
WO 2010/128391 A2

(51) International Patent Classification:
H04W 28/02 (2009.01)

(21) International Application Number:
PCT/IB2010/001084

(22) International Filing Date:
3 May 2010 (03.05.2010)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/175,316 4 May 2009 (04.05.2009) US

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(75) Inventors/Applicants *(for US only)*: **MOMTAHAN, Parham** [CA/CA]; 281 Lincoln Heights Road, Ottawa, Ontario K2B 5L7 (CA). **FREEN, Russ** [CA/CA]; 5 Clemow Avenue, Ottawa, Ontario, K1S 2A9 (CA).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *without international search report and to be republished upon receipt of that report (Rule 48.2(g))*

(54) Title: SYSTEM AND METHODS FOR MOBILE DEVICE-BASED DATA COMMUNICATIONS COST MONITORING AND CONTROL

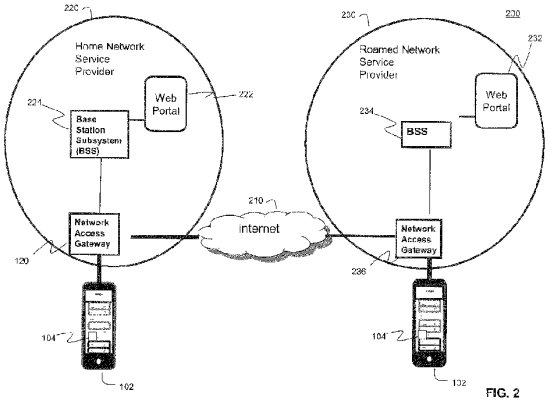


FIG. 2

(57) Abstract: Systems and methods for providing device-based data communications cost monitoring and controls are provided. In an embodiment, the method operates by receiving a registration request associated with a subscriber session, determining current data usage associated with the subscriber, and receiving data usage thresholds. The method further comprises receiving quotas associated with the subscriber session and collecting data usage information associated with the subscriber session. The method sends a notification to the subscriber when a predetermined quota is exceeded during the subscriber session and controls data usage. The system cost monitoring and control system comprises a usage policy server and a usage policy application. The usage policy application allows a subscriber to alter terms of a subscription. The usage policy application displays current data usage information on a per-network and per-application basis using subscriber profile information, subscriber session information, and prior subscriber usage history provided by the usage policy server.

WO 2010/128391 A2

System and Methods for Mobile Device-Based Data Communications Cost Monitoring and Control

FIELD OF THE INVENTION

[0001] The present invention relates generally to communications networks, more particularly, to monitoring and controlling data communications costs within wireless communications networks.

BACKGROUND

[0002] Portable computing devices such as laptop computers, personal data assistants (PDAs), smart phones and the like are in common usage, many featuring data communications support, powerful processors, larger and more colorful displays, and wireless networking and internet browsing capabilities. These advances in mobile technology have resulted in a dramatic increase in the volume of data communicated on wireless networks. These advances, coupled with subscribers seeking expanded mobility, will drive subscribers install and run data-hungry applications on their mobile devices. Data traffic is growing due to a combination of increasing market share of data-centric portable devices such as IPHONE™ and BLACKBERRY™ devices, lower wireless data subscription costs, higher wireless data throughput, and easier mobile access to data-intensive applications and rich content such as video. These trends are driving ever-increasing demands for wireless data communications.

[0003] Typically, users gain access to wireless data networks by purchasing a subscription plan from a service provider. In response to the explosive growth in mobile data traffic, service providers currently offer a wide variety of wireless subscription plan features such as actual usage plans, flat-rate plans, bandwidth caps that limit the amount of data per month for a mobile device, pre-paid and post-paid data plans. These plans typically impose limits on subscriber bandwidth consumption, often combined with additional fees for exceeding those limits. Bandwidth caps can alleviate network congestion by reducing overall mobile data traffic, but these caps reduce the attractiveness of data service for subscribers.

[0004] In a flat rate subscription plan a subscriber pays a fee for a billing cycle and is entitled to a set amount of network usage (i.e., a usage quota) during the billing cycle. For example, a subscriber may pay $30 for a month and be entitled to 500 minutes of network time. The usage quota can be specified as a time per billing cycle amount (e.g., 500 minutes per month) or as a data volume per billing cycle amount (e.g., 40 Mega Bytes per month). In some flat rate subscription plans, the usage quota is unlimited.

[0005] In an actual usage subscription plan a subscriber pays a set rate based on the actual amount of network usage during a billing cycle. For example, a user may pay $1 per minute of network usage. Actual usage plans can have incentives/penalties based on a subscriber's usage during a billing cycle. For example, in a subscription plan a subscriber may pay $1 per Mega Byte (MB) for the first 50 MBs and $2 per Mega Byte (MB) for every MB used beyond 50 MBs during the billing cycle. Subscription plans can combine aspects of flat rate plans and usage plans. For example, a subscriber may pay $30 per month for 40 MBs of wireless data usage and $1 per MB for every minute used after 40 MBs.

[0006] In the plans described above, as well as other subscriber plans, it is useful for a subscriber to be able to monitor his/her usage against one or more quotas.

[0007] Given the increasing versatility of mobile devices, it is helpful to implement a means by which these mobile devices can be used to monitor and control data communication costs, and to improve the subscriber experience.

[0008] Previous methods for network data communications cost monitoring and control are largely provider-centric, leaving the user with limited options to control and monitor costs. For example, a subscriber may be able to display cumulative consumption in MBs for the current month to determine if a monthly quota has been exceeded, but the subscriber cannot dynamically control and manage data communications costs without permanently changing his/her subscription plan. Provider-centric systems monitor usage and may allow subscribers to access usage information via a provider's web server, but they do not allow subscribers to set real time usage controls. For example, provider-centric systems do not allow subscribers to set data usage thresholds, quotas, or

caps on their devices each day based upon prior usage. Prior network data control techniques result in extra charges (i.e., due to roaming) and surprise data charges for subscribers who exceed bandwidth caps.

[0009] In prior systems, subscribers must rely on providers to monitor and control data usage. When a portable device moves to another provider network (i.e., roam), the amount of data usage information is limited to what the network the device is roaming in provides. For example, subscribers may not know what data charges (i.e., tariffs) apply while roaming. Prior techniques can result in excessive fees for subscribers who have unknowingly exceeded their plan's data quotas or caps. Subscribers cannot dynamically manage and control data costs for current data connections from their portable devices. In prior systems, subscribers only have data usage information in terms of overall volume of data used for all applications on a device, rather than the amount of data user per application. This lack of device-centric control and transparency limits the subscriber experience and causes subscribers to unnecessarily curtail their data usage.

[0010] What is therefore needed are systems and methods for providing device-based data communications cost monitoring and controls on a per application basis. What is further needed are systems and methods to allow subscribers to monitor and control expenditures on data services by providing proactive notification when subscribers are approaching bandwidth caps. What is also needed are systems and methods to allow subscribers to modify their plans either temporarily or permanently depending on their needs by providing add-on service availability (i.e., the ability to dynamically raise a bandwidth cap temporarily).

SUMMARY OF THE INVENTION

[0011] Embodiments of the present invention provide systems and methods that improve data communication usage and cost monitoring operations. An embodiment of the invention includes a system for monitoring and control of the

data usage that is based on a subscriber's device. Methods are disclosed that use a distributed system that runs on user equipment and mobile devices.

[0012] In an embodiment, a system provides subscribers with access to real-time information about data usage, and are given warnings to they are close to reaching bandwidth caps. The system notifies subscribers when they are close to reaching bandwidth caps or quotas and offers subscribers an opportunity to upgrade to a next service tier.

[0013] The invention also provides a method for managing data usage by allowing subscribers to gradually reduce download speeds, block some types of traffic, redirect device connection to on-portal applications, or select a new Quality of Service (QoS) level in order to manage bandwidth consumption. In this way, the invention makes different options available to subscribers, and lets them decide how to best-manage data usage according to their needs and priorities.

[0014] The invention additionally includes methods that use a distributed usage monitoring and control system that comprises applications that run on user devices.

[0015] Embodiments of the invention also include methods for performing cost monitoring and control on a per-application basis.

[0016] In an embodiment, the invention includes a centralized system for global monitoring and control of a plurality of mobile devices from a single, cross-provider (i.e., global) perspective.

[0017] Subscription data is used to calculate the likelihood of exceeding a quota (i.e., a quota breach) at a given time and this information is provided to a user of a mobile device. US Application No. 12/186,831, filed August 06, 2008 and entitled "Usage Measurement Collection and Analysis to Dynamically Regulate Customer Network Usage," describes methods and systems for calculating the likelihood of a quota breach. The present application includes the capabilities described therein. According to an embodiment of the present invention, a notification is sent to a subscriber when it is determined that a quota breach is likely to occur. In a related embodiment, subscribers are given the opportunity to

change a service tier associated with their subscription in order to prevent a likely quota breach.

[0018] In an embodiment, a service provider can present 'special offers' to a subscriber that provide the subscriber with an opportunity to change a service tier associated with their subscription. In further embodiments, acceptance of special offers can change service tiers associated with a subscriber's home network or roamed networks. According to embodiments of the invention, special offers can be sent to a subscriber by their home network service provider or roamed network service providers and are presented on the subscriber's mobile device.

[0019] In embodiments, both dynamic and static subscriber characteristics relative to a current usage session can be used to allow a subscriber to proactively manage data usage. Dynamic characteristics can be dynamic relative to the start of a usage session or relative to the usage session generally. An example of a dynamic characteristic relative to the start of a usage session is the type of data requested and the mobile applications requesting data. An example of a dynamic characteristic relative to the usage session is the total amount of data usage.

[0020] In a further embodiment, a subscriber characteristic used in data usage calculations includes knowledge of peak usage patterns (e.g., on peak/off-peak, weekdays).

[0021] It is an objective of the present invention that it may be incorporated into any mobile device capable of data communications.

[0022] In another embodiment, when a subscriber is roaming and the roaming traffic is not routed through the subscriber's home service provider home agent router or network access gateway, an interaction between the roamed service provider and home service provider occurs so that the home service provider has the information needed to control data usage in the roamed or visited network.

[0023] Another objective of the invention is to provide flexible policy descriptions for network service provider (carrier) charging plans. A further objective of the invention is to provide flexible tariff distribution. According to an embodiment of the invention, distribution of flexible policy descriptions associated to network service provider charging plans is achieved by using a

provider-based architecture. In an embodiment, a provider-dependent (i.e., carrier-based) architecture is also used to distribute tariffs associated with network service providers.

[0024] Further embodiments, features, and advantages of the invention, as well as the structure and operation of the various embodiments of the invention are described in detail below with reference to accompanying present drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The accompanying drawings, which are incorporated herein and form a part of the specification, illustrate the present invention and, together with the description, further serve to explain the principles of the invention and to enable a person skilled in the pertinent art to make and use the invention.

[0026] FIG. 1 depicts an exemplary operating environment for providing network data communications cost monitoring and controls within a communications network, according to embodiments of the present invention.

[0027] FIG. 2 depicts an exemplary operating environment for providing data communications cost monitoring and controls in a roaming scenario including multiple communications networks, in accordance with an embodiment of the present invention.

[0028] FIG. 3 illustrates a provider independent system architecture for providing data communications cost monitoring and controls within a communications network, in accordance with an embodiment of the present invention.

[0029] FIG. 4 illustrates a provider-based system architecture for providing data communications cost monitoring and controls within a communications network, in accordance with an embodiment of the present invention.

[0030] FIG. 5 depicts an exemplary message flow diagram for a method providing data communications cost monitoring and controls when the provider-based architecture provided in FIG. 4 is used, according to an embodiment of the present invention.

[0031] FIG. 6 provides a method for monitoring and controlling data usage in accordance with the present invention.

[0032] FIGs. 7-11 depict a graphical user interface (GUI) for a mobile device to display data usage, edit usage limits, define tariffs, and accept offers to change service tiers, according to embodiments of the invention.

[0033] FIG. 12 depicts an exemplary computer system on which methods and systems herein may be implemented, according to embodiments of the present invention.

[0034] The present invention will now be described with reference to the accompanying drawings. In the drawings, like reference numbers can indicate identical or functionally similar elements. Additionally, the left-most digit(s) of a reference number may identify the drawing in which the reference number first appears.

DETAILED DESCRIPTION OF THE INVENTION

Mobile Environment

[0035] FIG. 1 provides an exemplary operating environment 100 for providing an adaptive window size for network data communications cost monitoring and controls, according to embodiments of the present invention. Operating environment 100 includes user equipment 102, network access gateway 120, optional service controller 130, policy controller 140, subscriber data repository 150, usage policy server 160, and application server farm 170. Operating environment 100 provides a simplified diagram of a communications network to illustrate the concepts of data communications cost monitoring and controls. As would be recognized by persons of skill in the art, embodiments of the present invention can be used in any type of communications network (e.g., wireline, wireless, or hybrid networks).

[0036] User equipment 102 is any device that provides a user access to one or more networks. User equipment 102 can include, but is not limited to, a

computer such as user equipment 102a, a personal digital assistant (PDA) such as user equipment 102b, a wireless phone such as user equipment 102c, a smart phone, other wireless mobile devices, and/or wired communications devices.

[0037] Access network 110 is a communications network that couples user equipment 102 to a packet data network (not shown). Access network 110 may be a third generation partnership project (3GPP) access network or a non-3GPP access network. Exemplary 3GPP access networks include the UMTS terrestrial radio access network (UTRAN) and the GSM EDGE radio access network (RAN). Other access networks include, but are not limited to, WiFi, WiMAX, CDMA2000, GSM, and UMTS.

[0038] Network access gateway 120 provides an interface between access network 110 and a packet data network (not shown). In a 3GPP network, network access gateway 120 may be the Gateway General Packet Radio Service (GPRS) Support Node (GGSN). Note that network access gateway 120 may also act as a policy enforcement point.

[0039] Policy controller 140, at a high level, includes subscriber profiles and network policies needed to manage network resources, such as bandwidth, according to a subscriber, session, and/or application. A service provider may apply a policy based on business rules associated with a variety of factors (e.g., service tiers and/or dynamic parameters such as time of day).

[0040] Policy controller 140 includes a policy and charging rules function (PCRF) 142 and a quota manager 144. For example, in a 3GPP network, PCRF 142 acts as a decision point for policy and charging control of service data flows. PCRF 142 is configured to select and provide the applicable policy and charging control decisions to the policy control enforcement point.

[0041] Usage policy server 160 works in conjunction with policy controller 140 to extend policy and charging control of service data flows to user equipment 102. These data flows may be monitored and controlled on a per subscriber, per user equipment, or per application basis. For example, control and metering of data flows from applications hosted in application server farm 170 to user equipment 102a may be performed by usage policy server 160. Alternatively,

control and metering of data flows for a particular subscriber using user equipment 102a may be performed by usage policy server without regard to the applications being invoked by the subscriber. Similarly, control and metering of data flows between a pool of related subscribers (i.e., subscribers in the same family, organization, or corporation) using user equipment 102a-c may be performed by usage policy sever 160, regardless of the applications involved in the data flows. Although the exemplary environment 200 depicts usage policy server 160 as a separate server from policy controller 140, as would be understood by those skilled in the relevant art(s) usage policy server 160 may be implemented as software residing in policy controller 140. Conversely, policy controller 140 may comprise software residing on usage policy server 160

[0042] According to an embodiment of the invention, a subscriber using user equipment 102 can set usage limits in mobile usage policy application 104 running on user equipment 102. For example, a subscriber using user equipment 102a can use mobile policy application 104a to set total daily usage limits in Mega Bytes (MBs), which are communicated to usage policy server 160 via access network 110, network access gateway 120, and policy controller 140. Subscribers can also set data usage notification and stop thresholds in mobile usage policy application 104. Upon reaching a notification threshold (i.e., 400 MBs in the example embodiment depicted in FIG. 7), a subscriber will receive a notification on user equipment 102. At that point, the subscriber can optionally can set a new, higher usage limit in mobile usage policy application 104, or choose to curtail data usage. Upon reaching a stop threshold (i.e., 600 MBs in the example embodiment depicted in FIG. 7), a subscriber will be unable to use additional data services on user equipment 102 until a higher usage limit is set in mobile usage policy application 104 or server-side usage policy application 164.

[0043] Usage policy server 160 provides usage policy data to policy controller 140. Quota manager 144 is configured to collect data communications usage and cost data. Quota manager 144 provides data communications cost monitoring and data to user equipment 102a-c via network access gateway 120 and access network 110. If the subscriber exceeds a data usage cap or threshold, quota

manager 144 provides this information to user equipment 102a-c and usage policy server 160. In an embodiment, server-side usage policy application 164 running on usage policy server 160 allows subscribers to set data usage controls via a web portal (See FIGs. 2 and 3). Data usage controls include, but are not limited to, total daily usage thresholds, total hourly usage thresholds, per-application usage thresholds, per-device usage thresholds, and thresholds based on data sources (i.e., Uniform Resource Locator/URL addresses or Internet Protocol/IP addresses). In an alternative embodiment, a mobile usage policy application 104 running on user equipment 102 allows subscribers using user equipment 102 to set data usage controls, such as, but not limited to the thresholds mentioned above directly on user equipment 102.

[0044] Quota manager 144 is configured to set adaptive fair usage windows according to a variety of techniques including, but not limited to, using pre-defined value or values, calculating windows based on one or more formulas, and/or determining window based on how quickly previous windows were violated. These techniques are described in further detail in US Application No. 61/153,910, filed February 19, 2009, and entitled "Adaptive Window Size for Network Fair Usage Controls." The capabilities described therein are included in the current application.

[0045] Policy controller 140 is coupled to subscriber data repository 150. Subscriber data repository 150 includes a subscriber profile database 152, a subscriber state database 154, and a subscriber usage database 156. Although depicted as three separate databases in FIG. 1, a person of ordinary skill in the art will recognize that subscriber profile, subscriber state, and subscriber usage data may be stored in any number of databases.

[0046] Policy controller 140 is further coupled to network access gateway 120. In an embodiment, the interface between policy controller 140 and network access gateway 120 is a Gy interface.

[0047] Subscriber state database 154 includes information that identifies and defines a subscriber's network session. Subscriber state information includes the subscriber identifier for the session. In embodiments of the invention, subscriber

identifiers may be one or more of a Mobile Subscriber ISDN Number (MSISDN), a Mobile Identification Number (MIN), a Private Identifier, information about the network such as the IP address the subscriber is currently using and what network or networks to which the subscriber is currently connected, device information such as the device being used and the version of the software, location and roaming information, and other unique state information.

[0048] When a subscriber connects to any network, the core elements of the network assign an Internet Protocol (IP) address to the subscriber. At that time, the subscriber session begins and subscriber state information is created, derived and captured. For example, state information is typically generated either through RADIUS accounting or through interactions with the dynamic host control protocol (DHCP) service on a network. The accounting message feeds are generated to a Remote Authentication Dial In User Service (RADIUS) engine or an authentication, authorization and accounting (AAA) service from core network elements.

[0049] Subscriber profile database 152 includes static information about the subscriber. This information may include the service tier (e.g., gold, silver, bronze) assigned to the subscriber. In an embodiment of the invention, service tiers are associated with Quality of Service (QoS) levels.

[0050] Subscriber usage database 156 includes static and dynamic information related to the subscriber's history. The subscriber's history includes, but is not limited to the subscriber's data usage history. In embodiments of the present invention, subscriber usage database 156 may store information about the amount of data used on a per-application basis by the subscriber's user equipment 102 in previous sessions. Usage policy server 160 uses the per-application usage data from prior sessions to inform the subscriber about which applications running on user equipment 102 have consumed the most bandwidth or data based on previous behavior patterns.

[0051] According to an embodiment of the invention, a carrier or provider-based infrastructure is used wherein the service provider infrastructure provides data metering and control. In this architecture, usage policy server and server-side

usage policy application 164 are used to control and meter data usage on user equipment 102.

[0052] In another embodiment, a carrier-independent is used whereby metering and control is performed on user equipment 102 using mobile usage policy application 104. In this embodiment, some centralized functions are performed by policy controller 140 and usage policy server 160, such as controlling data usage policies across multiple user equipment 102a-c. In this embodiment, longer-term historical storage of usage information occurs in subscriber usage database 156 within subscriber data repository 150.

[0053] In an embodiment, a hybrid architecture gathers usage data on user equipment 102 but long-term storage of the usage data occurs in subscriber usage database 156 within subscriber data repository 150. In this way, centralization is performed within a service provider infrastructure. This architecture is useful for the roaming scenario depicted in FIG. 2 and described below.

[0054] FIG. 2 depicts an exemplary operating environment 200 for providing data communications cost monitoring and controls while roaming. Although the exemplary environment 200 depicts two network service providers, home network service provider 220 and roamed network service provider 230, as would be understood by those skilled in the relevant art(s), user equipment 102 may connect to a plurality of roamed network service providers 230 while roaming.

[0055] FIG. 2 is described with continued reference to the operating environment of FIG. 1. However, environment 200 is not limited to that embodiment.

[0056] Mobile data costs for a subscriber using user equipment 102 may be based on data volume used within a period. For example, a subscriber's subscription may entail a charge of $60 up to a 1Giga Byte (GB) cap of data access each month with a $3 per MB charge after the 1GB cap has been exceeded. Data costs also vary based on the home network service provider 220 that user equipment 102 is homed in or connected to. Typically, data costs increase when user equipment 102 is roaming in roamed network service provider 230. Due to these and other dynamic factors that can increase data costs, embodiments of the

present invention enable subscribers to monitor and control expenditure on data services on user equipment 102 on a real time basis.

[0057] In accordance with a 'provider-centric' embodiment of the invention, monitoring and control of usage and charging for data is performed by methods and systems that reside within home network service provider 220 and remain under the control of home network service provider 220. In the provider-centric embodiment, home network access gateway 120 and roamed network access gateway 236 monitor and control packet traffic between user equipment 102 and the Internet 210. Home network access gateway 120 and roamed network access gateway 236 generate usage accounting records that are input to off-line or on-line (prepaid) billing and reporting systems residing in base station subsystems 224 and 234. Examples of home network access gateway 120 and roamed network access gateway 236 include, but are not limited to gateway GPRS Support Node (GGSN), Packet Data Serving Node (PDSN), Deep Packet Inspection (DPI), and "Evolved NodeB (eNodeB).

[0058] Home network service provider 220 and roamed network service provider 230 may provide visibility of data usage records via a website user interface to subscribers that log in to check their account via web portals 222 and 232.

[0059] According to an embodiment, subscribers can monitor and control their data usage via web portals 222 and 232. For example, subscribers can select service extensions, data usage boosts, a lower bandwidth service, or other alternatives via home network web portal 222 and/or roamed network web portal 232. These changes are then passed to usage policy server 160 and propagated to server-side usage policy application 164. In an alternative embodiment, changes made via home network web portal 222 and roamed network web portal 232 are propagated to mobile usage policy application 104 resident on user equipment 102.

[0060] In another embodiment, when a subscriber is roaming and the roaming traffic is not routed through the subscriber's home service network provider 220 home agent or home network access gateway 120, an interaction between a usage policy server 160 in roamed network service provider 230 and a usage policy

server 160 in home network service provider 220 is initiated. This interaction between the respective usage policy servers includes a request being sent from usage policy server 160 in home network service provider 220 to a usage policy server 160 in roamed network service provider 230. According to an embodiment, the request is for information that home network service provider 220 needs in order to affect data usage controls for user equipment 102 while it is accessing data in roamed network service provider 230.

[0061] In an embodiment, to prevent unexpectedly high roaming charges from roamed network service provider 230, a subscriber using user equipment 102 may select, using usage policy application 104 to be barred from all or some data applications while roaming in the network of roamed network service provider 230. For instance, a subscriber using a mobile device such as user equipment 102 may wish to avoid the high cost of data services while they are outside the coverage area of home network service provider 220, but retain the data service when they are not roaming.

[0062] According to an embodiment, while user equipment 102 is using roamed network service provider 230, a subscriber may opt to have certain applications from application server farm 170 blocked.

[0063] Operators of home network service provider 220 and roamed network service provider 230 can detect access to on- or off-portal applications, and they typically choose to charge less, or impose no data fees, for access to on-portal applications from user equipment 102. In an embodiment, a subscriber may choose to select only on-portal applications (either in home network service provider 220 or roamed network service provider 230) in order to reduce data usage and costs.

[0064] In instances when access network 110 depicted in FIG. 1 becomes congested, an embodiment of the invention provides real-time traffic information from access network 110 and, more specifically, from individual base station subsystems 224 and 234 which enables operators of home network service provider 220 or roamed network service provider 230 to identify areas of congestion within their respective access networks 110. Policy controller 140

includes operator tools to contain congestion in real-time by temporarily enforcing more stringent policies (i.e., not allowing bursting behavior, or assigning lower priority to subscribers with low-tier service plans).

[0065] In an embodiment, in order to prevent 'bill shock' due to exceeding data quotas and in order to extend usage control to subscribers, mobile usage policy application 104 works in conjunction with policy controller 140 to provide proactive notifications to user equipment 102 when subscribers are nearing bandwidth usage thresholds or data roaming charge limits in roamed network service provider 230. Subscribers can then be given choices in real-time in mobile usage policy application 104, such as a service extension, a data usage boost, a lower bandwidth service, or other alternatives. In addition, operators of home network service provider 220 or roamed network service provider 230 can extend control to subscribers to set personalized usage caps that can be updated in real-time based on personal financial limits, or to boost roaming data usage while a subscriber is traveling.

Data Monitoring and Control Systems

[0066] FIG. 3 illustrates an architecture for a system 300 for providing data communications cost monitoring and controls within a communications network, in accordance with an embodiment of the present invention. System 300 is provider independent in that the architecture is distributed between user equipment 102 and a usage policy server 160.

[0067] FIG. 3 is described with continued reference to the operating environments of FIGs. 1 and 2. However, system 300 is not limited to those embodiments.

[0068] In an embodiment, monitoring and control of the data usage is based on user equipment 102 using mobile usage policy application 104, instead of within the infrastructure of home network service provider 220 or roamed network service providers 230. This distributed system runs on user equipment 102 and usage policy server 160. In system 300, the charging/cost monitoring and control

can be performed down to the level of the individual applications 306 running on user equipment 102. Applications 306 may include, but are not limited to games, social networking applications, Voice over Internet Protocol (VOIP) applications such as Skype, and wireless access to data-intensive web sites that host multimedia content such as video.

[0069] According to an embodiment, a device usage control subsystem (executes on user equipment 102 and monitors data flows (denoted as 1-4) on user equipment 102. The device usage control subsystem comprises the following components: local store 308, application controller 310, and mobile usage policy application 104. These components are described in the following paragraphs.

[0070] Application controller 310 is installed to mediate between applications 306 and communication stack 312 of user equipment 102. In an embodiment, communication stack 312 is a Transmission Control Protocol (TCP)/Internet Protocol (TCP/IP) stack. Application controller 310 presents a virtual socket layer to applications 306. Application controller 310 also counts how many bytes each application 306 sends and receives (denoted as data flow 1). Application controller 310 also stores the data usage on a per-application basis in local store 308 (denoted as data flow 4). Application controller 310 checks for application data usage threshold limits defined in the local store by the mobile usage policy application 104. In an alternative embodiment, application controller 310 checks for application data usage threshold limits defined in the global store 368 by the server-side usage policy application 164, which can be accessed via calls to Application Programming Interface (API) 366.

[0071] In an embodiment, data usage information for a single device is stored in a data store, such as local store 308 on user equipment 102. 2. Local store 308 may use non-volatile storage on user equipment 102 to hold information such as, but not limited to, data usage for each application 306, data budgets, thresholds, tariff information, and statistics regarding highest budget applications 306. Each of these types of information is described below.

[0072] Each of the types of information described below may optionally be stored in local store 308 on user equipment 102. The information described

below may also be periodically imported from or exported information to global store 368 residing on one or more usage policy servers 160.

[0073] Data 'budgets' for applications 306 or groups of applications 306 can be set in mobile usage policy application 104 or server-side usage policy application 164. In an embodiment, after reaching its budgeted allocation for a given period, an application 306 is capped or blocked from further data network usage. According to this embodiment until that period is elapsed (or the budget is changed or over-ridden by a subscriber), application 306 will be blocked from performing additional data transactions, thereby allowing the subscriber to control data costs that may otherwise cause 'bill shock.'

[0074] Thresholds for applications 306 are kept, whereby the subscriber is notified that an application 306 or group of applications 306, if a subscriber has set a threshold of 75% for an application 306, when that application 306 has consumed 75% of its data budget, the subscriber will receive a notification at user equipment 102.

[0075] Tariffs comprise information kept for each known potential roamed network service provider 230 in which the subscriber can roam, so that the user has control over which roamed network service provider 230 would be most cost-effective to use. Tariff information pertaining to a plurality of roamed network service providers 230 may be stored in a local store 308 on user equipment 102. Tariff data for each roamed network service provider 230 may reside in a database or data store on usage policy server 160, such as global store 368.

[0076] According to an embodiment, local store 308 may periodically import or export tariff information via data flows 5 and 6, respectively, to global store 368 residing on one or more usage policy servers 160 associated with one or more roamed network service providers 230. Tariff information stored in global store 368 and a plurality of local stores 308 can be used to provide flexible tariff distribution. In an embodiment of the invention, a carrier-based architecture is used to distribute tariffs stored in global store 368 and local stores 308.

[0077] Statistics regarding highest budget applications 306 include cumulative data usage information kept in order to meter and display subscribers, user

equipment 102, and/or applications 306 using highest budgeted amount of data for a give period. For example, statistics may be kept on a single user equipment 102 regarding applications 306 on a particular user equipment 102 which have used the largest amount of data. Statistics may also be compiled on usage policy server 160 regarding data usage for a plurality of subscribers and/or user equipment 102.

[0078] In accordance with an embodiment of the invention, data usage pertaining to a plurality of subscribers is stored in a data store on usage policy server 160, such as global store 368. According to an embodiment, local store 308 may periodically import or export information via data flows 5 and 6, respectively, to global store 368 residing on one or more usage policy servers 160 associated with one or more network service providers.

[0079] According to an embodiment, the types of data described in the following paragraphs are modeled by usage policy application 104 and stored in a local store such as local store 308.

[0080] Usage entity data, including, but not limited to data identifying a network service provider such as home network service provider 220, network type (WiFi, 3G, etc.), user equipment 102 device type, device group, subscriber or user, user group, application 306, and groups of applications 306 may be stored in local store 308.

[0081] Quota information, such as a quota expressed in MBs or GBs and cost for additional quota levels, may be modeled by usage policy application 104 and stored in a local store such as local store 308. Quotas may be modeled and stored on the network service provider level, subscriber level, subscriber group level, for each application 306, and for groups of applications 306.

[0082] Threshold information such as the percentage of a quota reached in a period (i.e., monthly, weekly, and/or daily) may also be stored in local store 308. Thresholds may be modeled and stored on the network service provider level, subscriber level, subscriber group level, for each application 306, and for groups of applications 306.

[0083] Information regarding data costs incurred may also be modeled by usage policy application 104 and stored in a local store such as local store 308. Data costs may be modeled and stored on the network service provider level, subscriber level, subscriber group level, for each application 306, and for groups of applications 306.

[0084] Usage intervals may be stored be stored in local store 308 on a daily, weekly, and monthly basis. Usage intervals pertaining to a plurality of subscribers and user equipment 102 may also be stored in global store 368.

[0085] Tariff information for a plurality of networks regarding data prices (i.e., expressed as cost per Byte, MB, or GB) may also be stored in a local store such as local store 308. Tariff information is collected and stored on a network level.

Mobile Usage Policy Application

[0086] With continued reference to FIG. 3, in an embodiment, mobile usage policy application 104 provides the functionality described in the following paragraphs.

[0087] Mobile usage policy application 104 provides a user interface for monitoring and control (denoted as data flow 3). An exemplary user interface is provided in FIGs. 7-11, which are described in detail below.

[0088] Mobile usage policy application 104 also defines the data and policies that application controller 310 and local store 308 require (denoted as data flow 2 in FIG. 3).

[0089] The following are the types of data usage policies defined by mobile usage policy application 104 for application controller 310 on user equipment 102.

[0090] Mobile usage policy application 104 can set data usage quotas, thresholds (including alert and stop thresholds), allowable maximum tariffs (i.e., tariff limits expressed in terms of maximum acceptable costs per Byte, MB, or GB), allowable network service providers (i.e., allowed roamed network service providers 230 for a given subscriber, user equipment 102 and/or application 306),

and allowable network tariff minimums. For example, mobile usage policy application 104 may only allow a given subscriber, user equipment 102, or application 306 to access a roamed network service provider 230 tariff less than a certain currency amount per storage unit (i.e., US dollars per MB or GB).

Usage Policy Server and Server Side Usage Policy Application

[0091] In an embodiment, usage policy server 160 hosts server side usage policy application 164, global store 368, a Global Policy Controller, and web portal 222.

[0092] Global store 368 optionally collects data usage information from local stores 308 from a plurality of user equipment 102. In an embodiment, global store 368 comprises a database that provides rolled up, or per user equipment 102, per-subscriber, per-application 306 breakdowns, or views of usage data within various contexts. These contexts may include, but are not limited to, corporations, organizations (i.e., departments), and a subscriber. The level of granularity of data stored in global store 368 allows subscribers and network administrators to run data queries and generate reports regarding data usage for a single subscriber, single user equipment 102, groups of subscribers, and related sets of user equipment 102 (i.e., user equipment leased by an organization or corporations) for a given period. In an embodiment, these queries and reports can be accessed via web portal 222.

[0093] Global store 368 on usage policy server 160 optionally stores and distributes the per user equipment 102 information. In this way, usage policy server 160 can be used to provide centralized provisioning of user equipment 102.

[0094] Global policy controller 370 is an application on usage policy server 160 that enables access to global store 368 and drives global store 368 to collect information from a plurality of user equipment 102 (denoted as data flow 5). Global policy controller 370 also drives global store 368 to provision information to a plurality of user equipment 102 (denoted as data flow 5).

Provider Based System

[0095] FIG. 4 illustrates an architecture for a provider-based system 400 for providing data communications cost monitoring and controls within a communications network, in accordance with an embodiment of the present invention.

[0096] FIG. 4 is described with continued reference to FIGs. 1-3. However, system 400 is not limited to those embodiments.

[0097] In the embodiment of system 400, the infrastructure of a network service provider provides data usage metering and control. Usage policy server 160 provides interface 404 to subscribers using user equipment 102 to allow subscribers to monitor and control charging for data usage.

[0098] In an embodiment the data usage metering and control is web based and accessed via web portal 222. Alternatively, data usage metering and control is device application based using interface 404 invoked locally on user equipment 102. Interface 404 allows the device to register with usage policy server 160 (denoted as data flow 1). After registration, user equipment 102 is synchronized with usage policy server 160 and local store 308 is updated (denoted as data flow 2).

[0099] Usage policy server 160 also allows subscribers and network administrators to access web interface via web portal 222 to fetch values for data usage attributes (denoted as data flow 3) such as, but not limited to thresholds and quotas on a per application 306, home network service provider 220, roamed network service provider 230, or subscriber basis.

[0100] Usage policy server 160 also stores usage data for all registered user equipment 102 in subscriber usage database 156 for a given period (e.g., 2 months).

[0101] Usage policy server 160 then registers with online and offline charging systems such as policy and charging rules function (PCRF) 142. In embodiments, the charging systems may include AAA and other protocols, capable of receiving data usage information for user equipment 102.

[0102] According to an embodiment, PCRF 142 receives a bulk registration request from usage policy server 160 (denoted as data flow 4). The bulk registration request comprises data usage information for a plurality of user equipment 102 that has registered with usage policy server 160. The data usage information contains threshold and stoppage policies based on criteria such as data volume and the characteristics of roamed network service provider 230.

[0103] System 400 can be used to provide flexible policy descriptions for a network service provider's charging plan. For example, a network service provider can furnish its policy and charging rules from PCRF 142 via usage policy server 160. The provider-based architecture illustrated in FIG. 4 enables distribution of flexible policy descriptions corresponding to network service provider charging plans via data flows between PCRF 142 and usage policy server 160.

[0104] System 400 and the provider-based architecture depicted in FIG. 4 can also be used to provide flexible tariff distribution. Tariffs comprise information kept for each known potential roamed network service provider 230 in which a subscriber can roam. Access to this information on user equipment 102 is useful when a subscriber wants to determine which potential roamed network service provider 230 will be most cost-effective to use. Tariff information pertaining to a plurality of roamed network service providers 230 may reside in a database or data store on usage policy server 160 to be distributed to a plurality of user equipment 102.

[0105] PCRF 142 accesses usage information forwarded by one or more network access gateways 120. In an embodiment, this usage information is received by network access gateway 120 via a radio access network (RAN) 406. PCRF 142 sends usage stream information comprising current data usage information for user equipment 102 to usage policy server 160 (denoted as data flow 5).

[0106] Usage policy server 160 requests that PCRF 142 control usage (i.e., affect bearer channel) for user equipment 102 once a stoppage decision is made by PCRF 142 (denoted as data flow 6).

Data Monitoring and Control Methods

[0107] FIG. 5 depicts an exemplary message flow diagram for a method 500 for providing data communications cost monitoring and controls when the provider-based architecture provided in FIG. 4 is used, according to an embodiment of the present invention. FIG. 5 is described with continued reference to FIG. 4. However, method 500 is not limited to that embodiment.

[0108] In step 505, a subscriber, using interface 404 on user equipment 102 enters data needed to make an initial request to register user equipment 102. In another embodiment, this step is performed by a subscriber accessing a web based user interface via web portal 222 on usage policy server 160.

[0109] In step 510, the user equipment 102 device registration request is sent to usage policy server 160.

[0110] In step 520, data from subscriber usage database 156 is sent from usage policy server 160 to user equipment 102 in order to synchronize. In this step, user equipment 102 is synchronized with usage policy server 160 and local store 308 is updated.

[0111] In step 530, a request to fetch values for data usage attributes is sent from user equipment 102 to usage policy server 160. Attribute/value pairs fetched in this step may include application, subscriber, and/or network-based thresholds and quotas.

[0112] In step 540, a bulk registration request is sent from usage policy server 160 to PCRF 142. In this step, a bulk registration request from usage policy server 160 comprising data usage information for a plurality of user equipment 102 that has registered with usage policy server 160 is forwarded to PCRF 142. In an embodiment, the data usage information contains threshold and stoppage policies based on criteria such as data volume and the characteristics of a home network service provider 220 or a roamed network service provider 230.

[0113] In step 545, PCRF 142 sends usage stream information comprising current data usage information for user equipment 102 to usage policy server 160.

[0114] In step 550, usage policy server 160 sends a request to PCRF 142. In this step, a request to control data usage for user equipment 102 is sent based upon a stoppage decision made by PCRF 142.

[0115] FIG. 6 depicts a flowchart 600 of an exemplary method for monitoring and controlling data usage, according to embodiments of the present invention.

[0116] FIG. 6 is described with continued reference to FIGs. 1-5. However, flowchart 600 is not limited to those embodiments.

[0117] In step 610, a user equipment 102 device registration request is sent to a usage policy server 160. In an embodiment this step is performed using interface 404 on user equipment 102. In another embodiment, this step is performed by a subscriber accessing a web based user interface via web portal 222 on usage policy server 160.

[0118] In step 620, user equipment 102 is synchronized and updated using data from subscriber usage database 156 sent from usage policy server 160. In this step, local store 308 is updated.

[0119] In step 630, values for data usage thresholds and attributes are requested from user equipment 102. In an embodiment, thresholds and attribute/value pairs are tunable or editable on user equipment using interface 404. Attribute/value pairs may include application, subscriber, and/or network-based thresholds and quotas. Thresholds may include percentage usage levels beyond which a notification is to be sent to a subscriber using user equipment 102.

[0120] In step 640, bulk registration is performed. The bulk registration includes collecting data usage information for a plurality of user equipment 102 that has registered with a usage policy server 160. The data usage information comprises threshold and stoppage policies based on criteria such as data volume and the characteristics of network service providers.

[0121] In step 650, the usage stream for a subscriber is updated. In this step, usage stream information comprising current data usage information for user equipment 102 may be sent to a usage policy server 160.

[0122] In step 660, a determination whether an attribute value obtained in step 630 has been exceeded. In this step, a determination is made whether any

attribute value has been exceeded, such as a daily MB cap, a cap by an application 306 running on user equipment 102, a cap for user equipment 102, and/or an overall data cap for a subscriber

[0123] If an attribute has not been exceeded, operation proceeds to step 665. If threshold has been exceeded, operation proceeds to step 670.

[0124] In step 665, a determination whether a threshold value obtained in step 630 has been exceeded. In this step, a determination is made whether any threshold has been exceeded, such as a percentage threshold regarding daily usage in MBs, has been reached.

[0125] If a threshold has been exceeded, operation proceeds to step 670. If threshold has not been exceeded, operation proceeds to step 680.

[0126] In step 670, a notification is sent to subscriber. In this step, a notification may comprise a prompt in interface 404, an email message, a Short Messaging Service (SMS) message, a subscriber notification posted via web portal 222, or any other notification capable of notifying a subscriber that a threshold has been exceeded.

[0127] In step 675, after the notification sent in step 670 has been received by a subscriber, a determination is made whether a service characteristic has been changed. In this step, a subscriber, in response to the notification sent in step 670, can optionally change a service tier associated with their subscription in order to alleviate either an exceeded threshold determined in step 665 or an exceeded attribute determined in step 660. In this step, an upgrade to a next service tier can be made when a subscriber is close to reaching bandwidth caps or thresholds.

[0128] If a service characteristic is modified, operation proceeds to step 680. If a service characteristics are unchanged, operation proceeds to step 685.

[0129] In step 680, current total data usage is determined for user equipment 102. In this step, data usage for applications 306 running on user equipment 102 may also be determined. After collection and calculation of data usage information is performed in this step, control is passed back to step 650.

[0130] In step 680, data usage is controlled on user equipment 102 after a subscriber opted to not modify service characteristics in step 675 and the method ends.

Example Graphical User Interfaces

[0131] FIGs. 7-11 depict a graphical user interface (GUI) for a mobile device to display data usage, edit usage limits, define tariffs, and accept special offers to change service tiers, according to embodiments of the invention.

[0132] In an embodiment of the present invention, mobile usage policy application 104 may include the exemplary interface illustrated in FIGs. 7-11. FIGs. 7-11 are described with continued reference to the embodiments illustrated in FIGs. 1-4. However, FIGs. 7-11 are not limited to those embodiments. Throughout FIGs. 7-11, displays are shown with various hyperlinks, command regions, 'turn wheels', buttons, 'slide bars', and data entry fields, which are used to initiate action, invoke routines, enter data, view data, or invoke other functionality. For brevity, only the differences occurring within the figures, as compared to previous or subsequent ones of the figures, are described below.

[0133] FIG. 7 illustrates a data usage interface 700 that allows a subscriber to view home data used 702 in home network service provider 220 as compared roamed data used 704 while roaming in roamed network service provider 230 for a given period. In the exemplary embodiment illustrated in FIG. 7, the period is 1 month (e.g., April), but as would as would be understood by those skilled in the relevant art(s) interface 700 could display other data usage periods (i.e., hourly, daily, weekly, etc). In an embodiment, interface 404 comprises interface 700.

[0134] A subscriber can set "Notify" and "Stop" limits by selecting, using input device 710, limits button 706. Similarly, a subscriber can display and set tariffs by selecting, using input device 710, tariffs button 708. Interface 700 also displays total data usage 712.

[0135] FIG. 8 illustrates a usage limits interface 800 that allows a subscriber to set data usage limits in home network service provider 220 and in roamed

network service providers 230. According to an embodiment of the invention, interface 404 comprises interface 800. A subscriber, using input device 710 or a touch screen interface within interface 800 can change usage limits 802 for one or more network service providers. In an embodiment, usage limits 802 are changeable by scrolling through different values by using 'turn wheels' within interface 800. After one or more usage limits 802 have been changed, new usage limits 802 may be saved when a subscriber, using input device 710 or a touch screen interface within interface 800 selects save button 804. Current, updated usage data is displayed when a subscriber, using input device 710 or a touch screen interface within interface 800, selects usage button 806.

[0136] FIG. 9 illustrates a tariffs interface 900 that allows a subscriber to display and define tariffs 902 for home network service provider 220 and for roamed network service providers 230. In embodiment of the invention, interface 404 comprises interface 900. In an embodiment, some pre-set tariffs 902 are provided by the network service providers and other tariffs 902 are editable by the subscriber in interface 900 in cases where the subscriber knows the tariff 902 and a network service providers cannot know the tariff.

[0137] FIG. 10 illustrates an interface 1000 for displaying data usage. Interface 1000 is an alternative embodiment of interface 700 depicted in FIG. 7. A subscriber, using slide bars 1006, can set "Notify" and "Stop" limits. According to an embodiment, a subscriber can display special offers by selecting, using input device 710, special offers button 1008. An exemplary interface for displaying and selecting special offers is described below with reference to FIG. 11.

[0138] FIG. 11 illustrates an interface 1100 for displaying special offers presented to a subscriber by a home network service provider 220 and/or roamed network service providers 230. In an embodiment, some special offers 1102 are provided by the home network service provider 220 and other special offers 1102 are offered by roamed network service providers 230. In the exemplary embodiment depicted in FIG. 11, special offers 1102 can include offers to increase the number of Short Messaging Service (SMS) text messages the

subscriber can send and receive, a 'DayPass' on a roamed network, and a 'TopUp and Go' offer to provide a certain amount of additional data usage and/or calling minutes. In an embodiment, special offers 1102 may be offered to a user for free or may be offered for sale to the subscriber. In an embodiment, a subscriber can select special offers by selecting, using input device 710, links displayed with special offers 1102. Interface 1100 also displays total data usage 712.

Example Computer System Implementation

[0139] In an embodiment of the present invention, the methods and systems of the present invention described herein are implemented using well-known computers, such as a computer 1200 shown in FIG. 12. The computer 1200 can be any commercially available and well-known computer capable of performing the functions described herein, such as computers available from International Business Machines, Apple, Sun, HP, Dell, Cray, etc.

[0140] Computer 1200 includes one or more processors (also called central processing units, or CPUs), such as processor 1210. Processor 1210 is connected to communication bus 1220. Computer 1200 also includes a main or primary memory 1230, preferably random access memory (RAM). Primary memory 1230 has stored therein control logic (computer software), and data.

[0141] Computer 1200 may also include one or more secondary storage devices 1240. Secondary storage devices 1240 include, for example, hard disk drive 1250 and/or removable storage device or drive 1260. Removable storage drive 1260 represents a floppy disk drive, a magnetic tape drive, a compact disk drive, an optical storage device, tape backup, ZIP drive, JAZZ drive, etc.

[0142] Removable storage drive 1260 interacts with removable storage unit 1270. As will be appreciated, removable storage drive 1260 includes a computer usable or readable storage medium having stored therein computer software (control logic) and/or data. Removable storage drive 1260 reads from and/or writes to the removable storage unit 1270 in a well-known manner.

[0143] Removable storage unit 1270, also called a program storage device or a computer program product, represents a floppy disk, magnetic tape, compact disk, optical storage disk, ZIP disk, JAZZ disk/tape, or any other computer data storage device. Program storage devices or computer program products also include any device in which computer programs can be stored, such as hard drives, ROM or memory cards, etc.

[0144] In an embodiment, the present invention is directed to computer program products or program storage devices having software that enables computer 1200, or multiple computer 1200s to perform any combination of the functions described herein

[0145] Computer programs (also called computer control logic) are stored in main memory 1230 and/or the secondary storage devices 1240. Such computer programs, when executed, direct computer 1200 to perform the functions of the present invention as discussed herein. In particular, the computer programs, when executed, enable processor 1210 to perform the functions of the present invention. Accordingly, such computer programs represent controllers of the computer 1200.

[0146] Computer 1200 also includes input/output/display devices 1280, such as monitors, keyboards, pointing devices, etc.

[0147] Computer 1200 further includes a communication or network interface 1290. Network interface 1290 enables computer 1200 to communicate with remote devices. For example, network interface 1290 allows computer 1200 to communicate over communication networks, such as LANs, WANs, the Internet, etc. Network interface 1290 may interface with remote sites or networks via wired or wireless connections. Computer 1200 receives data and/or computer programs via network interface 1290. The electrical/magnetic signals having contained therein data and/or computer programs received or transmitted by the computer 1200 via network interface 1290 also represent computer program product(s).

[0148] The invention can work with software, hardware, and operating system implementations other than those described herein. Any software, hardware, and

operating system implementations suitable for performing the functions described herein can be used.

Conclusion

[0149] While various embodiments of the present invention have been described above, it should be understood that they have been presented by way of example only, and not limitation. It will be understood by those skilled in the relevant art(s) that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined in the appended claims. It should be understood that the invention is not limited to these examples. The invention is applicable to any elements operating as described herein. Accordingly, the breadth and scope of the present invention should not be limited by any of the above-described exemplary embodiments, but should be defined only in accordance with the following claims and their equivalents.

WHAT IS CLAIMED IS:

1. A method for providing data communications cost monitoring and control for a subscriber session, comprising:

receiving, at a usage policy server, a registration request associated with the subscriber session;

determining current data usage associated with the subscriber session;

receiving, at the usage policy server, one or more data usage thresholds and one or more quotas associated with the subscriber session;

collecting, at the usage policy server, data usage information associated with the subscriber session;

sending a notification to a subscriber when the subscriber exceeds a pre-determined quota during the subscriber session; and

controlling data usage for the subscriber session when the subscriber exceeds a pre-determined quota during the subscriber session

2. The method of claim 1, wherein the notification is one or more of an email message, a Short Messaging Service (SMS) message, and a prompt in a user interface.

3. The method of claim 1, wherein determining current data usage comprises:

retrieving subscriber profile data from a subscriber data repository; and

determining the whether a quota has been exceeded based on a service tier associated with the subscriber.

4. The method of claim 1, further comprising:

sending a notification to the subscriber when a pre-determined threshold is exceeded during the subscriber session.

5. The method of claim 4, wherein the notification is one or more of an email message, a Short Messaging Service (SMS) message, and a prompt in a user interface.

6. The method of claim 1, further comprising:

storing data usage information in a subscriber data repository.

7. The method of claim 1, further comprising:

receiving, at the usage policy server, a request to change a service tier associated with the subscriber session; and

updating a subscriber profile based upon a requested service tier change request.

8. The method of claim 1, further comprising:

receiving, at the usage policy server, a request to change a threshold associated with the subscriber session; and

updating a subscriber profile based upon a requested threshold change request.

9. The method of claim 1, further comprising:

receiving, at the usage policy server, a request to change a quota associated with the subscriber session; and

updating a subscriber profile based upon a requested quota change request.

10. The method of claim 1, wherein the one or more quotas comprise a maximum amount data usage for a period, a maximum amount of data usage for an application, a maximum amount of data usage for a group of applications, and a maximum amount of data usage for a mobile device associated with the subscriber.

11. The method of claim 1, wherein the one or more data usage thresholds comprise a percentage of data usage as compared to a quota.

12. A system for providing data communications cost monitoring and control for a subscriber session, comprising:

a usage policy server configured to receive a registration request associated with the subscriber session;

a usage policy application configured to determine current data usage associated with the subscriber session;

a receiving module configured to receive one or more data usage thresholds and one or more quotas associated with the subscriber session;

a collection module configured to collect data usage information associated with the subscriber session;

a notification module configured to notify a subscriber when the subscriber exceeds a pre-determined quota during the subscriber session; and

a control module configured to limit data usage for the subscriber session when the subscriber exceeds a pre-determined quota during the subscriber session.

13. The system of claim 12 further comprising a data usage limit module configured to receive and display modifications to data usage limits associated with the subscriber session.

14. The system of claim 13, wherein the data usage limit module is further configured receive and display modifications to data usage limits associated with one or more applications running on a mobile device.

15. The system of claim 14, wherein the data usage limit module is further configured to run on a web server.

16. The system of claim 14, wherein the data usage limit module is further configured to run on a mobile device.

17. The system of claim 12 further comprising a tariff definition module configured to receive modifications to tariffs associated with one or more network service providers.

18. The system of claim 17, wherein the tariff definition module is further configured to display modified tariffs associated with associated with one or more network service providers.

19. The system of claim 18, wherein the tariff definition module is further configured to run on a web server.

20. The system of claim 18, wherein the tariff definition module is further configured to run on a mobile device.

21. The system of claim 12 further comprising a special offer module configured to receive and display special offers to alter a service tier associated with the subscriber session.

22. The system of claim 21, wherein the special offer module is further configured receive and display special offers from a home network service provider associated with the subscriber session.

23. The system of claim 21, wherein the special offer module is further configured receive and display special offers from a roamed network service provider associated with the subscriber session.

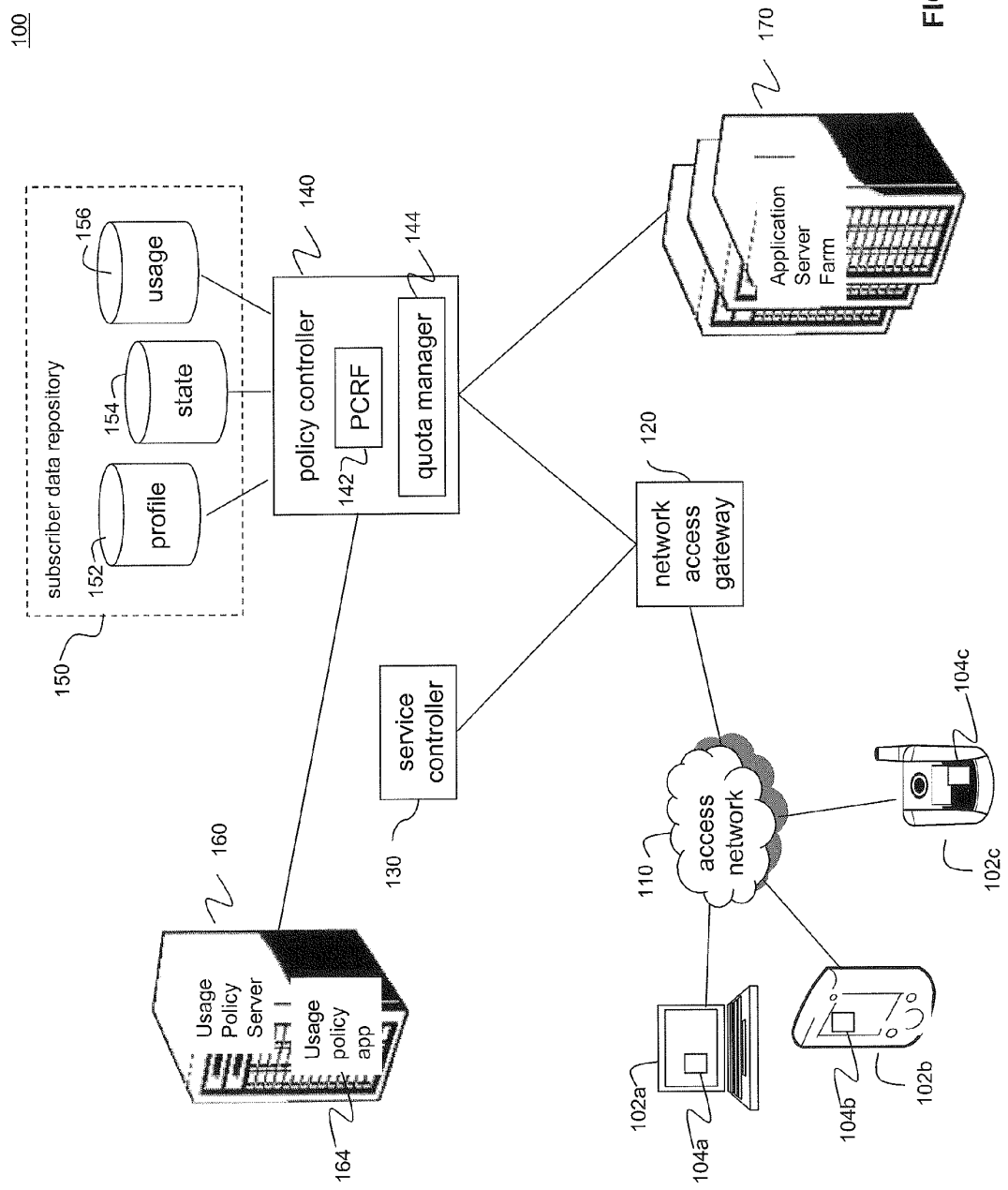

100
subscriber data repository
usage
state
profile
156
154
152
150
policy controller
PCRF
142
140
quota manager
144
Application Server Farm
170
network access gateway
120
service controller
130
Usage Policy Server
Usage policy app
160
164
access network
110
102a
104a
104b
102b
104c
102c

FIG. 1

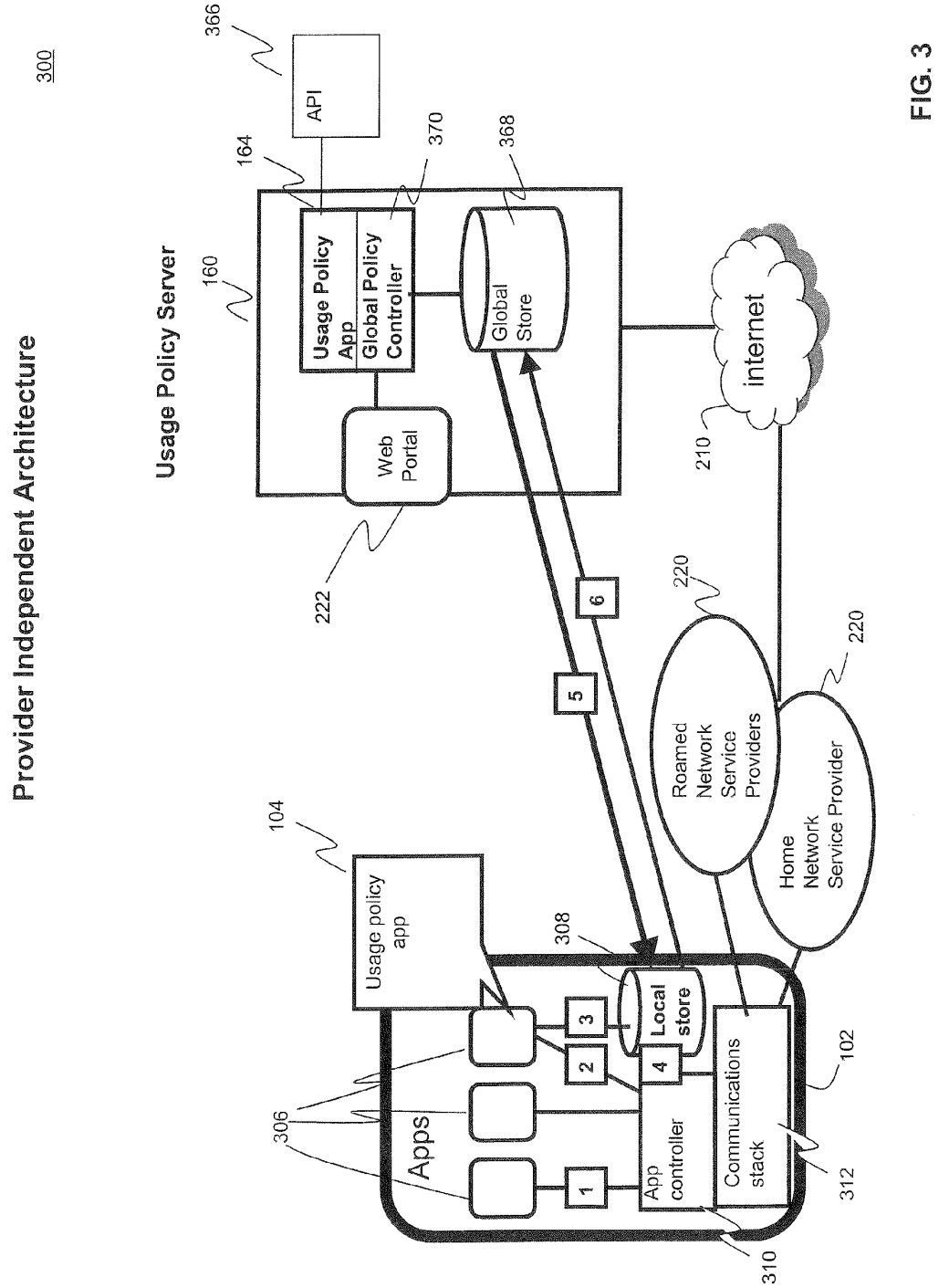

Provider Independent Architecture
300
Usage Policy Server
160
API
366
164
Usage Policy App
Global Policy Controller
370
Global Store
368
Web Portal
222
internet
210
220
Roamed Network Service Providers
Home Network Service Provider
220
104
Usage policy app
308
Local store
Apps
306
App controller
Communications stack
102
312
310
1
2
3
4
5
6

FIG. 3

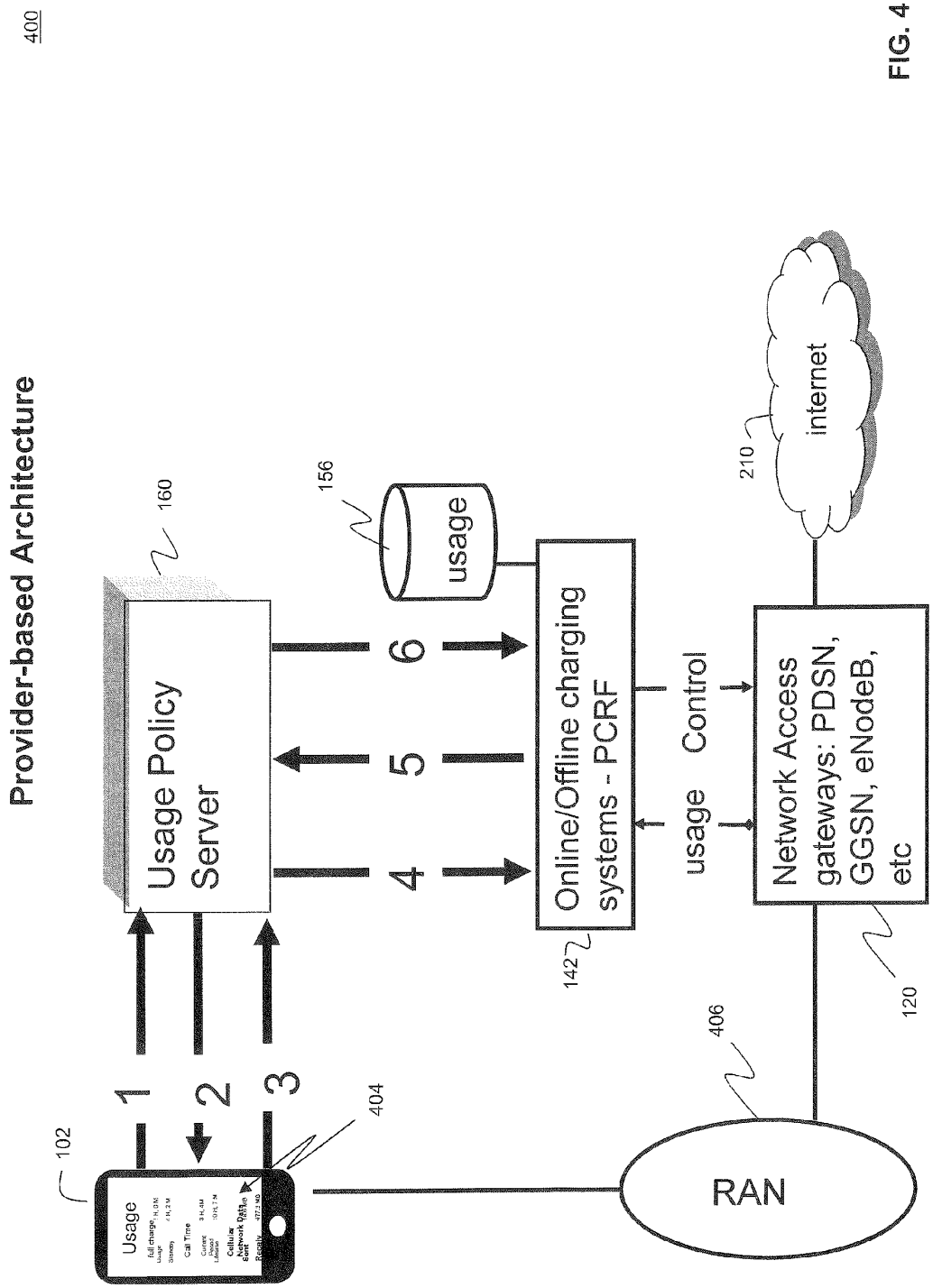

400
Provider-based Architecture
102
Usage
Call Time
Cellular Network Data
Ready
1
2
3
404
160
Usage Policy Server
4
5
6
156
usage
Online/Offline charging systems - PCRF
142
usage
Control
406
RAN
Network Access gateways: PDSN, GGSN, eNodeB, etc
120
210
internet

FIG. 4

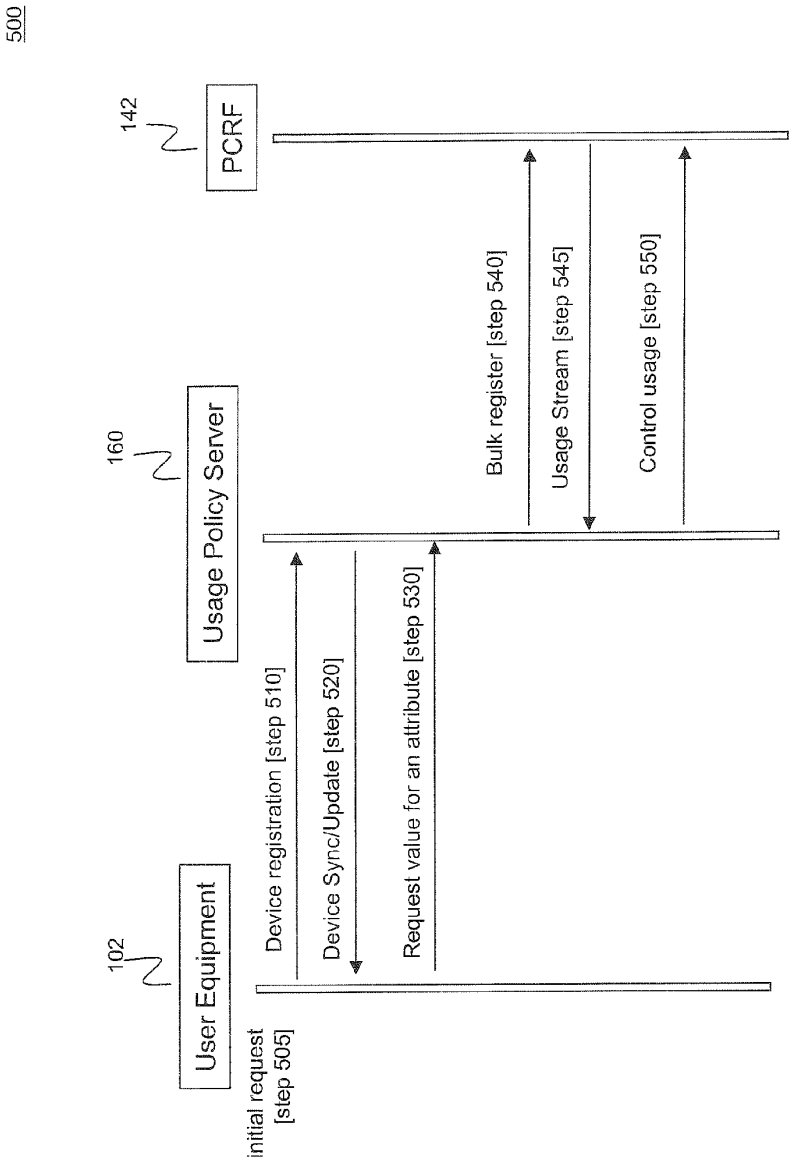

500
102
User Equipment
160
Usage Policy Server
142
PCRF
initial request [step 505]
Device registration [step 510]
Device Sync/Update [step 520]
Request value for an attribute [step 530]
Bulk register [step 540]
Usage Stream [step 545]
Control usage [step 550]

FIG. 5

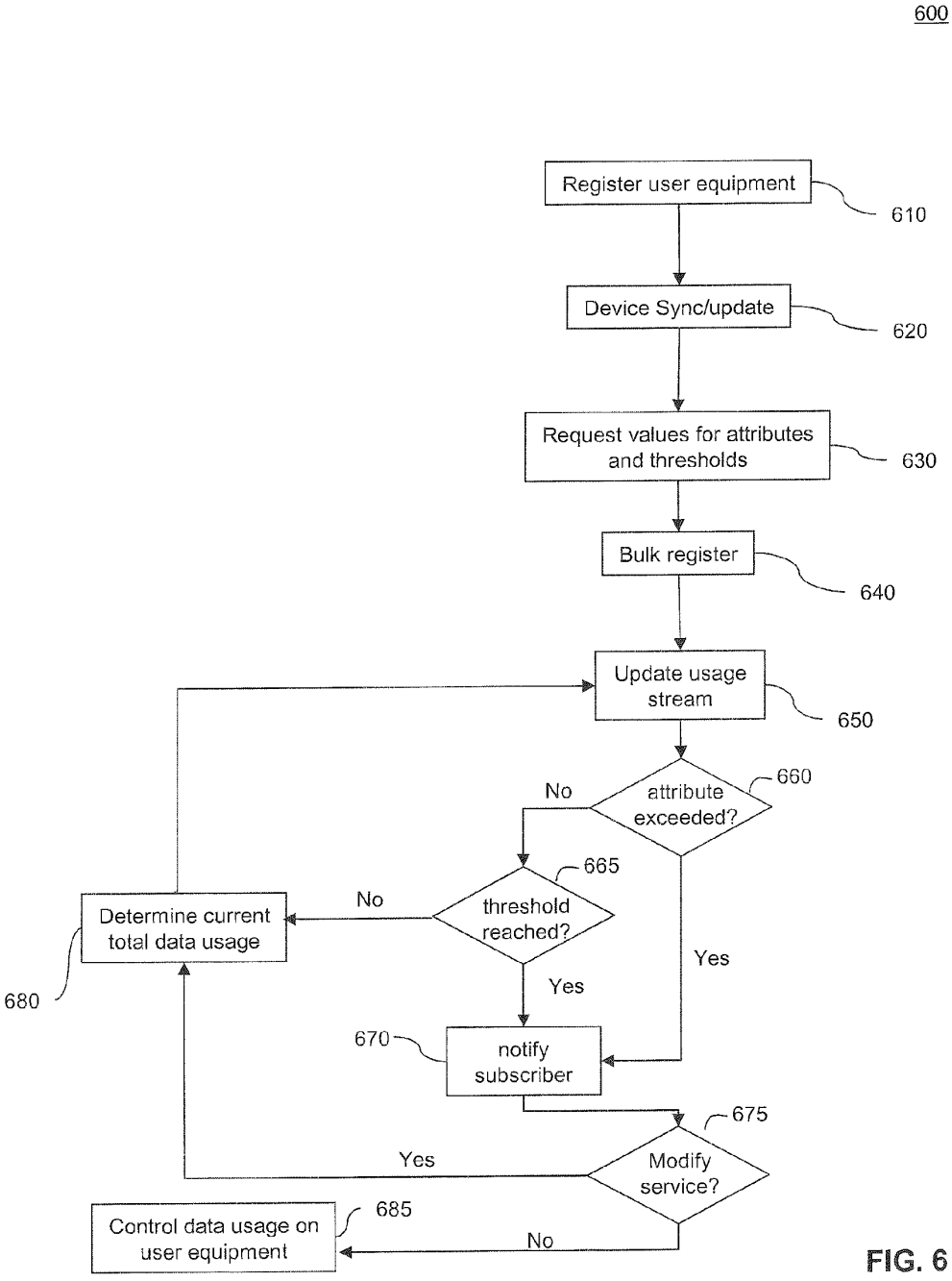

600
Register user equipment
610
Device Sync/update
620
Request values for attributes and thresholds
630
Bulk register
640
Update usage stream
650
attribute exceeded?
660
No
665
threshold reached?
No
Determine current total data usage
680
Yes
Yes
670
notify subscriber
675
Modify service?
Yes
Control data usage on user equipment
685
No

FIG. 6

Roaming Screen

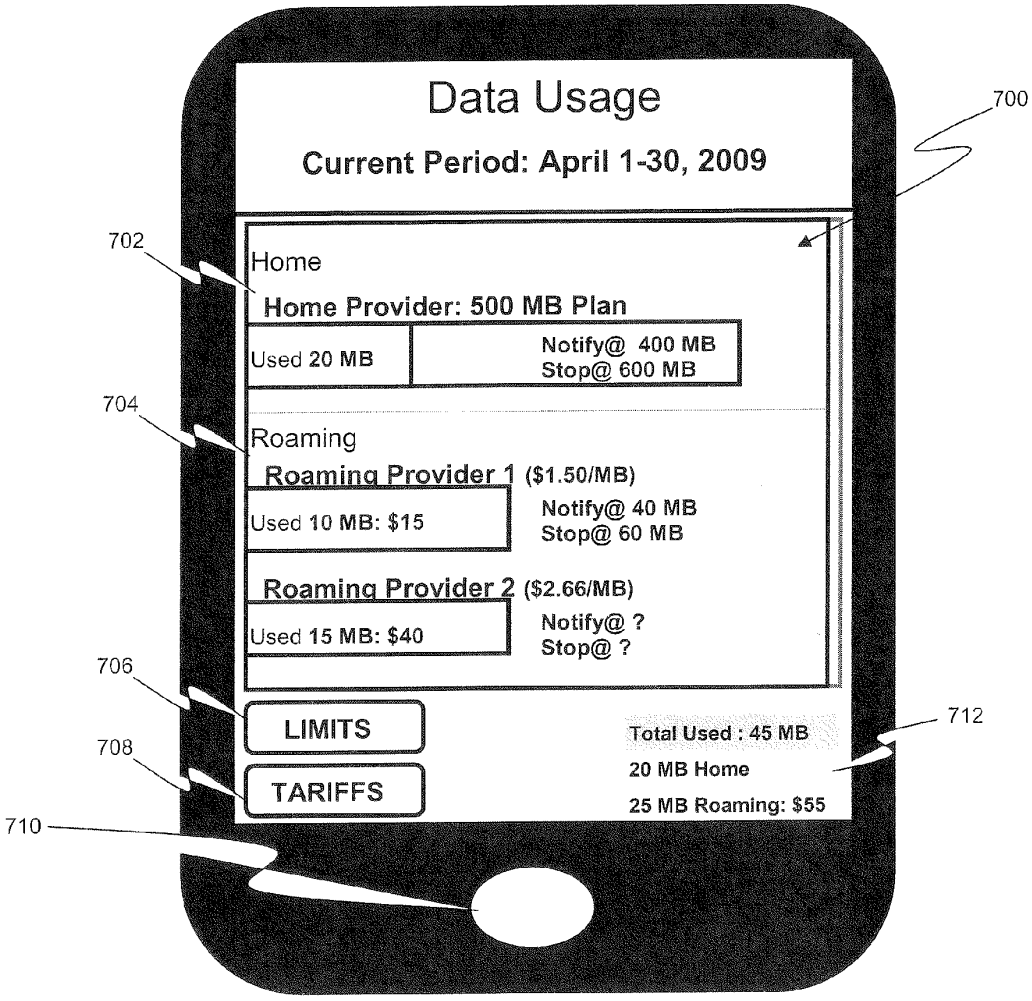


FIG. 7

Setting Usage Limits

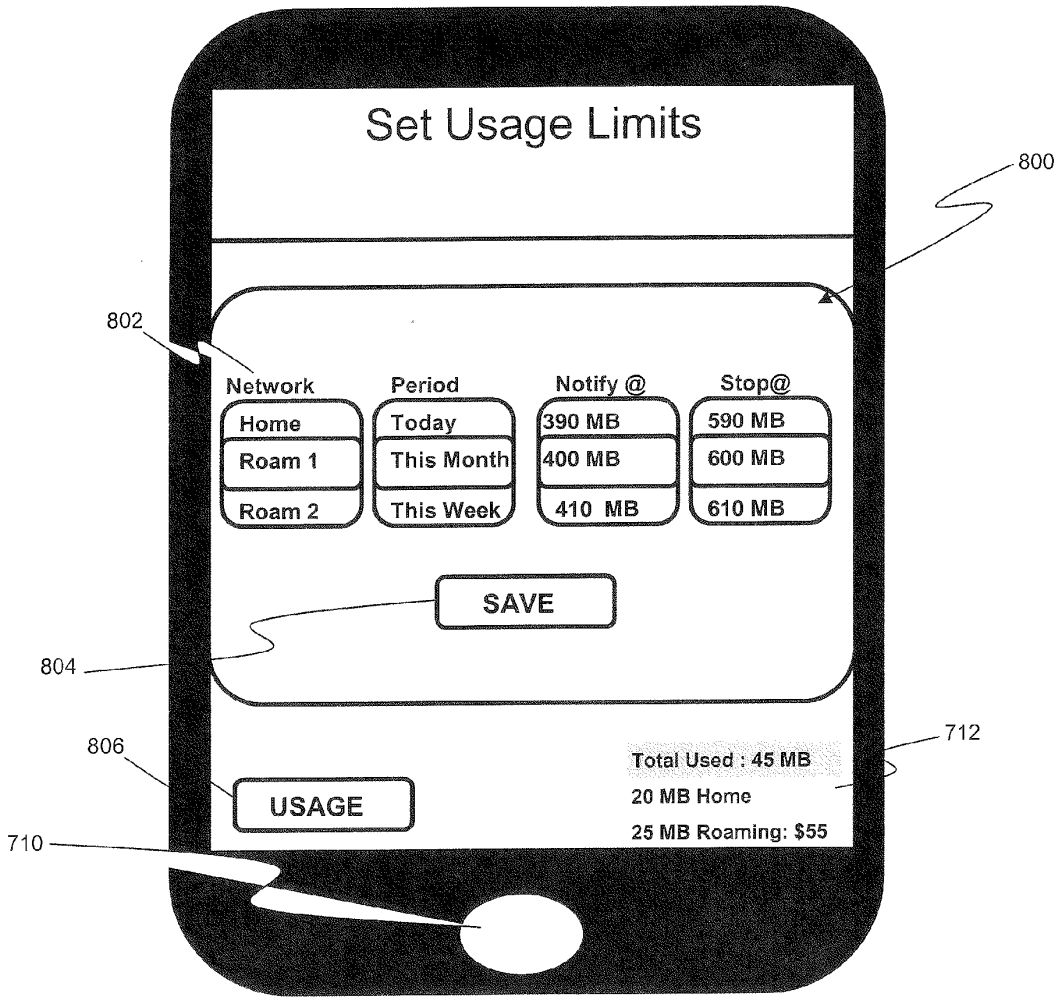


FIG. 8

Defining Tariff

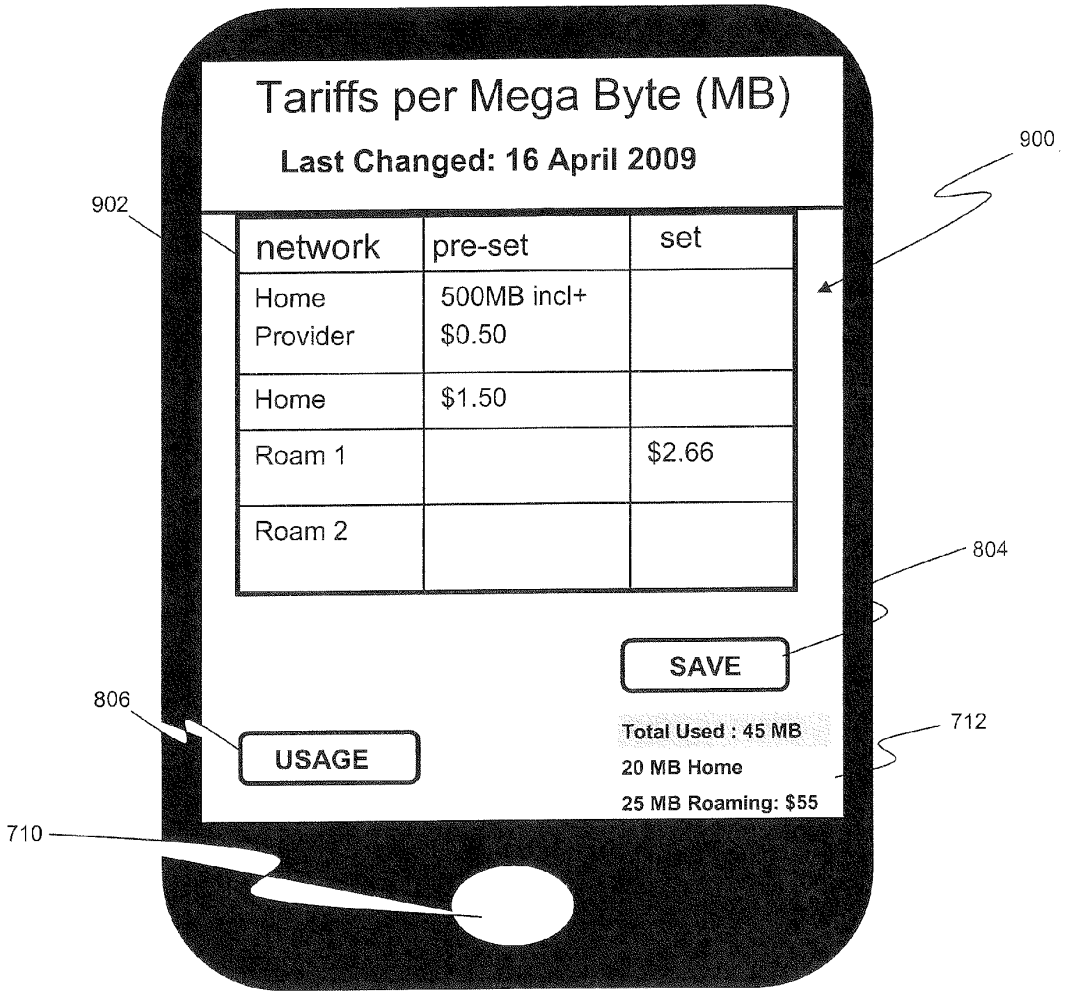


FIG. 9

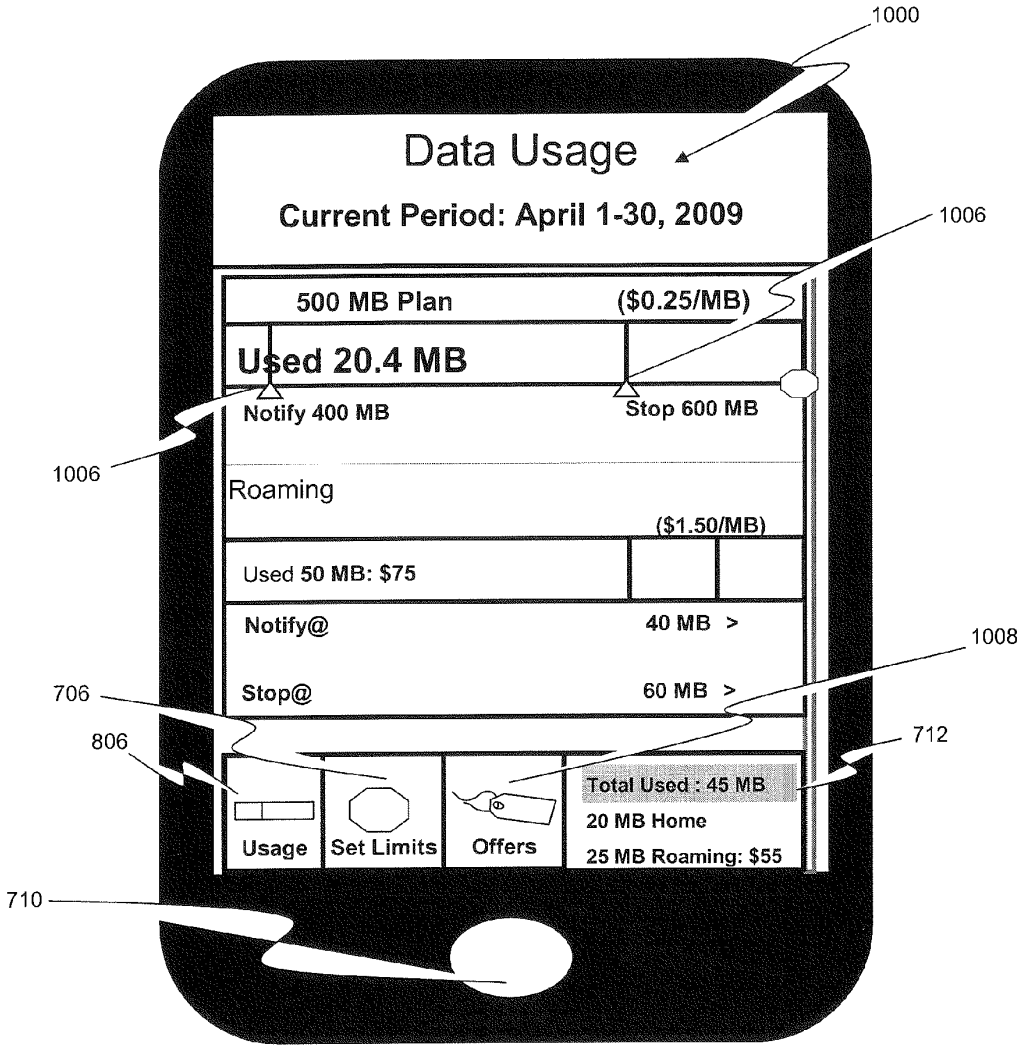

1000
Data Usage
Current Period: April 1-30, 2009
1006
500 MB Plan
($0.25/MB)
Used 20.4 MB
Notify 400 MB
Stop 600 MB
1006
Roaming
($1.50/MB)
Used 50 MB: $75
Notify@
40 MB >
1008
706
Stop@
60 MB >
806
712
Total Used : 45 MB
20 MB Home
25 MB Roaming: $55
Usage
Set Limits
Offers
710

FIG. 10

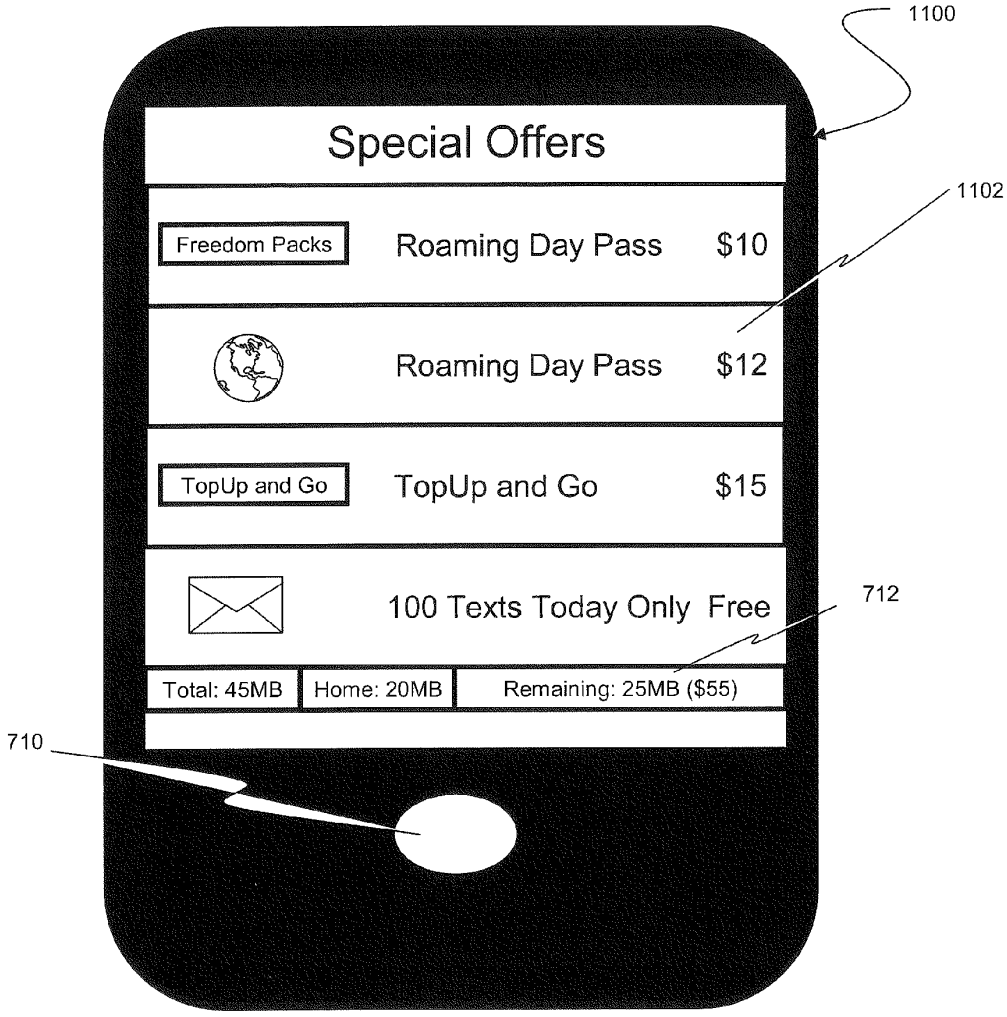

1100
Special Offers
1102
Freedom Packs
Roaming Day Pass
$10
Roaming Day Pass
$12
TopUp and Go
TopUp and Go
$15
100 Texts Today Only Free
712
Total: 45MB
Home: 20MB
Remaining: 25MB ($55)
710

FIG. 11

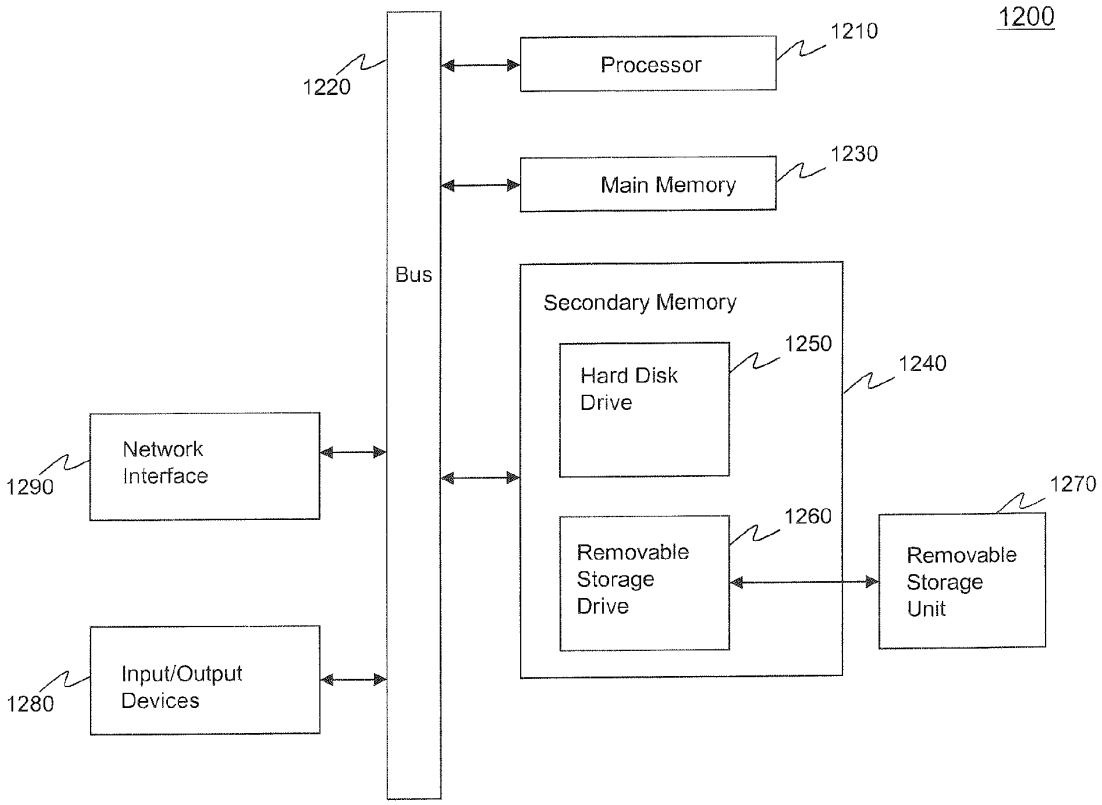

1200
1210
Processor
1220
1230
Main Memory
Bus
Secondary Memory
1250
Hard Disk Drive
1240
1290
Network Interface
1270
1260
Removable Storage Drive
Removable Storage Unit
1280
Input/Output Devices

FIG. 12

Electronic Patent Application Fee Transmittal

Application Number:	15287603
Filing Date:	06-Oct-2016
Title of Invention:	Enterprise Access Control and Accounting Allocation for Access Networks
First Named Inventor/Applicant Name:	Gregory G. Raleigh
Filer:	James E. Harris/Ann Taylor
Attorney Docket Number:	RALEP037D1C1

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($)
Extension - 3 months with $0 paid	2253	1	700	700
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	2806	1	120	120
		Total in USD ($)		**820**

Electronic Acknowledgement Receipt	
EFS ID:	32696781
Application Number:	15287603
International Application Number:	
Confirmation Number:	1013
Title of Invention:	Enterprise Access Control and Accounting Allocation for Access Networks
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:	RALEP037D1C1
Receipt Date:	22-MAY-2018
Filing Date:	06-OCT-2016
Time Stamp:	18:48:24
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$820
RAM confirmation Number	052318INTEFSW00005067505876
Deposit Account	505876
Authorized User	Ann Taylor
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.17 (Patent application and reexamination processing fees) 37 CFR 1.19 (Document supply fees)	

37 CFR 1.20 (Post Issuance fees)

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	Extension of Time	P037D1C1_Ext.pdf	164783 9efd16a47fbd5b51d8e7f8c5cc0c08e16146a345	no	2
Warnings:					
Information:					
2		P037D1C1_OAR.pdf	128227 25206d82bf36ee0d64a50af32f8bf3f9e6fc83d9	yes	8

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Applicant Arguments/Remarks Made in an Amendment	3	8
	Claims	2	2
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1

Warnings:					
Information:					
3	Information Disclosure Statement (IDS) Form (SB08)	P037D1C1_IDS.pdf	1055197 6a21f4d67966606d91cc7490915767f51618c79f	no	10
Warnings:					
Information:					
4	Foreign Reference	2095.pdf	9614977 9f371bf4ea0c289ac564aeba3ae2f306a3292b14	no	54
Warnings:					
Information:					
5	Foreign Reference	2096.pdf	4907249 5333d14d9890f1f3087752c23cd0692d086834f1	no	30

Warnings:					
Information:					
6	Foreign Reference	2097.pdf	5055092 48ff78fc65477c69338f1ae4f44454d2354083d9	no	29
Warnings:					
Information:					
7	Foreign Reference	2098.pdf	13411096 d640be147b894d8c3f2ad40fd7969e670da1b102	no	72
Warnings:					
Information:					
8	Foreign Reference	2099.pdf	4611633 bf9b948271be5b11856ba065b36bab8ca2c283b0	no	47
Warnings:					
Information:					
9	Non Patent Literature	3070.pdf	800138 a01751f11a1220082d7b94238b19e29ecf57278e	no	37
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Information:					
10	Fee Worksheet (SB06)	fee-info.pdf	32561 1c0af3c6e88a6a0f99ce4eb3281a18150e0e8be8	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	39780953		

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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.

PTO/AIA/22 (03-13)
Approved for use through 7/31/2016. 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 displays a valid OMB control number.

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)	Docket Number (Optional) RALEP037D1C1
Application Number 15/287,603	Filed October 6, 2016
For Enterprise Access Control and Accounting Allocation for Access Networks	
Art Unit 3687	Examiner Rudy, Andrew J.

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above-identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

		Fee	Small Entity Fee	Micro Entity Fee	
☐	One month (37 CFR 1.17(a)(1))	$200	$100	$50	$
☐	Two months (37 CFR 1.17(a)(2))	$600	$300	$150	$
☑	Three months (37 CFR 1.17(a)(3))	$1,400	$700	$350	$ 700
☐	Four months (37 CFR 1.17(a)(4))	$2,200	$1,100	$550	$
☐	Five months (37 CFR 1.17(a)(5))	$3,000	$1,500	$750	$

☑ Applicant asserts small entity status. See 37 CFR 1.27.

☐ Applicant certifies micro entity status. See 37 CFR 1.29.
Form PTO/SB/15A or B or equivalent must either be enclosed or have been submitted previously.

☐ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☑ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 505876.

☑ Payment made via EFS-Web.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the

☐ applicant.

☑ attorney or agent of record. Registration number 40013.

☐ attorney or agent acting under 37 CFR 1.34. Registration number _____.

/James E. Harris/ — Signature

May 22, 2018 — Date

James E. Harris — Typed or printed name

903-201-6212 — Telephone Number

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.

☐ * Total of _____ forms are submitted.

This collection of information is required by 37 CFR 1.136(a). 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 6 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: Mail Stop PCT, 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 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.

REMARKS

Claims 2-3 are pending and stand rejected by the Office Action dated November 22, 2017. Claim 1 was previously canceled. In view of the remarks below, Applicant respectfully requests reconsideration.

Claim Rejections – 35 U.S.C. § 101

The Office Action rejected claims 2 and 3 under 35 U.S.C. § 101, alleging that the claimed invention is directed to a judicial exception and considered abstract. Applicant respectfully traverses the rejection.

The Abstract Idea Analysis section of the rejection identified "abstract concepts that are considered to be at least a part of the abstract idea," including "storing secure policy information," "allowing a first set of multiple application instances to run in a first secure application environment and allowing a second set of device applications to run outside of the first secure application environment," and "initiate a first secure tunnel." "Here, the examiner has found that the claims are not directed to 'an improvement in computer technology,' such as found by the CAFC in *Enfish*, but to the abstract idea itself."

The rejection identified several cases and alleged that the ineligible claimed concepts found in those cases were "similar to the concepts claimed." These cases, however, fall into categories such as fundamental economic practices, collecting, analyzing, and displaying information, methods of organizing human activity, and performing mental processes. Applicant asserts that claim 2 is not conceptually similar to any of these cases, but is similar to *Enfish*. Nothing in claim 2 involves any economic practice. Although the apps benefitting from the claimed method may collect, analyze, or display information, the method itself is agnostic as to what specifically the apps do—the method assures the security of certain of the apps. The method recited is not something humans do or even can do. Finally, computer execution and communication security is not a mental process, but a problem unique to computing.

Claim 2 improves the wireless end-user device itself in adding an ability for the device to support multiple applications that interact securely with a secure network, while both

guaranteeing communications from those apps only go to the secure network and also allowing insecure applications to operate. Generally, wireless end-user devices with multiple applications have several basic insecurities, if one desires to have some applications, data, and communications secure, and not all. The claimed method improves on such a device by use of secure policy information indicative of *both* an application-specific execution environment policy and a configurable communication security policy. The execution environment policy partitions the execution of apps that are in a secure group from the execution of apps that are not. The configurable communication security policy ensures that network communications to and from the applications executing in the secure applications environment are only exchanged over a known secure tunnel with a known network endpoint. Per the claim, stored secure policy information, multiple enforced application environments, and an enforced secure tunnel all must interact to effectively operate the method—Applicant does not agree that any of these elements can be part of an abstract idea. A result of such a method is that whatever zone of security exists at the network endpoint can be extended across the wireless network and to the secure applications environment. Thus, like *Enfish*, "we are not faced with a situation where general-purpose computer components are added post-hoc to a fundamental economic practice or mathematical equation." *Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327, 1339 (Fed. Cir. 2016). Accordingly, Applicant does not agree that the present claims fall within a judicially-recognized class of abstract concepts, and Applicant asserts that the claims improve a wireless end-user device itself, which has been found to encompass patentable subject matter.

Even if one were to find an abstract idea related to claim 2 (such as "allow a mobile device to execute both secure and unsecure applications"), claim 2 adds more than well-understood, routine, and conventional activity to such an idea. On April 19, 2018, Deputy Commissioner Robert Bahr issued a Memorandum to the Patent Examining Corps, titled "*Changes in Examination Procedure Pertaining to Subject Matter Eligibility, Recent Subject Matter Eligibility Decision (Berkheimer v HP, Inc.)*" (the "Berkheimer Memo").

The Berkheimer memo "clarifies that [a conclusion that an element (or combination of elements) represents well-understood, routine, conventional activity] must be based upon a factual determination that is [one of the following:]"

1. A citation to the specification or a statement made by the applicant during prosecution demonstrating the well-understood, routine, conventional nature of the added element(s).

2. A citation to a court decision discussed in MPEP § 2106.05(d)(II) as noting the well-understood, routing, conventional nature of the additional element(s).

3. A citation to "a book, manual, review article, or other source that describes the state of the art and discussed what is well-known and in common use in the relevant industry."

4. An Examiner's statement that they are taking official notice, in certain strict circumstances.

Although the Berkheimer Memo had not yet been promulgated on the date that the Office Action was mailed, the Memo states what is now the standard. Applicant submits that this standard is not met by the § 101 "Significantly More Analysis" in the Office Action. Further, Applicant is unaware of information of the types specified in the Berkheimer Memo that would show, for mobile devices, a combination of a secure execution environment, at least one other execution environment, a secure tunnel, and an enforcement mechanism based on stored secure policy information that determines which applications must run in which environments and locks the applications executing in the secure environment to only communicate over the secure tunnel.

Claim Rejections – 35 U.S.C. § 112

The Office Action rejected claims 2 and 3 under 35 U.S.C. § 112, second paragraph, alleging that the claims are indefinite for failing to particularly point out and distinctly claim the subject matter which the applicant regards as the invention. Applicant respectfully traverses the rejection.

The claim 2, lines 2-3 claim limitation "storing secure policy information indicative of an application-specific execution environment policy and a configurable communication security policy" was addressed in the rejection, which asserted that "support for such does not appear to

be found in the descriptive portion of the specification, nor the drawings." Original specification paragraph [0089], for example, describes exemplary provisioning of a device 110 with policies for setting secure applications and communications, configurable from an enterprise service design center 194. Original specification paragraph [00146], for example, further discusses that "service design center 190 or enterprise service design center 194 is configured to provision a device 110 software application or agent (e.g., service processor framework program 139 or service processor kernel program 138, secure network interface 128, secure hardware partition manager 108) with application access policy rules to identify network access activity associated with individual applications and specify which applications are to be routed or directed to the enterprise side of the VPN tunnel and which applications are to be routed or directed to the consumer side of the VPN tunnel. Applicant submits that the first clause of claim 2 is fully supported by the figures and descriptive portions of the specification.

The claim 2, lines 4-8 claim limitation "based on the secure stored information indicative of an application-specific execution environment policy, allowing a first set of multiple device application instances to run only in a first secure application environment on the wireless end-user device, and allowing a second set of device application instances to run only outside of the first secure application environment" was also addressed in the rejection, which asserted that "support for such does not appear to be found in the descriptive portion of the specification, nor the drawings." Figures 8-12, 14-15, 17-22, and 24-25 each depict such an environment partitioning. Paragraph [00137], for example, describes some embodiments for associating application identification with access policies. Applicant submits that the second clause of claim 2 is fully supported by the figures and descriptive portions of the specification.

The claim 2, lines 9-12 claim limitation "based on the secure stored information indicative of a configurable communication security policy, initiate a first secure tunnel to a network tunnel endpoint, and direct all network data communications to and from device application instances executing in the first secure application environment through the first secure tunnel" was also addressed in the rejection, which asserted that "support for such does not appear to be found in the descriptive portion of the specification, nor the drawings." Original specification paragraph [00146], for example, discusses a split-tunnel VPN device client function, "wherein an enterprise side of the split tunnel is configured to securely communicate

between one or more enterprise applications … and a counterpart VPN function that secures access to the enterprise network 170 …, and a consumer side of the split tunnel is configured to communicate without encryption for access network services provided to consumer applications on the device." The paragraph continues to detail different application or agent approaches to direct the traffic appropriately to the enterprise and consumer sides of the split tunnel, and to detail the provisioning of the application or agent with application access policy rules to specify which applications are routed to which side of the tunnel. Several figures, for instance Figure 9, show the secure network interface for the enterprise applications on the device, and not for the user services applications, both of which can access the network stack and access modem of the device. Applicant submits that the third clause of claim 2 is fully supported by the figures and descriptive portions of the specification.

The rejection further states that "claim 3 contain[s] similar issues." Claim 3 adds a limitation of "directing all network data communications to and from device application instances executing outside of the first secure application environment through a network path outside of the first secure tunnel." Original specification paragraph [00146], for example, discusses a split-tunnel VPN device client function, "wherein an enterprise side of the split tunnel is configured to securely communicate between one or more enterprise applications … and a counterpart VPN function that secures access to the enterprise network 170 …, and a consumer side of the split tunnel is configured to communicate without encryption for access network services provided to consumer applications on the device." The paragraph continues to detail different application or agent approaches to direct the traffic appropriately to the enterprise and consumer sides of the split tunnel, and to detail the provisioning of the application or agent with application access policy rules to specify which applications are routed to which side of the tunnel. Several figures, for instance Figure 9, show the secure network interface for the enterprise applications on the device, and not for the user services applications, both of which can access the network stack and access modem of the device. Applicant submits that claim 3 is fully supported by the figures and descriptive portions of the specification.

CONCLUSION

Applicant respectfully requests entry of the remarks 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: May 22, 2018 By: /James E. Harris/

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Date: May 22, 2018 By: /Ann Taylor/
Ann Taylor

LISTING OF THE CLAIMS

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

1. (Canceled).

2. (Previously Presented) A method of operating a wireless end-user device, the method comprising:

storing secure policy information indicative of an application-specific execution environment policy and a configurable communication security policy;

based on the secure stored information indicative of an application-specific execution environment policy, allowing a first set of multiple device application instances to run only in a first secure application environment on the wireless end-user device, and allowing a second set of device application instances to run only outside of the first secure application environment; and

based on the secure stored information indicative of a configurable communication security policy, initiate a first secure tunnel to a network tunnel endpoint, and direct all network data communications to and from device application instances executing in the first secure application environment through the first secure tunnel.

3. (Previously Presented) The method of claim 2, wherein the configurable communication security policy defines a first configuration, which indicates that application instances in the second set of device application instances are not allowed to use the first secure tunnel, the method further comprising, based on the secure stored information indicative of a configurable communication security policy indicating the first configuration, directing all network data communications to and from device application instances executing outside of the first secure application environment through a network path outside of the first secure tunnel.

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 15/287,603	Filing Date 10/06/2016	☐ To be Mailed

ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) 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 05/22/2018	(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))	* 2	Minus	** 20	= 0	X $50 =	0
Independent (37 CFR 1.16(h))	* 1	Minus	***3	= 0	X $230 =	0
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	0

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 $ =	
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☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
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(Not for submission under 37 CFR 1.99)

Application Number	15287603
Filing Date	2016-10-06
First Named Inventor	Gregory G. Raleigh
Art Unit	3687
Examiner Name	Rudy, Andrew J.
Attorney Docket Number	RALEP037D1C1

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	6466984	B1	2002-10-15	Naveh et al.	
	2	6522629	B1	2003-02-18	Anderson, Sr., Ronald D.	
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	1	0208863	WO		2002-01-31	Telemac Corp.		

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Application Number	15287603
Filing Date	2016-10-06
First Named Inventor	Raleigh
Art Unit	2642
Examiner Name	not yet assigned
Attorney Docket Number	RALEP037D1C1

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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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	First Named Inventor	Raleigh
	Art Unit	2642
	Examiner Name	not yet assigned
	Attorney Docket Number	RALEP037D1C1

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	First Named Inventor	Raleigh
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	Examiner Name	not yet assigned
	Attorney Docket Number	RALEP037D1C1

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	First Named Inventor	Raleigh
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	Attorney Docket Number	RALEP037D1C1

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	Art Unit	2642
	Examiner Name	not yet assigned
	Attorney Docket Number	RALEP037D1C1

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	First Named Inventor	Raleigh
	Art Unit	2642
	Examiner Name	not yet assigned
	Attorney Docket Number	RALEP037D1C1

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	55	7881697		2011-02-01	Baker, Matthew Donald et al.	
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	57	7945238		2011-05-17	Baker, Matthew Donald et al.	
	58	8078140		2011-12-13	Baker, Matthew Donald et al.	
	59	8285249		2012-10-09	Baker, Matthew Donald et al.	
	60	7493659		2009-02-17	Wu, Handong et al.	
	61	7801985		2010-09-21	Pitkow, Jim et al.	
	62	8242959		2012-08-14	Mia, Rashidus S. et al.	
	63	8326319		2012-12-04	Davis, Richard W.	

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	64	8019886		2011-09-13	Harrang, Jeffrey Paul et al.	
	65	7102620		2006-09-05	Harries, Andrew Stanely Guy et al.	
	66	7139569		2006-11-21	Kato, Akira	
	67	7529204		2009-05-05	Bourlas, Yair et al.	
	68	7720960		2010-05-18	Pruss, Richard Manfred et al.	
	69	7969950		2011-06-28	Iyer, Pradeep J. et al.	
	70	8032409		2011-10-04	Mikurak, Michael G.	
	71	8045973		2011-10-25	Chambers, Michael D.	
	72	8116781		2012-02-14	Chen, Xixian et al.	
	73	8126396		2012-02-28	Bennett, James D.	
	74	8351898		2013-01-08	Raleigh, Gregory G.	

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	75	5630159		1997-05-13	Zancho, William F.	
	76	5633484		1997-05-27	Zancho, William F. et al.	
	77	5814798		1998-09-29	Zancho, William F.	
	78	7039403		2006-05-02	Wong, Gregory A.	
	79	7583964		2009-09-01	Wong, Gregory A.	
	80	7593730		2009-09-22	Khandelwal, Deepak et al.	
	81	7948953		2011-05-24	Melkote, Keerti G. et al.	
	82	8200509		2012-06-12	Kenedy, Andrew Alexander et al.	
	83	8270972		2012-09-18	Otting, Marcia J. et al.	
	84	7929959		2011-04-19	DeAtley, Dallas et al.	
	85	7478420		2009-01-13	Wright, Michael et al.	

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	86	7502672		2009-03-10	Kolls, H. Brock	
	87	7756757		2010-07-13	Oakes III, Charles Lee	
	88	7930446		2011-04-19	Kesselman, Alex et al.	
	89	8078163		2011-12-13	Lemond, Eric et al.	
	90	8068829		2011-11-29	Lemond, Eric et al.	
	91	8086497		2011-12-27	Oakes III, Charles Lee	
	92	8166040		2012-04-24	Brindisi, Richard G. et al.	
	93	6934249		2005-08-23	Bertin, Olivier et al.	
	94	7774456		2010-08-10	Lownsbrough, Derek Leigh et al.	
	95	8447607		2013-05-21	Weider, Chris et al.	
	96	8504729		2013-08-06	Pezzutti, David A.	

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	97	8495227		2013-07-23	Kaminsky, David L. et al.	
	98	8472371		2013-06-25	Bari, Farooq et al.	
	99	8134954		2012-03-13	Godfrey, James A. et al.	
	100	7535880		2009-05-19	Hinman, Brian L. et al.	
	101	7499438		2009-03-03	Hinman, Brian L. et al.	
	102	7496652		2009-02-24	Pezzutti, David	
	103	6957067		2005-10-18	Iyer, Pradeep J. et al.	
	104	6654814		2003-11-25	Britton, Kathryn H. et al.	
	105	8374592		2013-02-12	Proctor, Jr. James A. et al.	
	106	8325638		2012-12-04	Jin, Haipeng et al.	
	107	8116749		2012-02-14	Proctor Jr., James Arthur et al.	

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	108	8090616		2012-01-03	Proctor Jr., James Arthur et al.	
	109	8090359		2012-01-03	Proctor Jr., James Arthur et al.	
	110	8150431		2012-04-03	Wolovitz, Lionel et al.	
	111	8483135		2013-07-09	Cai, Yigang et al.	
	112	6104700		2000-08-15	Haddock, Stephen R. et al.	
	113	8185127		2012-05-22	Cai, Zheng et al.	
	114	8521110		2013-08-27	Rofougaran, Ahmadreza	
	115	7310424		2007-12-18	Gehring, Stephan Walter et al.	
	116	7356011		2008-04-08	Waters, Christopher J.F. et al.	
	117	7546460		2009-06-09	Maes, Stephane H.	
	118	7921463		2011-04-05	Sood, Kapil et al.	

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	119	7940751		2011-05-10	Hansen, Christopher J.	
	120	8122249		2012-02-21	Falk, Rainer et al.	
	121	8495360		2013-07-23	Falk, Rainer et al.	
	122	8520589		2013-08-27	Bhatt, Yogesh et al.	
	123	6542992		2003-04-01	Peirce, Kenneth L. et al.	
	124	8379847		2013-02-19	Bell, Robert H. et al.	
	125	8185093		2012-05-22	Jheng, Yu-Syuan et al.	
	126	8296404		2012-10-23	McDysan, Dave et al.	
	127	8195163		2012-06-05	Gisby, Doug et al.	
	128	8437734		2013-05-07	Ray, Amar N. et al.	
	129	8280351		2012-10-02	Ahmed, Shahid et al.	

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	130	7460837		2008-12-02	Diener, Neil R.	
	131	7653394		2010-01-26	McMillin, Brian K.	
	132	8130793		2012-03-06	Edwards, Stephen K. et al.	
	133	8509082		2013-08-13	Heinz, John M. et al.	
	134	8526329		2013-09-03	Mahany, Ronald L. et al.	
	135	5983270		1999-11-09	Abraham, Dalen M. et al.	
	136	6598034		2003-07-22	Kloth, Axel K.	
	137	7032072		2006-04-18	Quinn, Michael J. et al.	
	138	7580356		2009-08-25	Mishra, Sanjeev K. et al.	
	139	7742406		2010-06-22	Muppala, Suresh	
	140	7953877		2011-05-31	Vemula, Narendra et al.	

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	141	7957381		2011-06-07	Clermidy, Fabien et al.	
	142	8031601		2011-10-04	Feroz, Azeem et al.	
	143	8255534		2012-08-28	Assadzadeh, Alireza	
	144	8489720		2013-07-16	Morford, Michael Robert et al.	
	145	7774323		2010-08-10	Helfman, Nadav	
	146	7043268		2006-05-09	Yukie, Satoru et al.	
	147	8391262		2013-03-05	Maki, Lasse et al.	
	148	7113780		2006-09-26	McKenna, Daniel Bernard et al.	
	149	8166554		2012-04-24	John, Pramod	
	150	7697540		2010-04-13	Haddad, Reda et al.	
	151	6748195		2004-06-08	Phillips, W. Garland	

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	152	8583499		2013-11-12	De Judicibus, Dario et al.	
	153	8352360		2013-01-08	De Judicibus, Dario et al.	
	154	8463232		2013-06-11	Tuli, Amol et al.	
	155	7958029		2011-06-07	Bobich, Thomas et al.	
	156	7540408		2009-06-02	Levine, Judah Joseph et al.	
	157	7826427		2010-11-02	Sood, Kapil et al.	
	158	8185088		2012-05-22	Klein, Robert S. et al.	
	159	8548428		2013-10-01	Raleigh, Gregory G.	
	160	8483694		2013-07-09	Lewis, Allan D. et al.	
	161	8351592		2013-01-08	Freeny, Jr., Charles C. et al.	
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	174	7574509		2009-08-11	Nixon, Mark J. et al.	
	175	7826607		2010-11-02	de Carvalho Resende, Mauricio Guilherme et al.	
	176	7940685		2011-05-10	Breslau, Lee Michel et al.	
	177	8196199		2012-06-05	Hrastar, Scott E. et al.	
	178	8204505		2012-06-19	Jin, Haipeng et al.	
	179	8228818		2012-07-24	Chase, Christopher J. et al.	
	180	8320244		2012-11-27	Muqattash, Alaa et al.	
	181	8411691		2013-04-02	Aggarwal, Rahul	
	182	8461958		2013-06-11	Saenz, Jorge E. et al.	
	183	8484327		2013-07-09	Werner, Eran et al.	
	184	8522039		2013-08-27	Hyndman, Arn et al.	

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	163	7610396		2009-10-27	Taglienti, Claudio et al.	
	164	7984511		2011-07-19	Kocher, Paul Carl et al.	
	165	7987510		2011-07-26	Kocher, Paul C. et al.	
	166	8571993		2013-10-29	Kocher, Paul C. et al.	
	167	8543265		2013-09-24	Ekhaguere, David E. et al.	
	168	8385975		2013-02-26	Forutanpour, Babak	
	169	6873988		2005-03-29	Hermann, Conrad K. et al.	
	170	7013469		2006-03-14	Smith, Adam W. et al.	
	171	7203169		2007-04-10	Okholm, Jon Eric et al.	
	172	7286834		2007-10-23	Walter, Edward	
	173	7555757		2009-06-30	Smith, Adam W. et al.	

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	197	8229394		2012-07-24	Karlberg, Johan	
	198	8495700		2013-07-23	Shahbazi, Majid	
	199	8548427		2013-10-01	Chow, Paulo S.T. et al.	
	200	8572117		2013-10-29	Rappaport, Theodore S.	
	201	8589955		2013-11-19	Roundtree, Brian et al.	
	202	8660853		2014-02-25	Robb, Terence A. et al.	
	203	8601125		2013-12-03	Huang, Shibi et al	
	204	8046449		2011-10-25	Yoshiuchi, Hideya	
	205	8635164		2014-01-21	Rosenhaft, Matthew et al.	
	206	8566236		2013-10-22	Busch, James David	

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	185	8544105		2013-09-24	Mclean, Ivan H. et al.	
	186	8571474		2013-10-29	Chavez, Timothy R. et al.	
	187	8194572		2012-06-05	Horvath, Robert et al.	
	188	8516552		2013-08-20	Raleigh, Gregory G.	
	189	8441955		2013-05-14	Wilkinson, Robert Todd et al.	
	190	5774532		1998-06-30	Gottlieb, Louis G. et al.	
	191	8095124		2012-01-10	Balia, Hinal K.	
	192	7797060		2010-09-14	Grgic, Richard J. et al.	
	193	7930327		2011-04-19	Craft, David Jones et al.	
	194	8264965		2012-09-11	Dolganow, Andrew et a.	
	195	8626115		2014-01-07	Raleigh, Gregory G. et al.	

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	219	8391834		2013-03-05	Raleigh, Gregory G.	
	220	6185576		2001-02-06	McIntosh, Lowrie	
	221	8175574		2012-05-08	Panda, Biswaranjan et al.	
	222	8375128		2013-02-12	Tofighbakhsh, Mostafa et al.	
	223	8527410		2013-09-03	Markki, Outi et al.	
	224	7320029		2008-01-15	Rinne, Janne Petri et al.	
	225	8275415		2012-09-25	Huslak, Nicholas S.	
	226	8539561		2013-09-17	Gupta, Akhilesh et al.	
	227	8554876		2013-10-08	Winsor, Gerald W.	
	228	8191124		2012-05-29	Wynn, Simon et al.	

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	208	8442015		2013-05-14	Behzad, Arya et al	
	209	7853255		2010-12-14	Karaoguz, Jeyhan et al	
	210	7720464		2010-05-18	Batta, Puneet	
	211	8300575		2012-10-30	Willars, Per	
	212	8666395		2014-03-04	Silver, Andrew	
	213	8315593		2012-11-20	Gallant, John K. et al.	
	214	8180881		2012-05-15	Seo, Kyoung-Il et al.	
	215	7539132		2009-05-26	Werner, Carl E. et al.	
	216	8589541		2013-11-19	Raleigh, Gregory G. et al.	
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	240	8370483		2013-02-05	Choong et al.	
	241	8670334		2014-03-11	Keohane et al.	
	242	8693323		2014-04-08	McDysan, David E.	
	243	7409447		2008-08-05	Assadzadeh, Alireza	
	244	8725899		2014-05-13	Short, Joel et al.	
	245	8676925		2014-03-18	Liu, Jiawei et al.	
	246	8645518		2014-02-04	David, Scott L.	
	247	7756056		2010-07-13	Kim et al	
	248	8131281		2012-03-06	Hildner et al.	
	249	8160598		2012-04-17	Savoor, Raghvendra	
	250	8375136		2013-02-12	Roman et al.	

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	230	8605691		2013-12-10	Soomro, Amjad et al.	
	231	8655357		2014-02-18	Gazzard, Daryl Robert et al.	
	232	8706863		2014-04-22	Fadell, Anthony	
	233	6640334		2003-10-28	Rasmussen, John H.	
	234	7668612		2010-02-23	Okkonen, Harri	
	235	5325532		1994-06-28	Crosswy, Wm. Caldwell et al.	
	236	7614051		2009-11-03	Glaum, Jeffrey D. et al.	
	237	5131020		1992-07-14	Liebesny, John P. et al.	
	238	8223741		2012-07-17	Bartlett, Roger Danforth et al.	
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	263	8355696		2013-01-15	Olding et al.	
	264	8488597		2013-07-16	Nie et al.	
	265	6438575		2002-08-20	Khan et al.	
	266	7222304		2007-05-22	Beaton et al.	
	267	7561899		2009-07-14	Lee, Changseok	
	268	8200200		2012-06-12	Belser et al.	
	269	8229914		2012-07-24	Ramer et al.	
	270	8522249		2013-08-27	Beaule, Stephane	
	271	8701015		2014-04-15	Bonnat, Pierre	
	272	6697821		2004-02-24	Ziff et al.	

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	252	8694772		2014-04-08	Kao et al.	
	253	8719423		2014-05-06	Wyld, Jeremy	
	254	8347104		2013-01-01	Pathiyal, Krishna K.	
	255	7149229		2006-12-12	Leung, Kent K.	
	256	7242668		2007-07-10	Kan, Chao et al.	
	257	8095640		2012-01-10	Guingo, Pierrick et al.	
	258	8705361		2014-04-22	Venkataraman, Ramesh et al.	
	259	8780857		2014-07-15	Balasubramanian, Srinivasan et al.	
	260	8811991		2014-08-19	Jain, Nikhil et al.	
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	285	8880047		2014-11-04	Konicek et al.	
	286	8739035		2014-05-27	Trethewey, Jim	
	287	8571598		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	
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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.J.R./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15287603
	Filing Date	2016-10-06
	First Named Inventor	Raleigh
	Art Unit	2642
	Examiner Name	not yet assigned
	Attorney Docket Number	RALEP037D1C1

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	274	6982733		2006-01-03	McNally et al.	
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	278	8249601		2012-08-21	Emberson et al.	
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	282	9014973		2015-04-21	Ruckart, John	
	283	8977284		2015-03-10	Reed, Mark J.	

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	Examiner Name	not yet assigned
	Attorney Docket Number	RALEP037D1C1

	1	1538730A	CN		2004-10-20	Zhongxing Communication Co., Ltd.		
	2	101115248A	CN		2008-01-30	Lenovo Beijing Ltd.		
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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
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	Attorney Docket Number	RALEP037D1C1

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	Art Unit	2642
	Examiner Name	not yet assigned
	Attorney Docket Number	RALEP037D1C1

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	13	101183958A	CN		2008-05-21	Huawei Tech. Co. Ltd.		
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	15	1867024A	CN		2006-11-22	Huawei Technologies Co., Ltd.		
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/ANDREW JOSEPH RUDY/ 10/16/2017

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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	VerizonWireless.com news, "Verizon Wireless Adds to Portfolio of Cosumer-Friendly Tools With Introduction of Usage Controls, Usage Controls and Chaperone 2.0 Offer Parents Full Family Security Solution," August 18, 2008	
	2	"The Construction of Intelligent Residential District in Use of Cable Television Network," Shandong Science, Vol. 13, No. 2, June 2000	
	3	"Communication Concepts for Mobile Agent Systems," by Joachim Baumann et al.; Inst. Of Parallel and Distributed High-Performance Systems, Univ. of Stuttgart, Germany, pp. 123-135, 1997	
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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (03-15)
Approved for use through 07/31/2016. OMB 0651-0031
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(Not for submission under 37 CFR 1.99)

Application Number	15287603
Filing Date	2016-10-06
First Named Inventor	Gregory G. Raleigh
Art Unit	2447
Examiner Name	not yet assigned
Attorney Docket Number	RALEP037D1C1

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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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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	20060020787	A1	2006-01-26	Choyi et al.	
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	Examiner Name	not yet assigned
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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	2005053335	WO	A1	2005-06-09	Nokia Corp.		

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Examiner Signature	/ANDREW JOSEPH RUDY/	Date Considered	10/16/2017

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/287,603	10/06/2016	Gregory G. Raleigh	RALEP037D1C1	1013

106963 7590 11/22/2017

Headwater Research LLC
1011 Pruitt Place
Tyler, TX 75703

EXAMINER	
RUDY, ANDREW J	

ART UNIT	PAPER NUMBER
3687	

NOTIFICATION DATE	DELIVERY MODE
11/22/2017	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

Office Action Summary	Application No. 15/287,603	Applicant(s) Raleigh et al.	
	Examiner ANDREW JOSEPH RUDY	Art Unit 3687	AIA 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 March 21, 2017 .

☐ 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) 2-3 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) 2-3 is/are rejected.

8)☐ Claim(s) _____ 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

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

2. Claims 2 and 3 are pending. Applicant cancelled claim 1.

Claim Rejections - 35 USC § 101

3. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

4. Claims 2 and 3 are rejected under 35 U.S.C. § 101 because the claimed invention is directed to a judicial exception (i.e., an abstract idea) without "significantly more." Claims 2 and 3 are directed to a method for operating a wireless device, which is considered an abstract idea. The claims do not include additional elements that are sufficient to amount to significantly more than the judicial exception because the generically recited computer elements (e.g. a processor, a communication device) do not add a meaningful limitation to the abstract idea and the function(s) performed by such generic computer elements would be routine, conventional, and well-understood to one of ordinary skill in the computer arts.

Abstract Idea Analysis

Exemplary claim 2 recites the following abstract concepts that are considered to be at least a part of the abstract idea:

Limitation 1 – storing secure policy information;

Limitation 2 – allowing a first set of multiple application instances to run in a first secure application environment and allowing a second set of device applications to run only outside of the first secure application environment;

Limitation 3 – initiate a first secure tunnel.

In Enfish, the CAFC "clarified that a relevant inquiry at step one is 'to ask whether the claims are directed to an improvement to computer functionality versus being directed to an abstract idea.'" See Enfish, LLC v. Microsoft Corp., No 2015-2044 (Fed. Cir. May 12, 2016). Here, the examiner has found that the claims are not directed to "an improvement to computer technology," such as found by the CAFC in Enfish, but to the abstract idea itself. In determining whether the claims are directed to abstract idea, examiners have been instructed to refer to the body of case law precedent in order to better identify abstract ideas by way of comparison to concepts already found to be abstract. The examiner refers to the following cases (and their associated judicial descriptor(s)), each of which relate to concepts that are similar to the concepts claimed:

buySAFE (precedential—ineligible) – abstract idea found to be concepts relating to agreements between people or performance of financial transactions such as creating a contractual relationship, where this was found to be a fundamental economic practice and/or a certain method of organizing human activity ;

Intellectual Ventures v. Capitol One Bank (precedential—ineligible) – abstract idea found to be customizing information based on information known about the user, where this was found to be a certain method of organizing human activity;

Electric Power Group (precedential—ineligible) – abstract idea found to be collecting information, analyzing the information, and displaying certain results, where this was found to be a certain method of organizing human activity;

TLI Communications (precedential—ineligible) – abstract idea found to be concepts relating to classifying and storing digital images in an organized manner, where this was found to be a certain method of organizing human activity;

Dealertrack (precedential—ineligible) – abstract idea found to be concepts relating to processing loan information in automated credit application system, where this was found to be a certain method of organizing human activity;

Accenture (precedential—ineligible) – abstract idea found to be concepts relating to generating rule-based tasks for processing an insurance claim, where this was found to be a certain method of organizing human activity;

Myriad CAFC (precedential—ineligible/eligible) – abstract idea found to be concepts relating to processes of comparing data that can be performed mentally such as comparing information regarding a sample or test subject to a control or target data, where this was found to be an idea of itself ; and

Classen (precedential—ineligible/eligible) – abstract idea found to be concepts relating to collecting and comparing known information, where this was found to be an idea of itself.

As indicated above, the claims are directed to similar concepts. Therefore, the claims are found to be directed to abstract idea. According to the case law cited, the examiner finds the abstract idea to include at least the judicial descriptor(s) of: fundamental economic practice, certain methods of organizing human activity, an idea of 'itself'.

Significantly More Analysis

The next step is for the examiner to "search for inventive concept." In other words, does the claim include significantly more than the underlying abstract idea? For instance, this includes removing the abstract idea from the claim and determining what else is in the claim, such as computer elements

or improvements to "technology." As stated above, the examiner has found that the generically-recited computer elements (e.g., the elements that could potentially include "significantly more" than the underlying abstract idea) perform functions that would be routine, conventional, and well-understood to one of ordinary skill in the computer art. Therefore, the examiner has been unable to find inventive concept in these claims.

For this step, examiners have been instructed to rely on what the courts have recognized, or those in the art would recognize, as elements that are well-understood, routine, and conventional. The courts have, for instance, recognized the following computer functions to be well-understood, routine, and conventional functions when claimed in a merely generic manner:

- performing repetitive calculations,
- receiving, processing, and storing data,
- electronically scanning or extracting data from a physical document,
- electronic recordkeeping,
- automating mental tasks, and
- receiving or transmitting data over a network, e.g., using the Internet to gather data.

See July 2015 Update: Subject Matter Eligibility. The examiner refers to the following exemplary generically-recited computer elements and their associated functions, which are considered to be routine, conventional, and well-understood:

Generic Computer Element 1 – a wireless user device storing secure policy information.

In sum, the examiner finds that the claims "are directed to the use of conventional or generic technology in a nascent but well-known environment, without any claim that the invention reflects an inventive solution to any problem presented by combining the two." In re TLI Communications LLC, No.

2015-1372 (May 17, 2016). Accordingly, the examiner finds the claims to be directed to in-eligible subject matter. The examiner has reviewed each claim and claim limitations individually and in ordered combination.

It is noted the descriptive portion of the specification in juxtaposition with the drawing figures does not appear to provide any meaningful technical limitation that obviates the "Alice" analysis above.

Claim Rejections - 35 USC § 112

2. The following is a quotation of 35 U.S.C. 112(b):

> (b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

> The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:
> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 2 and 3 rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

Claim 2, lines 2-3, "storing secure policy . . . communication security policy" is not clear as to what is being claimed, as support for such does appear to be found in the descriptive portion of the specification, nor the drawings.

Claim 2, lines 4-8, "based on the secure . . . . first secure application environment" is not clear as to what is being claimed, as support for such does appear to be found in the descriptive portion of the specification, nor the drawings.

Claim 2, lines 9-12, "based on the secure stored information . . . the first secure tunnel" is not clear as to what is being claimed, as support for such does appear to be found in the descriptive portion of the specification, nor the drawings.

Claim 3 contain similar issues.

Applicant is requested to carefully review the claim language and provide proper antecedent basis for each item cited in order for the claim language to be understood as to its metes and bounds.

7. Applicant's seven Information Disclosure Statements (IDS's) have been reviewed. Note the attached IDS's.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Error! Unknown document property name.** whose telephone number is **Error! Unknown document property name.**. The examiner can normally be reached on **Error! Unknown document property name.**.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Fahd A. Obeid can be reached on 571-270-3324. 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.

/ANDREW JOSEPH RUDY/

Primary Examiner

Art Unit 3687

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

PTO/SB/08a (01-10)
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	1	20020022472		2002-02-21	WATLER et al.	
	2	20020120540		2002-08-29	KENDE et al.	
	3	20020131404		2002-09-19	MEHTA et al.	
	4	20020138601		2002-09-26	PIPONIUS et al.	
	5	20020176377		2002-11-28	HAMILTON, Thomas E.	

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	6	20020199001		2002-12-26	WENOCUR et al.	
	7	20030004937		2003-01-02	SALMENKAITA et al.	
	8	20030005112		2003-01-02	KRAUTKREMER, Todd Joseph	
	9	20030013434		2003-01-16	ROSENBERG et al.	
	10	20030018524		2003-01-23	FISHMAN et al.	
	11	20030046396		2003-03-06	RICHTER et al.	
	12	20030050070		2003-03-13	MASHINSKY et al.	
	13	20030050837		2003-03-13	KIM, Do Sik	
	14	20030088671		2003-05-08	KLINKER et al.	
	15	20030133408		2003-07-17	CHENG et al.	
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	18	20030182435		2003-09-25	REDLICH et al.	
	19	20030220984		2003-11-27	JONES et al.	
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	21	20030229900		2003-12-11	REISMAN, Richard	
	22	20030236745		2003-12-25	HARTSELL et al.	
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	25	20040030705		2004-02-12	BOWMAN-AMUAH, Michel K.	
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	29	20040082346		2004-04-29	SKYTT et al.	
	30	20040098715		2004-05-20	AGHERA et al.	
	31	20040103193		2004-05-27	PANDYA et al.	
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	34	20040132427		2004-07-08	LEE et al.	
	35	20040168052		2004-08-26	CLISHAM et al.	
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	40	20050048950		2005-03-03	MORPER, Hans-Jochen	
	41	20050055291		2005-03-10	BEVENTE et al.	
	42	20050055309		2005-03-10	WILLIAMS et al.	
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	46	20050128967		2005-06-16	SCOBBIE, Donald MacGregor	
	47	20050166043		2005-07-28	ZHANG et al.	
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	51	20050228985		2005-10-13	YLIKOSKI et al.	
	52	20050238046		2005-10-27	HASSAN et al.	
	53	20050246282		2005-11-03	NASLUND et al.	
	54	20050250508		2005-11-10	GUO et al.	
	55	20050254435		2005-11-17	MOAKLEY et al.	
	56	20050266825		2005-12-01	CLAYTON, Steve	
	57	20050266880		2005-12-01	GUPTA, Vivek G.	
	58	20060014519		2006-01-19	MARSH et al.	
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	66	20060085543		2006-04-20	HRASTAR et al.	
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	73	20060190314		2006-08-24	HERNANDEZ, Rick	
	74	20060199608		2006-09-07	DUNN et al.	
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	76	20060218395		2006-09-28	MAES, Stephane H.	
	77	20060233108		2006-10-19	KRISHNAN, Murali R.	
	78	20060233166		2006-10-19	BOU-DIAB et al.	
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	84	20070022289		2007-01-25	ALT et al.	
	85	20070036312		2007-02-15	CAI et al.	
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	95	20070140275		2007-06-21	BOWMAN et al.	
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	164	20090068984		2009-03-12	BURNETT, R. Alan	
	165	20090077622		2009-03-19	BAUM et al.	
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	210	20100153781		2010-06-17	HANNA, Stephen R.	
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CONFIRMATION NO. 1013

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
15/287,603	10/06/2016 RULE	709	3687	RALEP037D1C1

APPLICANTS

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INVENTORS

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Alireza Raissinia, Saratoga, CA;
Jeffrey Green, Sunnyvale, CA;

**** CONTINUING DATA ***************************

This application is a CON of 14/578,124 12/19/2014 PAT 9565707
which is a DIV of 13/248,028 09/28/2011 PAT 8924469
which claims benefit of 61/387,243 09/28/2010
and is a CIP of 12/380,778 03/02/2009 PAT 8321526
and is a CIP of 12/380,780 03/02/2009 PAT 8839388
and said 12/380,778 03/02/2009
claims benefit of 61/206,354 01/28/2009
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and claims benefit of 61/207,393 02/10/2009
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and said 12/380,780 03/02/2009
claims benefit of 61/206,354 01/28/2009
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**** FOREIGN APPLICATIONS ***************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **** ** SMALL ENTITY **
10/19/2016

Foreign Priority claimed ☐ Yes ☑ No 35 USC 119(a-d) conditions met ☐ Yes ☑ No Verified and Acknowledged /ANDREW JOSEPH RUDY/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		CA	28	1	1

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1011 Pruitt Place
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UNITED STATES

TITLE

Enterprise Access Control and Accounting Allocation for Access Networks

FILING FEE	FEES: Authority has been given in Paper	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time)

BIB (Rev. 05/07).

RECEIVED 800	No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	❑ 1.18 Fees (Issue) ❑ Other _____ ❑ Credit

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	Art Unit	2642
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	Attorney Docket Number	RALEP037D1C1

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	Examiner Name	Rudy, Andrew J.
	Attorney Docket Number	RALEP037D1C1

	9	8214890	B2	2012-07-03	Kirovski et al.	
	10	8285992	B2	2012-10-09	Mathur et al.	
	11	8588240	B2	2013-11-19	Ramankutty et al.	
	12	8676682	B2	2014-03-18	Kalliola, Janne	
	13	8818394	B2	2014-08-26	Bienas et al.	
	14	9064275	B1	2015-06-23	Lu et al.	
	15	9286604	B2	2016-03-15	Aabye et al.	
	16	9589117	B2	2017-03-07	Ali et al.	

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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	20100284388	A1	2010-11-11	Fantini et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15287603
	Filing Date	2016-10-06
	First Named Inventor	Gregory G. Raleigh
	Art Unit	3687
	Examiner Name	Rudy, Andrew J.
	Attorney Docket Number	RALEP037D1C1

	2	20110252430	A1	2011-10-13	Chapman et al.	
	3	20020099848	A1	2002-07-25	Lee, Hoon	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2]	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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	Application Number	15287603
	Filing Date	2016-10-06
	First Named Inventor	Gregory G. Raleigh
	Art Unit	3687
	Examiner Name	Rudy, Andrew J.
	Attorney Docket Number	RALEP037D1C1

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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)	2017-11-09
Name/Print	James E. Harris	Registration Number	40013

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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.

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EFS ID:	30906711
Application Number:	15287603
International Application Number:	
Confirmation Number:	1013
Title of Invention:	Enterprise Access Control and Accounting Allocation for Access Networks
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:	RALEP037D1C1
Receipt Date:	09-NOV-2017
Filing Date:	06-OCT-2016
Time Stamp:	16:05:59
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	P037D1C1.pdf	1054428 e892dbfc14368ae6114dbe26fb9c80fe8ba102db	no	5

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PTO/SB/08a (03-15)
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(Not for submission under 37 CFR 1.99)

Application Number	15287603
Filing Date	2016-10-06
First Named Inventor	Gregory G. Raleigh
Art Unit	3687
Examiner Name	Rudy, Andrew J.
Attorney Docket Number	RALEP037D1C1

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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	6466984	B1	2002-10-15	Naveh et al.	
	2	6522629	B1	2003-02-18	Anderson, Sr., Ronald D.	
	3	6996062	B1	2006-02-07	Freed et al.	
	4	7269157	B2	2007-09-11	Klinker et al.	
	5	7340772	B2	2008-03-04	Panasyuk et al.	
	6	7423971	B1	2008-09-09	Mohaban et al.	
	7	7522576	B2	2009-04-21	Du et al.	
	8	7769397	B2	2010-08-03	Funato et al.	

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	Examiner Name	Rudy, Andrew J.
	Attorney Docket Number	RALEP037D1C1

	9	7882247	B2	2011-02-01	Sturniolo et al.	
	10	7925740	B2	2011-04-12	Nath et al.	
	11	8010990	B2	2011-08-30	Ferguson et al.	
	12	8159520	B1	2012-04-17	Dhanoa et al.	
	13	8446831	B2	2013-05-21	Kwan et al.	
	14	8499087	B2	2013-07-30	Hu, Qingmin	
	15	8619735	B2	2013-12-31	Montemurro et al.	
	16	8826411	B2	2014-09-02	Moen et al.	
	17	9015331	B2	2015-04-21	Lai et al.	
	18	9402254	B2	2016-07-26	Kneckt et al.	
	19	9634850	B2	2017-04-25	Taft et al.	

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	1	20050111463	A1	2005-05-26	Leung et al.	
	2	20090149154	A1	2009-06-11	Bhasin et al.	
	3	20090291665	A1	2009-11-26	Gaskarth et al.	
	4	20110177811	A1	2011-07-21	Heckman et al.	

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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	0208863	WO		2002-01-31	Telemac Corp.		

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See attached certification statement.

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Name/Print	James E. Harris	Registration Number	40013

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(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
31 January 2002 (31.01.2002)

PCT

(10) International Publication Number
WO 02/08863 A2

(51) International Patent Classification[7]: G06F

(21) International Application Number: PCT/US01/23226

(22) International Filing Date: 23 July 2001 (23.07.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/220,241 21 July 2000 (21.07.2000) US

(71) Applicant: **TELEMAC CORPORATION** [US/US]; 6701 Center Drive West, Suite 700, Los Angeles, CA 90045 (US).

(72) Inventors: **WATLER, Theodore, W.**; 5341 E. 4th Street, Long Beach, CA 90814-1920 (US). **HANLEY, Jerry**; 1315 Franklin Street, #D, Santa Monica, CA 90404 (US).

(74) Agents: **NG, Horace** et al.; Townsend and Townsend and Crew LLP, Two Embarcadero Center, 8th Floor, San Francisco, CA 94111-3834 (US).

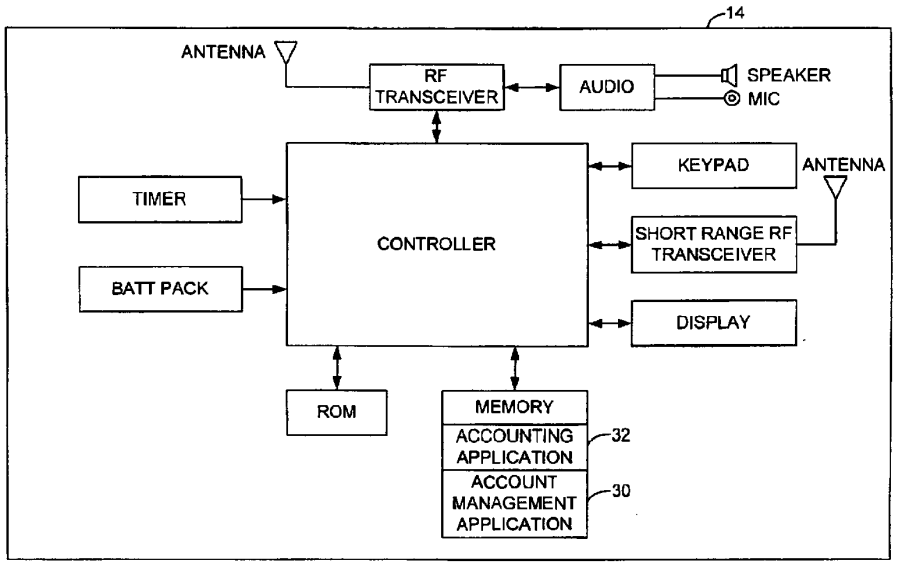
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(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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[Continued on next page]

(54) Title: MULTIPLE VIRTUAL WALLETS IN WIRELESS DEVICES



(57) Abstract: A system having a wireless device capable of monitoring and tracking its own usage and account activities is disclosed. The wireless device includes an account management application and accounting applications. The account management application manages a variety of accounts in conjunction with the accounting applications and is used by a user to determine how each call/transaction is to be paid for. For example, the user of the wireless device may wish to pay for business calls using a first account and personal calls using a second account.

WO 02/08863 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.

MULTIPLE VIRTUAL WALLETS IN WIRELESS DEVICES

CROSS-REFERENCES TO RELATED APPLICATION

[01] This application claims the benefit of priority under 35 U.S.C. § 119 from U.S. Provisional Patent Application Serial No. 60/220,241 filed on July 21, 2000, the disclosure of which is hereby incorporated by reference in its entirety for all purposes.

BACKGROUND OF THE INVENTION

[02] The present invention generally relates to a system with an account management protocol for wireless devices, and in particular, to a system with an account management protocol which is used to monitor and track usage and account activities of a wireless device.

[03] More specifically, the account management system is adapted for a mobile phone so as to allow the usage and account activities of the mobile phone to be tracked and monitored on an individual basis. A number of accounting systems are described in U.S. Patent Nos. 5,325,418 (the '418 Patent), 5,625,669 (the '669 Patent), 5,577,100 (the '100 Patent), and 6198,915 B1 (the '915 Patent), which are incorporated herein by reference. The '418 and '669 Patents describe accounting systems with features that have particular application to post-paid mobile phone services, such as a mobile phone rental service or controlled mobile phone services. In a controlled mobile phone service, capturing phone call data and calculating phone charges for each call enable service providers (or corporations in an intra-corporate system) to limit, or at least monitor, mobile phone usage before the periodic billing cycle. For example, if mobile phone usage exceeds a pre-established limit, the mobile phone could be temporarily disabled or restricted until an interim payment or additional credit sources are obtained. In an intra-corporate system, a warning message could be sent to a corporate authority that could then either authorize additional use or temporarily disable the mobile phone. In such systems, phone call data is stored in the mobile phone and then transmitted to a host processor that calculates charges. The host processor is typically located on a network that is separate from the mobile phone.

[04] Since the issuance of the '418 and '669 Patents, the state of the art has advanced to a point where an accounting application in the mobile phone is able to calculate calling charges internally. As described in the '100 and '915 Patents, such

systems minimize the communication traffic required between the service provider's host processor and the mobile phone and thus expand the overall traffic handling capacity of the mobile phone system. The '100 and '915 Patents describe accounting systems with features that have particular application to pre-paid mobile phone services.

[05] Due to the increasing ease of use and lower costs, the proliferation and use of mobile phones is going to continue. Many companies nowadays provide employees with mobile phones in order to ensure that such employees remain in contact. Since carrying two mobile phones is quite impractical, these employees inevitably tend to use their company-provided mobile phones for both business and personal calls. Hence, in order to prevent abuses and/or provide accurate accounting, it would be desirable to have the ability to monitor proper usage and account activities of company-provided mobile phones.

[06] Furthermore, some mobile phones on the market today provide a two-line or multi-line capability. With a two-line phone, the two phone lines could be dedicated to handle a first type and a second type of calls respectively. As a result, account activities for different types of calls may need to be monitored separately. Therefore, it would be desirable to provide a mobile phone system that is capable of handling and monitoring different types of usage and account activities for wireless devices.

SUMMARY OF THE INVENTION

[07] The system of the present invention relates to wireless communication systems having wireless devices, particularly mobile phones, that are part of a wireless communication network. In particular, the present invention relates to a wireless device, such as a mobile phone, that includes an internal account management application for internal management of a variety of accounts. In an exemplary embodiment, the account management application interacts with an accounting application for calculation of communication charges on the fly. Such mobile phones are typically cellular telephones in a cellular phone network, radio telephones in a personal communication service network or other communication system, where the mobile phone is moveable from place to place.

[08] Use of the system of the present invention is intended for mobile phones, where real time calculation of calling charges is desirable to limit phone usage or to immediately bill for phone usage where the billings of the public switched service providers and participating wireless service providers are not yet available.

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[09] The account management system includes an account management application, carried internally in the wireless device, that manages a variety of accounts. The account management application interacts with one or more accounting applications, such as, a complex billing algorithm with multiple factor accounting protocol to account for local charges, roaming charges when the wireless device moves from one zone to another, long distance charges, international charges including country independent local charges, and surcharges which may be per call or rate based. The complex billing algorithm can be expanded to accommodate special charges of service providers or called stations or special discounts or premiums for data transfer calls.

[10] The accounting applications related to mobile phone usage may include a rate schedule. A rate schedule in the wireless device may be periodically updated by wireless communications with the service provider's host processor or customer service representative. The accounting applications related to m-commerce transactions obtain the amount to be deducted from a pre-defined communication protocol with the vendor's transaction device or customer service representative.

[11] It is to be understood that the accounting applications may reside either in the wireless device or on a network which is accessible to the wireless device. Depending on design specification or constraints, the functionality of the account management application may be incorporate into the accounting application.

[12] It is to be further understood that the wireless device with the account management system can be implemented into existing wireless communication networks without substantial modification to the network and can be implemented into most existing wireless devices with minimal modification, primarily by internal reprogramming of the wireless device. Modification to most existing wireless devices is even more minimal when existing accounting applications residing on a network are utilized by the wireless device.

[13] A wireless device such as a mobile phone currently includes an internal processor and sufficient internal memory to incorporate the programming and data storage necessary to accomplish the real time accounting. The account management application and the complex algorithms providing the multiple factor accounting capabilities are sufficiently compact that storage and processing of the call data is enabled in real time with sufficient accuracy to account for multiple charges from multiple service providers even for a roaming phone. The accounting and account management

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applications should utilize an encryption system to permit secure programming and transactions over the airways.

[14] The accounting and account management system as described herein provides customers and businesses with greater flexibility in managing costs of mobile phone use and m-commerce transactions, especially where costs must be segregated into different accounts by multiple criteria such as business versus personal, or by different profit centers within the same business. The increased flexibility also includes different methods for controlling costs with respect to each account such as pre-paid service or post-paid service with usage limits. The present invention describes a system in which an individual wireless device could be utilized in a controlled service mode for certain purposes such as business calls, in a pre-paid service mode for other purposes such as private calls, and have additional secure electronic accounts for other m-commerce transactions.

[15] The system of the present invention is adapted for analog or digital cellular telephones, radiophones in personal communication service networks and other wireless communication systems. The system is also adapted for other wireless devices, such as personal digital assistants, that are used for m-commerce transactions through short-range radio frequency communication protocols or data bearer communication services such as short message service.

[16] Reference to the remaining portions of the specification, including the drawings and claims, will realize other features and advantages of the present invention. Further features and advantages of the present invention, as well as the structure and operation of various embodiments of the present invention, are described in detail below with respect to accompanying drawings, like reference numbers indicate identical or functionally similar elements.

BRIEF DESCRIPTION OF THE DRAWINGS

[17] Fig. 1 is a simplified schematic diagram illustrating a typical wireless telecommunication arrangement;

[18] Fig. 2 is a simplified schematic diagram illustrating a typical arrangement for sending data bearer messages such as short message service to a wireless device;

[19] Fig. 3 is a simplified schematic diagram illustrating a typical wireless transaction arrangement; and

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[20] Fig. 4 is a simplified schematic diagram showing an exemplary embodiment of a wireless device in accordance with the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[21] Fig. 1 is a simplified schematic diagram illustrating a typical wireless telecommunication arrangement. A network 10 communicates with a wireless device 14, such as a mobile phone, via a transmission station 12. The transmission station 12 uses over-the-air communications to communicate with the wireless device 14. Over-the-air communication protocols which can be used to implement wireless communications between the wireless device 14 and the network 10 include, for example, GSM, CDMA, TDMA, UMTS, etc. A person of ordinary skill in the art will know of other ways and methods to implement over-the-air communications.

[22] Fig. 2 is a simplified schematic diagram illustrating a typical arrangement for sending data bearer messages such as short message service to a wireless device 14. An application program 16 residing on a host processor 18 uses a communication link 20, such as a TCP/IP link over the Internet, to communicate with a data bearer message controller 22 within the network 10 to transmit a data bearer message such as a short message service message to the wireless device 14, such as a mobile phone, via a transmission station 12.

[01] Fig. 3 is a simplified schematic diagram illustrating a typical wireless transaction arrangement. A vending machine 24 with a short range radio communication transceiver and the wireless device 14, such as a mobile phone with a short range radio communication transceiver, communicate using a short range radio communication link 26. Short range radio communication links which can be used to implement wireless communications between the wireless device 14 and the vending machine 24 include, for example, Bluetooth ™ wireless communication links. A person of ordinary skill in the art will know of other ways and methods to communicate transactional data between two devices. As another example, vending machine 24 and wireless device 14, each with the appropriate transceiver, can communicate transactional data using a data bearer message service such as short message service.

[24] Referring to Fig. 4, there is shown an exemplary embodiment of the wireless device 14 in accordance with the present invention. According to the exemplary embodiment, the wireless device 14 includes an account management application 30 which permits the usage and account activities of the wireless device 14 to be tracked and

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monitored on an individual basis. The account management application 30 functions as multiple virtual wallets and is capable of maintaining a number of different accounts which are chargeable for calls or transactions handled by the wireless device 14. The different accounts include, for example, traditional postpaid account, postpaid monitored or controlled usage account, and prepaid account.

[25] The account management application 30 can reside on executable memory within the wireless device 14. Such memory can be one of any type such as ROM, EPROM, or flash memory. The account management application 30 can store dynamic data in RAM and utilize nonvolatile memory such as EEPROM or flash memory to store control data. Alternatively, the account management application 30 can reside on a smart card, such as a universal subscriber identification module (USIM) or Universal Identity Module (UIM), which is attachable to the wireless device 14.

[26] According to an exemplary embodiment, the account management application 30 further interacts with other applications, such as the accounting application 32 described below, so as to properly manage and process the different accounts. The accounting application 32 is capable of calculating calling charges in real time or on the fly. An example of the accounting application 32 is the complex billing algorithm described in the '100 Patent. The complex billing algorithm factors the multiple variables of a telephone call from a mobile phone into a billing equation that virtually mirrors the factors considered by public switched network providers and participating wireless service providers, (of which there may be more than one in a single call). The resultant call charge accurately approximates the summation of real charges that will be billed by the participating service providers thereby enabling an instantaneous calculation and display of calling charges. The complex billing algorithm can be expanded to accommodate special charges of service providers or called stations or special discounts or premiums for data transfer calls. The accounting application 32 can reside on executable memory within the wireless device 14. Such memory can be one of any type such as ROM, EPROM, or flash memory. The accounting application 32 can store dynamic data in RAM and utilize nonvolatile memory such as EEPROM or flash memory to store control data. Alternatively, the accounting application 32 can reside on a smart card, such as a universal subscriber identification module (USIM) or Universal Identity Module (UIM), which is attachable to the wireless device 14. In the alternative, it is to be also understood that the accounting application 32 may reside on the network 10. A

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person of ordinary skill in the art will know of ways and methods to obtain and retrieve calling charge information from an accounting application 32 residing on the network 10.

[27] It is to be further understood that the accounting applications 32 may reside either in the wireless device 14 or on the network 10 which is accessible to the wireless device 14. Depending on design specification or constraints, the functionality of the account management application 30 may be incorporated into or combined with the accounting application 32.

[28] The wireless device 14 can be programmed using systems such as that described in U.S. Patent No. 6,243,574 B1. In addition to installing account management application 30 and accounting applications 32, programming can include providing data, such as initial monetary values for pre-paid accounts or credit limits, to the wireless device 14. Alternatively, the wireless device 14 can be programmed over the air using DTMF signals, or a data bearer communication service such as short message service, initiated from an application program 16 residing on a host processor 18 such as described in the '100 Patent.

[29] The wireless device 14 is preferably a contemporary unit with an LCD display screen for display of numeric or alphanumeric data, such as a user menu and warning messages; a keypad for entry of data, such as menu selections; and a timer for determining the duration of calls thereby allowing calling charges to be calculated. In the alternative, a person of ordinary skill in the art will know that timer information can be obtained from the network 10.

[30] In an exemplary embodiment, the account management application 30 charges a call or transaction to the account selected by a user. The account selection is accomplished via a user interface. The user interface permits the user to interact with the account management application 30 and select which one of the accounts is to be used for each call or transaction. Furthermore, the user interface also allows the user to perform certain account management functions. For example, the user, via the user interface, may transfer balances between accounts or perform other typical accounting functions. As another example, the user, via the user interface, may change the account to which a particular call has been charged. Preferably, the user interface is implemented in the form of a menu of available accounts presented on the LCD screen of the wireless device 14.

[31] In an exemplary mode of operation, the usage and account activities of the wireless device 14 are monitored and tracked as follows. In the situation where an outgoing call is to be made via the wireless device 14, before such call is made, the user

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using the user interface selects which account is to be charged for that call. Once the account is selected, the user then continues with the normal procedures to make the call. If, for example, a prepaid account is selected, the accounting application 32 then calculates the charges to be debited and the account management application 30 accordingly debits the selected prepaid account.

[32] Similarly, in the situation where an incoming call is to be received by the wireless device 14, before such call is answered, the user using the user interface selects which account is to be charged for that call. Once the account is selected, the user then continues with the normal procedures to receive the call. If, for example, a postpaid account is selected, the charges for the call are calculated and the account management application 30 accordingly updates the postpaid account.

[33] As described above, a selected account is charged for a call handled by the wireless device 14. However, it should be understood that an account may also be charged for any transaction handled by the wireless device 14. That is, the account management application 30 is also able to monitor and track transactions handled by the wireless device 14. For example, referring to Fig. 3, if the wireless device 14 is used to communicate with the vending machine 24 to make a purchase, an appropriate account on the wireless device 14 can similarly be charged for making that purchase.

[34] Alternatively, the account management application 30 may automatically select the account to be charged from a multifactor algorithm. For example, where the wireless device 14 is a multi-line mobile phone, the account management application 30 detects which line of the multi-line mobile phone is in use and charges the account associated with that line. The calling charges to be applied to that account is determined by the accounting application 32. For example, the account management application 30 may select and apply a postpaid account for calls made or received on one line and select and apply a prepaid account for calls made or received on another line.

[35] In another exemplary embodiment, the account management application 30 is able to determine the telephone number of the device which originated the call using the network 10 automatic number identification features, and charge the account associated with that telephone number in a table stored on EEPROM or flash memory within the wireless device 14. In the event that the originating telephone number was not found in the table, a default account is then charged or the user is prompted to select an account to be charged for the call. The timing of the prompt may vary depending on design. For example, the prompt may occur after the call is concluded, if the available

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prepaid fund and/or credit limit of all potentially chargeable accounts was sufficient. Alternatively, the timing of the prompt may also occur at the preprogrammed time for warning of exhaustion of the available prepaid fund and/or credit limit based on the account, out of all potentially chargeable accounts, which first reaches the time for such warning. It is understood that the multifactor algorithm may include one or more of the above factors, as well as other factors appropriate for selecting the account to be charged.

[36] In an exemplary embodiment , the account management application 30 maintains each account according to an algorithm programmed by the service provider or by authorized corporate personnel. For example, an application program 16 residing on a host processor 18 can provide secure access to authorized corporate personnel to allow such personnel to enter control data with respect to each account. The application program 16 can initiate the transmission of a data bearer message, such as a short message service message, which, when received by the wireless device 14, accordingly reprograms the wireless device 14 with such control data. For example, one account may be set up to be a traditional postpaid account with a limit on usage and a second account may be set up to be a prepaid account. Corporate procedures may require the user to use the first account only for legitimate business calls. The user's compliance with such procedures may be monitored through call detail records stored on the wireless device 14 and transmitted to a host processor as described in the '418 and '669 Patents.

[37] It is understood that the call detail records can be stored on RAM or other memory within the wireless device 14, or alternatively, the call detail records can be stored on a smart card, such as a universal subscriber identification module (USIM), which is attachable to the wireless device 14.

[38] The control data transmitted to the wireless device 14 can also be used to determine the consequence of the user reaching a usage limit. For example, one such consequence is for the account management application 30 to generate and transmit an SMS message, or other data bearer message, to the appropriate corporate authority warning that the user had exceeded the usage limit and that review of the call detail records is warranted. Another such consequence is for the account management application 30 to temporarily restrict operation of the wireless device 14, allowing only emergency calls and calls to customer representatives until the restriction is removed. Corporate procedures may permit personal calls on the same wireless device 14 if the user utilizes the second account, the prepaid account. Authorized corporate personnel may receive acceptable forms of payment from the user, and, using the application program

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16, transmit control data to the wireless device 14 adding funds to the prepaid account accordingly, similar to the description in the '100 Patent.

[39] In another exemplary embodiment, an application program 16 on a host processor 18 is able to provide secure access to authorized personnel of a service provider or, in an intra-corporate system, of the corporation to change control data with respect to each account. The application program 16 can initiate the transmission of a data bearer message, such as a short message service message, which, when received by the wireless device 14, accordingly reprograms the wireless device 14 with such control data. Examples of such changes include changes in the rate tables utilized by the accounting application 32, changes in credit limits for controlled post-paid accounts, and changes in paid funds in pre-paid accounts etc. Alternatively, the users may be provided with over the air access to application program 16 on the host processor 18 to make limited changes, such as using credit cards or prepaid calling cards to add funds to pre-paid accounts, similar to the description provided in the '100 Patent. Furthermore, the updated rate table may be transmitted to the wireless device 14 when the user applies for an increase in the internal phone account.

[40] In an exemplary embodiment, the account management application 30 is able to generate audio warnings through the speaker of the wireless device 14 and/or warning messages displayed on the LCD screen of the wireless device 14 so as to inform the user that s/he is about to exhaust the credit limit or prepaid funds. The warning messages may include information identifying the applicable account and the amount of remaining funds or credit.

[41] The system of the present invention provides substantial flexibility by the features described above. For example, a user of the wireless device 14 is given the flexibility to pay for each call differently on an ad hoc basis. A user may wish to separate and pay for the calls based on the nature of each call. Business and personal calls handled by the same wireless device 14 may be paid from different accounts. A business call is to be paid from one account and a personal call is to be paid from another account. A user may also wish to use different accounts to pay for different calls; one call may be paid from a prepaid account, while another call may be charged to a postpaid account.

[42] It is understood that the examples and embodiments described herein are for illustrative purposes only and that various modifications or changes in light thereof will be suggested to persons skilled in the art and are to be included within the spirit and purview of this application and scope of the appended claims. All publications, patents,

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and patent applications cited herein are hereby incorporated by reference for all purposes in their entirety.

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WHAT IS CLAIMED IS:

1. A system for handling a plurality of account activities, comprising:
a wireless device capable of performing a plurality of billable operations;
an account management application residing in the wireless device;
wherein the account management application is configured to manage a plurality of accounts; and
wherein each billable operation performed by the wireless device is selectively charged to one of the plurality of accounts.

2. The system according to claim 1 further comprising:
a user interface configured to allow a user to determine how each billable operation performed by the wireless device is to be selectively charged to one of the plurality of accounts.

3. The system according to claim 1 wherein the account management application automatically selects one of the plurality of accounts to be charged for at least one of the plurality of billable operations in accordance with an algorithm.

4. The system according to claim 1 further comprising:
an accounting application configured to calculate charges for each billable operation performed by the wireless device;
wherein the account management application functions in cooperation with the accounting application to manage the plurality of accounts.

5. The system according to claim 1wherein the plurality of billable operations includes making or receiving a voice or data communication.

6. The system according to claim 5 wherein how each billable operation performed by the wireless device is to be selectively charged to one of the plurality of accounts depends on origin or destination of the voice or data communication.

7. The system according to claim 1 wherein the wireless device is a mobile phone.

8. The system according to claim 1 wherein the account management application resides on a smart card attachable to the wireless device.

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9. The system according to claim 1 wherein the account management application resides on a memory residing in the wireless device.

10. The system according to claim 1 wherein the accounting application resides on a memory residing in the wireless device.

11. The system according to claim 1 wherein the accounting application resides on a network.

12. The system according to claim 1 wherein the account management application is configured so as to allow a user to transfer balances amongst the plurality of accounts.

13. The system according to claim 1 wherein the plurality of accounts includes a postpaid account and a prepaid account.

14. The system according to claim 1 wherein at least one of the plurality of accounts has a usage limit; and

wherein the plurality of billable operations performable by the wireless device is restricted when the usage limit is exceeded.

15. A wireless device configured to perform a plurality of billable operations, comprising:

an account management application residing on the wireless device and configured to maintain a plurality of accounts;

an accounting application configured to calculate charges for each billable operation performed by the wireless device; and

a user interface configured to allow a user to selectively determine how each billable operation performed by the wireless device is to be charged to one of the plurality of accounts;

wherein the account management application and the accounting application function in cooperation with each other in order to maintain the plurality of accounts.

16. The wireless device of claim 15 wherein the plurality of billable operations includes making or receiving a voice or data communication.

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17. The wireless device of claim 16 wherein how each billable operation performed by the wireless device is to be selectively charged to one of the plurality of accounts depends on origin or destination of the voice or data communication.

18. The wireless device of claim 15 wherein the wireless device is a mobile phone.

19. The wireless device of claim 15 wherein the account management application resides on a smart card attached to the wireless device.

20. The wireless device of claim 15 wherein the account management application resides on a memory residing in the wireless device.

21. The wireless device of claim 15 wherein the accounting application resides on a network.

22. The wireless device of claim 15 wherein the account management application is configured so as to allow the user to transfer balances amongst the plurality of accounts.

23. The wireless device of claim 14 wherein the plurality of accounts includes a postpaid account and a prepaid account.

24. The wireless device of claim 14 wherein at least one of the plurality of accounts has a usage limit; and

wherein the plurality of billable operations performable by the wireless device is restricted when the usage limit is exceeded.

25. A mobile phone comprising:

a first line and a second line both configured to make and receive calls; and

an account management application residing on the mobile phone and configured to manage a plurality of accounts;

wherein calls made or received via the first line is charged to one of the plurality of accounts and calls made or received via the second line is charged to another one of the plurality of accounts.

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26. The mobile phone of claim 25 further comprising:

a user interface configured to allow a user to selectively determine how each call made or received by the mobile phone is to be charged to one of the plurality of accounts.

27. The mobile phone of claim 25 further comprising:

an accounting application configured to calculate charges for each call made or received by the mobile phone.

28. The mobile phone of claim 25 wherein the account management application resides on a smart card attachable to the mobile phone.

29. The mobile phone of claim 25 wherein the account management application resides on a memory residing in the mobile phone.

30. The mobile phone of claim 27 wherein the accounting application resides on a memory residing in the mobile phone.

31. The mobile phone of claim 27 wherein the accounting application resides on a network.

32. The mobile phone of claim 25 wherein the plurality of accounts includes a postpaid account and a prepaid account.

33. The mobile phone of claim 25 wherein the calls made or received via the first line include business calls and the calls made or received via the second line include personal calls.

34. The mobile phone of claim 25 wherein the account management application is configured so as to allow the user to transfer balances amongst the plurality of accounts.

35. A method for tracking account activities relating to a plurality of billable operations performable by a wireless device, comprising:

selecting one of a plurality of accounts to be charged for a billable operation, wherein the plurality of accounts are maintained on the wireless device;

calculating charges to be paid for the billable operation;

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causing the wireless device to perform the billable operation; and

updating the selected account.

36. The method according to claim 35 wherein the step of selecting one of the plurality of accounts further comprises:

allowing a user to select one of the plurality of accounts via a user interface.

37. The method according to claim 35 wherein the step of calculating charges to be paid for the billable operation is performed by an accounting application.

38. The method according to claim 35 wherein the accounting application resides on a memory residing in the wireless device.

39. The method according to claim 35 wherein the accounting application resides on a network.

40. The method according to claim 35 wherein the wireless device is a mobile phone.

41. The method according to claim 35 wherein the billable operation includes making or receiving a voice or data communication.

42. The method according to claim 41 wherein the step of selecting one of a plurality of accounts to be charged for the billable operation further comprises:

identifying origin or destination of the voice or data communication;

selecting the one of the plurality of accounts to be charged for the billable operation based on the identified origin or destination of the voice or data communication.

43. The method according to claim 35 further comprising:

restricting ability of the wireless device to perform the billable operation when credit limit of at least one of the plurality of accounts is exceeded.

44. The method according to claim 35 further comprising:

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restricting ability of the wireless device to perform the billable operation when prepaid level of at least one of the plurality of accounts is exhausted or goes below a pre-established limit.

45. A method for tracking account activities made by a mobile phone having a first line and a second line both configured to make and receive calls, comprising:

assigning a first account to calls made or received via the first line;

assigning a second account to calls made or received via the second line, wherein the first and second accounts are maintained on the mobile phone;

making or receiving a call via either the first line or the second line;

calculating charges to be paid for the call; and

updating either the first account or the second account based on the calculated charges depending on which one of the first and second lines the call is made or received.

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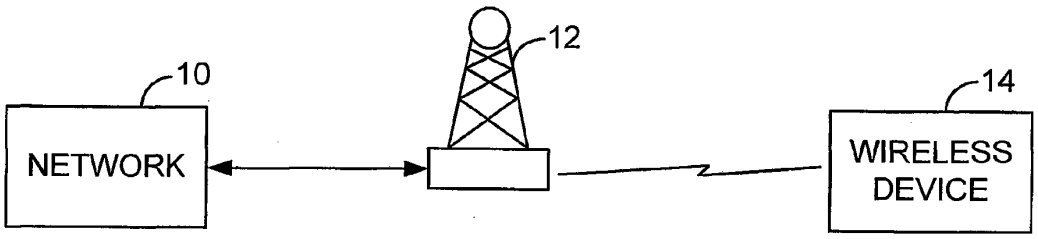


FIG. 1.

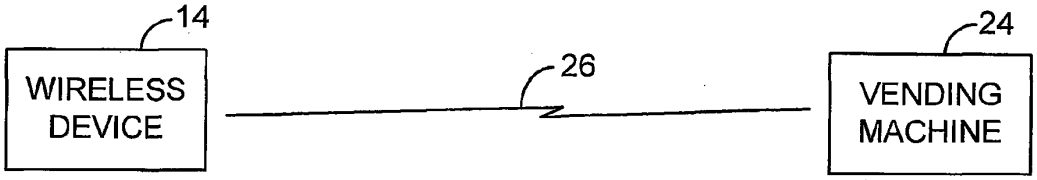


FIG. 3.

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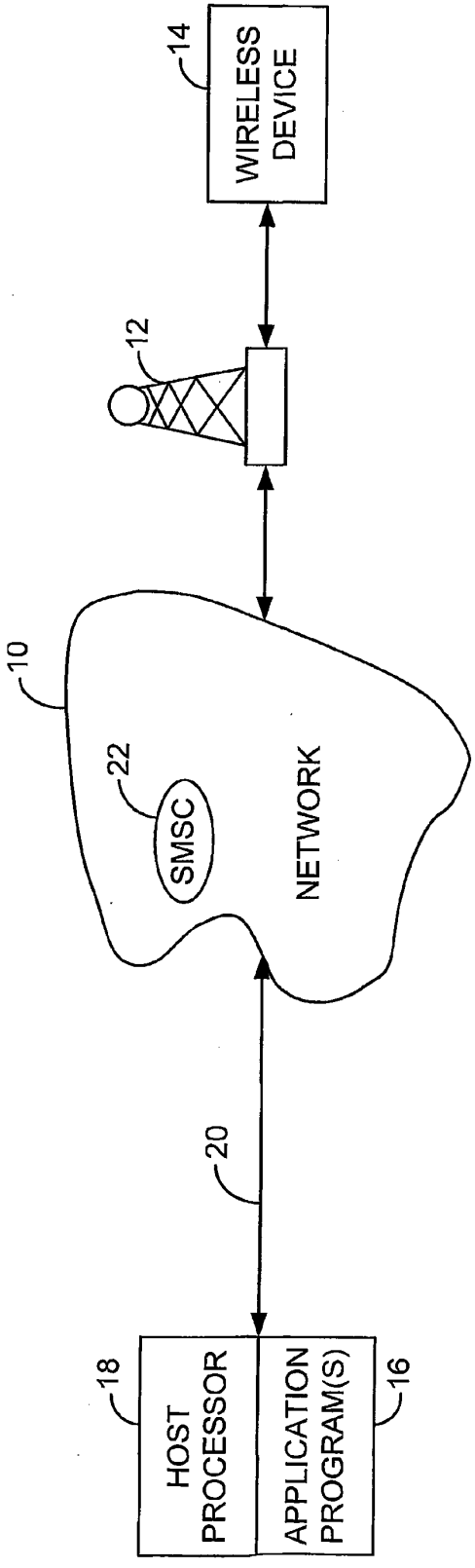


FIG. 2.

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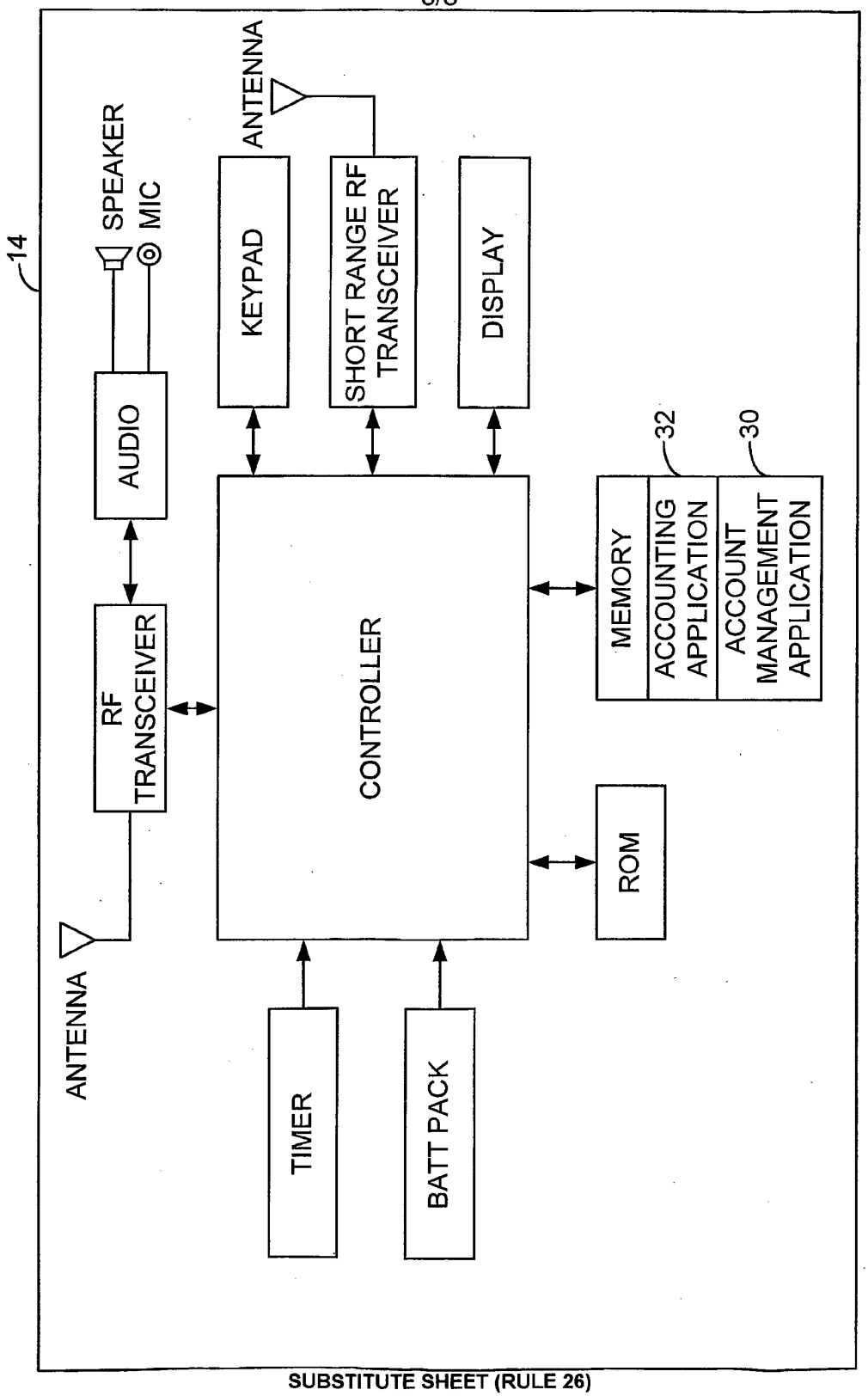


FIG. 4.

BNSDOCID: <WO_____0208863A2_I_>

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
31 January 2002 (31.01.2002)

PCT

(10) International Publication Number
WO 02/08863 A3

(51) International Patent Classification[7]: H04M 15/00

(21) International Application Number: PCT/US01/23226

(22) International Filing Date: 23 July 2001 (23.07.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/220,241 21 July 2000 (21.07.2000) US

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(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

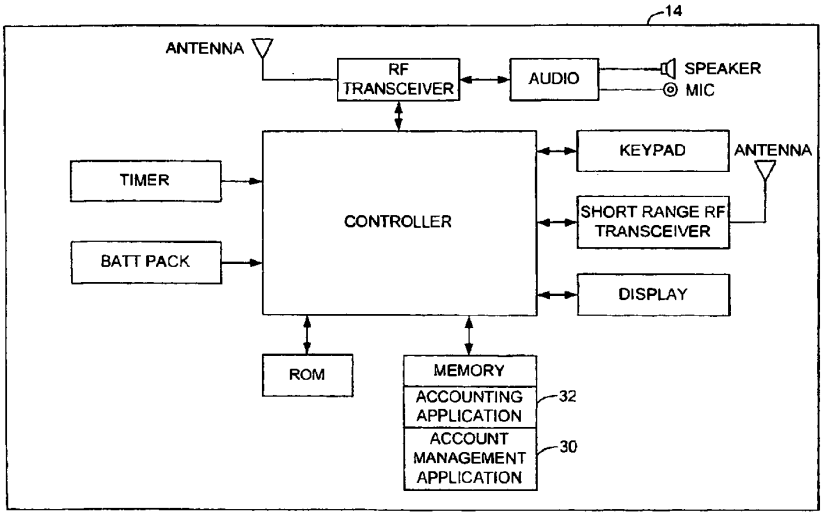
(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

(88) Date of publication of the international search report:
30 May 2002

[Continued on next page]

(54) Title: MULTIPLE VIRTUAL WALLETS IN WIRELESS DEVICES



(57) Abstract: A system having a wireless device (14) capable of monitoring and tracking its own usage and account activities is disclosed. The wireless device (14) includes an account management application (30) and accounting applications (32). The account management application (30) manages a variety of accounts in conjunction with the accounting applications (32) and is used by a user to determine how each call/transaction is to be paid for. For example, the user of the wireless device (14) may wish to pay for business calls using a first account and personal calls using a second account.

WO 02/08863 A3

BNSDOCID: <WO_____0208863A3_I_>

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.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US01/23226

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : H04M 15/00
US CL : 455/405, 406, 407, 408; 379/114.26

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)
U.S. : 455/405, 406, 407, 408, 409, 422, 575; 379/114.01, 114.03, 114.26

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)
EAST

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,774,533 A (PATEL) 30 June 1998 (30.06.1998), column 7, lines 8-31, column 17, line 57 - column 18, line 19, and figure 3.	1-45
Y	US 5,956,653 A (LAHTI) 21 September 1999 (21.09.1999), column 2, lines 7-38, and figure 1.	1-45
Y	US 5,428,666 A (FYFE et al) 27 June 1995 (27.06.1995), column 3, line 59 - column 7, line 36, and figures 1-2.	1-45
Y	US 5,109,401 A (HATTORI et al) 28 April 1992 (28.04.1992), see abstract, column 5, line 56 - column 6, line 56, and figure 3.	14, 24, 43, 44
A	US 5,657,373 A (HERMANSSON et al) 12August 1997 (12.08.1997), column 4,1 ine 2 - column 5, line 2.	1-45

☐ Further documents are listed in the continuation of Box C. ☐ 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 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

"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
17 September 2001 (17.09.2001)	22 JAN 2002
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703)305-3230	Authorized officer Quochien Vuong Telephone No. (703) 306-4530

Form PCT/ISA/210 (second sheet) (July 1998)

BNSDOCID: <WO_____0208863A3_I_>

Electronic Acknowledgement Receipt

EFS ID:	30055002
Application Number:	15287603
International Application Number:	
Confirmation Number:	1013
Title of Invention:	Enterprise Access Control and Accounting Allocation for Access Networks
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:	RALEP037D1C1
Receipt Date:	11-AUG-2017
Filing Date:	06-OCT-2016
Time Stamp:	13:33:04
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	Information Disclosure Statement (IDS) Form (SB08)	P037D1C1_IDS.pdf	1054581 843f3790350e70937fdc4701dd18d62037eb75ab	no	6

Warnings:

Information:					
2	Foreign Reference	2094.pdf	3952944 dfa7cbac15ff6f3701105acf137953f96f215840	no	25
Warnings:					
Information:					
			Total Files Size (in bytes):	5007525	

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
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New International Application Filed with the USPTO as a Receiving Office
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UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
15/287,603	10/06/2016	Gregory G. Raleigh	RALEP037D1C1

CONFIRMATION NO. 1013

106963
Headwater Research LLC
1011 Pruitt Place
Tyler, TX 75703

PUBLICATION NOTICE

OC000000092444668

Title: Enterprise Access Control and Accounting Allocation for Access Networks

Publication No.US-2017-0187839-A1
Publication Date:06/29/2017

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 Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, 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 https://portal.uspto.gov/pair/PublicPair. 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.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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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
15/287,603	10/06/2016	3687	800	RALEP037D1C1	1	1

CONFIRMATION NO. 1013

106963
Headwater Research LLC
1011 Pruitt Place
Tyler, TX 75703

CORRECTED FILING RECEIPT

OC000000091884818

Date Mailed: 06/07/2017

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;
Alireza Raissinia, Saratoga, CA;
Jeffrey Green, Sunnyvale, CA;

Applicant(s)

Headwater Research 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 14/578,124 12/19/2014 PAT 9565707
which is a DIV of 13/248,028 09/28/2011 PAT 8924469
which claims benefit of 61/387,243 09/28/2010
and is a CIP of 12/380,778 03/02/2009 PAT 8321526
and is a CIP of 12/380,780 03/02/2009 PAT 8839388
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
and said 12/380,780 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: 10/19/2016

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 15/287,603**

Projected Publication Date: 06/29/2017

Non-Publication Request: No

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

Enterprise Access Control and Accounting Allocation for Access Networks

Preliminary Class

709

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.

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Title 37, Code of Federal Regulations, 5.11 & 5.15

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	Raleigh et al.	Examiner:	not yet assigned
Serial No.:	15/287,603	Art Unit:	2447
Filed:	October 6, 2016	Conf. No.:	1013
Title:	Enterprise Access Control and Accounting Allocation for Access Networks		

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) A copy of the Filing Receipt mailed March 24, 2017 with the requested changes noted thereon.

(2) A supplemental Application Data Sheet correcting the name of the Applicant to Headwater Research LLC.

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 corrected Applicant name.

CONCLUSION

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

Respectfully submitted,

Date: June 2, 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: June 2, 2017 By: /Ann Taylor/
Ann Taylor

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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
15/287,603	10/06/2016	2642	800	RALEP037D1C1	1	1

CONFIRMATION NO. 1013

106963
Headwater Research LLC
1011 Pruitt Place
Tyler, TX 75703

UPDATED FILING RECEIPT

OC000000090086495

Date Mailed: 03/24/2017

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;
Alireza Raissinia, Saratoga, CA;
Jeffrey Green, Sunnyvale, CA;

Applicant(s)

~~Headwater Partners LLC~~, Tyler, TX; **Headwater Research LLC**

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

Domestic Priority data as claimed by applicant

This application is a CON of 14/578,124 12/19/2014 PAT 9565707
which is a DIV of 13/248,028 09/28/2011 PAT 8924469
which claims benefit of 61/387,243 09/28/2010
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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
and said 12/380,780 03/02/2009
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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: 10/19/2016

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 15/287,603**

Projected Publication Date: 06/29/2017

Non-Publication Request: No

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

Enterprise Access Control and Accounting Allocation for Access Networks

Preliminary Class

455

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

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SUPPLEMENTAL Application Data Sheet		Atty Docket No.	RALEP037D1C1
		Application No.	15/287,603
Title of Invention	Enterprise Access Control and Accounting Allocation for Access Networks		

Applicant Information:

Applicant 1 –

Applicant is the Assignee.

Applicant is an Organization.

Organization Name: ~~Headwater Partners I LLC~~ Headwater Research LLC
1011 Pruitt Place
Tyler, TX 75703 US
903-201-6212
patent@headwaterllc.com

Signature:

Signature: /James E. Harris/

Date: June 2, 2017

Printed/Typed Name: James E. Harris

Registration Number: 40,013

Electronic Acknowledgement Receipt

EFS ID:	29386653
Application Number:	15287603
International Application Number:	
Confirmation Number:	1013
Title of Invention:	Enterprise Access Control and Accounting Allocation for Access Networks
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:	RALEP037D1C1
Receipt Date:	02-JUN-2017
Filing Date:	06-OCT-2016
Time Stamp:	17:49:59
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	P037D1C1_Request.pdf	244015 48395f308778fecc9c20a46ccbc2203dcbafd3a2	no	5

Warnings:

Information:	
Total Files Size (in bytes):	244015

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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
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PTO/SB/08a (03-15)
Approved for use through 07/31/2016. 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)

Application Number	15287603
Filing Date	2016-10-06
First Named Inventor	Gregory G. Raleigh
Art Unit	2447
Examiner Name	not yet assigned
Attorney Docket Number	RALEP037D1C1

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	6219786	B1	2001-04-17	Cunningham et al.	

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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	20060020787	A1	2006-01-26	Choyi et al.	
	2	20060072550	A1	2006-04-06	Davis et al.	
	3	20060190987	A1	2006-08-24	Ohta et al.	
	4	20080077705	A1	2008-03-27	Li et al.	
	5	20080259924	A1	2008-10-23	Gooch et al.	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15287603
	Filing Date	2016-10-06
	First Named Inventor	Gregory G. Raleigh
	Art Unit	2447
	Examiner Name	not yet assigned
	Attorney Docket Number	RALEP037D1C1

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	2005053335	WO	A1	2005-06-09	Nokia Corp.		

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	Application Number	15287603
	Filing Date	2016-10-06
	First Named Inventor	Gregory G. Raleigh
	Art Unit	2447
	Examiner Name	not yet assigned
	Attorney Docket Number	RALEP037D1C1

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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).

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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)	2017-05-10
Name/Print	James E. Harris	Registration Number	40013

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(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
9 June 2005 (09.06.2005)

PCT

(10) International Publication Number
WO 2005/053335 A1

(51) International Patent Classification[7]: H04Q 7/32

(21) International Application Number:
PCT/EP2004/013101

(22) International Filing Date:
19 November 2004 (19.11.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
10/724,569 26 November 2003 (26.11.2003) US

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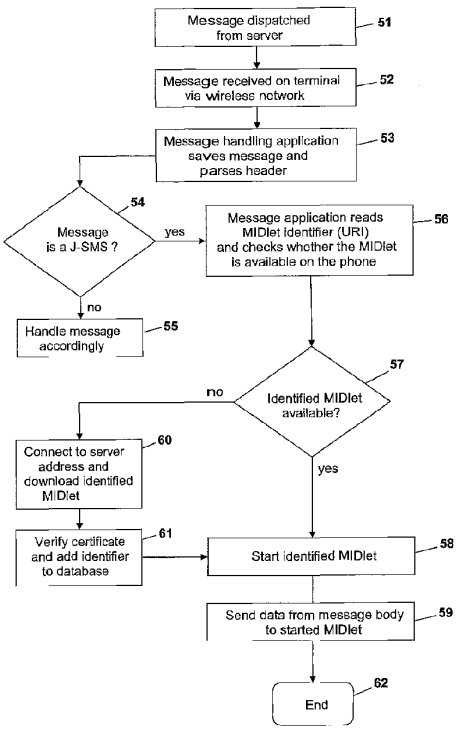
(74) Agent: **VAN WALSTIJN, B., Gerard, G.**; Walstijn Intellectual Property ApS, Parkovsvej 3, DK-2820 Gentofte (DK).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,

[Continued on next page]

(54) Title: FLEXIBLE MESSAGING SYSTEM



(57) Abstract: A universal messaging system for wireless networks that can handle a great variety of different content. The messaging system operates with messages that include an application identifier in the header for an application in platform independent code. The message body contains data to be used by the identified application. The mobile terminals for operation on the wireless network are provided with native software and with a virtual machine capable of executing platform independent code. The identifier allows the mobile terminal to start the correct application for using the data contained in the message body. A uniform recourse identifier (URI) is used to identify the application and to provide an address at which the application can be downloaded if it is not yet available on the message receiving mobile terminal.

WO 2005/053335 A1

FR, GB, GR, HU, IE, IS, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

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.

FLEXIBLE MESSAGING SYSTEM

The present invention relates to the use of messaging for sending and receiving various items in a wireless communication network.

BACKGROUND ART

Smart Messaging is a concept developed by Nokia for sending and receiving ring tones, picture messages, operator logos, business cards, calendar requests, and Internet settings over the Short Message Service (SMS). Since its introduction in 1997, Smart Messaging has become an extremely popular terminal-specific content delivery technology and the de facto standard for the industry. Examples of different SMS type messages are: Business Card format, Calendar format, Ringing tone format, OTA Bitmap format, CLI Icon format, Operator logo format, Picture Message format and Downloadable Profile message format. There are advanced message types that allow e.g. a network operator to send a complex set of configuration information like "GPRS settings" to a mobile phone. The software on the phones presently on the market is programmed to handle, on average, about 6 to 8 of these different message types. The message types that a phone can handle is determined by the manufacturer, depending on the target customer group, since it is not realistic to attempt to provide a phone that can handle all available message types.

There is presently a fast increase in the number of applications for mobile phones, such as e.g. background images, screen savers, location based services, financial services, operator controlled updating or settings/phonebook contents, etc. that have created a need to increase in the number of message types. It is

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however problematical to harmonize these message types between the different phone manufacturers, despite the dominance of the Nokia Smart Messaging Concept. The present SMS standard may be augmented as described below to provide for more flexible handling of increasing demand.

Accordingly, a need exists for a universal messaging system for wireless networks that can handle a great variety of different content.

DISCLOSURE OF THE INVENTION

The devices and method described below provide for a method of handling incoming messages received on a mobile communication terminal via a wireless network, the terminal having native software and a virtual machine capable of executing applications in platform independent object code. The method comprises the step of receiving and storing a message that comprises a header and a message body. The header contains an identifier for an application in platform independent object code to be executed by the virtual machine. In the next step it is verified if the identified application is available on the terminal, and the identified application is started when available on the terminal.

Thus, the terminal is able to automatically start the application required for using the data in the message body of a received message, regardless of the type and version of the native software of the terminal unless the required application is not available on the terminal. Therefore, the header may further contain an address at which the identified application can be downloaded from a server that is accessible through the wireless network, and the method further comprises the steps of connecting

to the terminal to the server at the address contained in the header, downloading the identified application when the identified application was not available on the terminal, and starting the identified application when downloaded.

Thus, the required application can automatically be downloaded if it is not already available on the terminal. Since the application is in platform independent object code, there is no platform compatibility problems, and because the download address is contained in the header the user does not need to search for it.

Preferably, the message body contains data to be used by the identified application.

The platform independent object code can be Java™, in particular Java™ 2 Platform, Micro Edition (J2METM) from Sun Microsystems Inc. but other platform independent object codes can be used.

The virtual machine preferably is a K Virtual Machine™ (KVM). The identified application can be a Java™ application, a Java™ applet or a Java™ MIDlet.

The devices and method described below provide for a mobile communication terminal that can operate with a flexible messaging concept for a wireless network. This terminal has native software and a virtual machine. The virtual machine is capable of executing applications in platform independent object code. The terminal also has a message handling application in the native software or in an application run by the virtual machine. The message handling application is capable of sending and receiving messages via the wireless network, and the

message handling application is programmed to start an application written in the independent object code when a corresponding identifier is contained the header of a received message.

Thus, the terminal is able to automatically start the application required for using the data in the message body of a received message, regardless of the type and version of the native software of the terminal if the required application is available on the terminal.

The message handling application can also be programmed to download the identified application from a server that is accessible via the wireless network at an address contained in the header when the identified application is not already available on the terminal.

The message handling application is programmed to verify the certification of the downloaded application.

The mobile communication terminal may further comprise an application identifier database listing the identifiers of all the applications in platform independent object code that are available on the terminal.

The message to be used with a flexible messaging concept for mobile terminals that operate on a wireless network is describe in detail below, and provides a format suitable for transmission through a wireless network to a mobile communication terminal, the terminal having native software and an virtual machine capable of handling platform independent object code and the message having a syntax comprising a header part and message body part. The header contains an identifier for an application in platform independent object code to be executed by the

virtual machine in the mobile communication terminal that receives the message.

Preferably, the header includes an address at which the identified application can be downloaded from a server that is accessible through the wireless network. The message body may contain data to be used by the identified application.

The message header may include a URI that serves as identifier and contains the address at which the identified application can be downloaded from a server.

The message can be an SMS message with a port address in octets 4-5 that identifies it as a message containing an identifier for an application in platform independent object code to be started upon receipt of the message. The identified application can be a Java™ applet or MIDlet, preferably in the Java™ 2, Micro Edition, Mobile Information Device Profile (MIDP) format.

The message may also contain a signed certificate issued by a recognized certification authority and including a public key from the signatory. In addition, the message may include field communication of an unique sender identifier in the form of a telephone number of an originating mobile phone, or other unique identifier for mobile terminals and/or computers.

On this background, it is an object of the present invention to provide.

With the system described herein, a flexible messaging method for mobile terminals that operate on a wireless network achieved by providing a method of enabling an application in platform independent object code to be run

on a mobile communication terminal comprising the steps of sending a message from a server via the wireless network to a mobile communication terminal, the terminal being provided with a virtual machine capable of executing applications in platform independent object code. The message contains a header with an identifier for the application to be started on the mobile communication terminal and a message body with the data to be used by the identified application.

Thus, the system and methods described herein make it possible to send a message with data to be used by a specific application to a mobile communication terminal, without needing to know first which platform is installed in the terminal.

The message header may further contain an address at which the identified application can be obtained from a server that is accessible through the wireless network, and thus the method may further comprise the step of uploading the identified application to the mobile communication terminal when the mobile terminal connects to the server at the address in the header.

Thus, it is rendered possible to transfer an application to a mobile terminal without being required to know the platform installed on the terminal. There is also no risk of installing the application twice on the same terminal.

Further objects, features, advantages and properties of the flexible messaging system according to the invention will become apparent from the detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

In the following detailed portion of the present description, the invention will be explained in more detail with reference to the exemplary embodiments shown in the drawings, in which

Fig. 1 shows the architecture of a wireless cellular communication network for use with the present invention,
Fig. 2 shows a mobile phone in accordance with the present invention,
Fig. 3 is a block diagram showing the basic components of the mobile phone of Fig. 2,
Fig. 4 shows the software architecture of the mobile phone of Fig. 2,
Fig. 5 is a flowchart illustrating the message handling procedure according to a preferred embodiment of the present invention,
Fig. 6 shows a sequence diagram of an example of the use of the flexible messaging system according to the invention, and
Fig. 7 shows a sequence diagram of a further example of the use of the flexible messaging system according to the invention.

DETAILED DESCRIPTION

Fig. 1 illustrates a network architecture for use with the present invention. The telecommunication system includes a wireless cellular network 16 and a data network 24. The wireless cellular network 16 can be implemented in a conventional wireless cellular telephone network that has been enhanced to carry data. A wireless network capable of carrying circuit-switched data can be used for this purpose. More preferably, however, the wireless cellular network provides a packet-switched data

service. An example of a wireless infrastructure includes UMTS (Universal Mobile Telephone System), a 3rd Generation wireless system based on GSM (Global System for Mobile communications). GSM adds a packet network overlay known as GRPS (GSM Packet Radio Service) to a wireless circuit voice network. The data network can e.g. be the Internet.

The cellular network comprises a large number of base stations 20 (only two are shown) that are provided with a transceiver for handling mobile phone communications. The base stations 20 are connected to a mobile switching centre 21. Each of the base stations 20 has its own control channel frequency (control channel frequencies can be reused for distant cells).

The base stations 20 are provided with an SMS/MMS message controller (not shown) and an SMS/MMS message transmission driver to allow it to send message to a mobile phone 1 and to receive messages from a mobile phone 1.

The mobile switching centre 21 is connected to a data 22 switching node that connects the cellular communication network 16 with the data network 24. Different servers 25,26,27,28 described in more detail below, are connected to the data network.

Fig. 2 shows a preferred embodiment of a mobile phone 1 according to the invention. The mobile phone 1, comprises a user interface having a keypad 2, a display 3, an on/off button 4 (present in the top of the phone) a speaker 5, and a microphone 6 (only the opening present in the bottom of the phone is visible). The mobile phone 1 according to the preferred embodiment is adapted for communication via a cellular network, such as the GSM

900/1800 MHz network, but could just as well be adapted for use with a Code Division Multiple Access (CDMA) network.

According to a preferred embodiment, the keypad 2 has a first group 7 of keys as alphanumeric keys, two softkeys 9, a cursor navigation key 10 (scroll up/down), and on-hook and off-hook keys 12. The present functionality of the softkeys 9 is shown in separate fields (softkey-labels) in the display 3 just above the softkeys 9. The softkeys 9 are multifunction keys and their present function depends on the state of the mobile phone 1. The softkeys 9 give access to the menu, the phonebook and call can activate actions related to call handling and message handling. A releasable battery pack 14 is placed on the rear side of the mobile phone 1.

Fig. 3 schematically shows the most important components of a preferred embodiment of the mobile phone 1, said components being essential to the understanding of the invention. The processor 18 controls the communication with the network via the transmitter/receiver circuit 19 and an internal antenna 15.

The microphone 6 transforms the user's speech into analogue signals, the analogue signals formed thereby are A/D converted in an A/D converter (not shown) before the speech is encoded in a digital signal processing unit 14 (DSP). The encoded speech signal is transferred to the processor 18, which i.e. supports the GSM terminal software. The processor 18 also forms the interface to the peripheral units of the apparatus, including a RAM memory 17a and a Flash ROM memory 17b, a SIM card 16, the display 3 and the keypad 2 (as well as data, power supply, etc.). The DSP 14 speech-decodes the signal,

which is transferred from the processor 18 to the speaker 5 via a D/A converter (not shown).

Fig. 4 illustrates the software architecture of the mobile phone 1. The software architecture comprises an operating system, in a preferred embodiment the Symbian™ 7.0 OS that provides the platform for the native software. The native software comprises a number of native applications of which a few can be mentioned: User interface, KVM support, a call handling, phone book, message handling and a MIDlet database. The listed native applications are, however, merely exemplary, there could be more as well as fewer native applications.

A Connected Limited Device Configuration (CLDC) provides the runtime environment for Java™ applications. CLDC is one of the most appropriate configurations for mobile phones available for Java™, since it is tailored for devices with 160-512 KB memory battery powered, slow, possibly intermittent, connection.

The CLDC comprises a K Java™ Virtual Machine (KVM) and a set of libraries and Application Program Interfaces (APIs). The libraries and APIs are specified in the Mobile Information Device Profile (MIDP) sitting on top of the CLDC. The MIDP is a vertical extension of CLDC. Together they provide a run-time environment for Java™ Applets and MIDlets (MIDlet: an application written for the Mobile Information Device profile (MIDP)) on the mobile phone concerned.

The MIDlets are in code that is created by a Java™ compiler. This code can be run on any platform that has a KVM installed. A MIDlet will run the same in any KVM, regardless of the hardware and software underlying the system. The MIDLETS are therefore ideal for extending

the functionality of mobile phones, also because their relatively small size renders them suitable for downloading to the phone. In the present embodiment, a calculator MIDlet and two other MIDlets X2 and X3 have been downloaded to the mobile phone 1. The MIDlets co-exist with other applications on the mobile phone 1 such as the Original Equipment Manufacturer (OEM) Specific Applications. In the present embodiment a Java™ xhtml micro browser applet has been installed by the OEM.

The message handling application is capable of receiving, creating and sending text messages in the SMS standard (Short Message Service (SMS) part of the Global System for Mobile communications (GSM) digital standard - well known in the art). The message handling application may also be able to handle other message formats for exchanging information between mobile phones/servers such as the more recent MIME (Multipurpose Internet Mails Extensions) and MMS (Multimedia Messaging Service) standards. The message handling application may run in the native software or in an application run by the virtual machine.

The mobile phone 1 can send and receive data using the General Packet Radio Service (GRPS) for e.g. downloading MIDlets or other applications and is Wireless Application Protocol (WAP) enabled. A micro-browser written in Java™ is one of the OEM-specific applications.

The present invention provides for a new SMS message type in which the message header contains a MIDlet identifier and an address at which the identified MIDlet can be downloaded from a server that is connected to the wireless cellular network. This header is in addition the now-standard SMS header and the user data header. The message body contains the data to be used by the

identified MIDlet. The new SMS message type will be referred to hereafter as a Java-message (J-SMS).

The syntax of the J-SMS in a preferred embodiment is as follows:

<sms>::=

<sms-header>

<sms-data>

<sms-header>::= standard sms header described somewhere else

<sms-data>::

<user-data-header>

<user-data>

<user-data-header>::= user data header as described in smart messaging specification

<user-data>::=

<j-sms-header>

<j-sms-data>

<j-sms-header>::=

<j-sms-header-length>

<j-sms-version>

<j-sms-flags>

<j-sms-uris>

<j-sms-certificates>

<j-sms-header-length>::=two bytes giving the length of the j-sms header

<j-sms-version>::=one byte with the version of the j-sms protocol (01)

<j-sms-flags>::=one byte with flags for the message. Sum of the following:

1: the message includes certificates and a checksum

2: the message can be displayed as text

4: the message can be discarded if not able to display

<j-sms-uris>::=

<number of uris>

*<uri_s>**

<number of uris>::=one byte with the number of uris

<uri_s>::=uri's terminated with \n

<j-sms-certificates>

<checksum>

*<certificate>**

<checksum>::=checksum of the whole user data block (user data header plus user data) excluding this checksum

<certificate>::=certificate in base64 encoding terminated by \n

<j-sms-data>::=data that is to be transferred to the MIDlet

An example of a J-SMS in accordance with a preferred embodiment of the present invention in the form of an application port addressing scheme as defined in GSM 03.40 is listed below:

Octet Number	Value	Description
1	0B	Length of the User Data Header
2	05	Information Element Identifier (IEI; application port addressing scheme, 16-bit port address)
3	04	Information Element Data Length (IEDL)
4 - 5	2136	Information Element Data (octets 4 & 5 → 2136 - destination port)

6 - 7	00 00	Information Element Data (octets 6 & 7 → 0000 - originator port)
8	00	Information Element Identifier (IEI; concatenated short message, 8-bit reference number)
9	03	Information Element Data Length (IEDL; 3 octets)
10	01	Information Element Data (concatenated short message reference number)
11	02	Information Element Data (total number of concatenated messages (0-255))
12	01	Information Element Data (sequence number of current short message)
13	30	MIDlet message version number. ISO-8859-1 character "0"
14	00	Message flags where the following bits have the meaning: 1. message includes certificate 2. message data can be displayed as text 3. message can be discarded if not able to display 4. reserved for future use.
15	01	Number of following URIs
16..	"http://www.d2.de/greetingcard.jat"	The URI of the MIDlet used to display the content. Terminated by a newline (0x0A) character.
..	http://www.d2.de/greeting/picture1.jpg "Hi there, how are you doing ?".	MIDlet message data in a format defined only by the MIDlet.

The port number in octet 4-5 defines the SMS message type. The number used in this example is arbitrary and has not been reserved for the message type according to the present invention. Regular port numbers are reserved in the NBS port number space at the Internet Assigned Numbers Authority (IANA).

Octets 1 to 12 are in use in conventional SMS types, and for further information on their function reference is made to the GSM 03.40 specification, hereby incorporated by reference.

Octet 13 identifies the MIDlet message version number.

Octet 14 contains message flags where the following bits have the meaning:

1. message includes certificate
2. message data can be displayed as text
3. message can be discarded if not able to display
4. reserved for future use.

Octet 15 defines the number of Uniform Resource Identifiers (URIs) contained in the message. Octet 16 contains the first URI, followed by the message body with the data to be used by the identified MIDlet.
The message handling application detects the message type through the port number in octet 4-5. If the port number is (in present example) 2136 (HEX) the message is treated as a J-SMS. SMS messages with other port numbers in octet 4-5 are handled by the message handling application in the respective intended way, which is though not described here since this other types of the message handling are well known from e.g. the SMART MESSAGING SPECIFICATION, Revision 3.0.0, 2000-12-18, hereby incorporated by reference.

The MIDlet to be executed upon receipt of the message is defined by the URI in octet 16. The data to be used during the execution of the identified MIDlet is contained in the message body in the following octets. The data may comprise image files, formatted text files, audio files database files, or any other type of file executable on the terminal, or it may contain links to

such files. Referring to the table, greeting card MIDlet identified in octet 16 is needed to display the greeting card which includes an image file and associated text. The greeting card image file "picture1.jpg" is provide by an identification of the URI "http://www.d2.de/greeting/picture1.jpg," and the accompanying text "Hi there, how are you doing?" is provided as a text file within the message itself.

The following example illustrates the practical application of the J-SMS type messages. A first mobile subscriber A wishes to send his friend, mobile subscriber B, an e-postcard. Subscriber A visits the WAP-site of a postcard server 25 using the micro browser on his mobile phone 1. There, he selects the type of e-postcard to be sent, e.g. the graphics, accompanying tune, animation, font type, color, etc. The server 25 prompts subscriber A to enter a message text, that may or may not be used in combination with text integrated in the selected e-postcard. The server 25 also prompts subscriber A to enter the intended recipient's name and phone number. When the server 25 has received these data and an accept from subscriber A it sends a J-SMS to subscriber B. The header of the J-SMS contains an identifier for a postcard displaying MIDlet, and an address where the postcard displaying MIDlet can be downloaded from a server, in this case a MIDlet server 26, but it could just as well have been the postcard server 25. The URI serves as MIDlet identifier and as download address.

The postcard displaying MIDlet is an application that displays the postcard as selected and composed by subscriber A correctly on any mobile device with a Java™ Virtual Machine. The postcard contains text and may contain graphics, backgrounds, animations, music, etc.

The message body contains the data for the postcard displaying MIDlet.

Fig. 5 is a flowchart that illustrates the procedure after dispatch of the J-SMS (step 51). Upon receipt of the J-SMS by the mobile phone 1 of subscriber B (step 52) the message handling application saves the message and examines the message header (step 53), parsing the message header for the information indicated in table above. Then, the message handling application determines the message type by checking the port number in octets 4-5 (step 54).

If the message is not a J-SMS, but e.g. a profile or a text message, the message handling application handles the message accordingly (step 55), as is well-known in the art and therefore not further explained here.

If the message handling application finds port number 2136 (HEX) in octet 4-5 the message is handled as a J-SMS. The message handling application reads the first URI included in the message. The URI serves as the MIDlet identifier. The mobile phone 1 maintains a small MIDlet database (one of the native applications) that lists the URIs of all the MIDlets that have been downloaded to the phone. The URI of OEM installed MIDlets is preferably also listed in the MIDlet database. The message handling application checks the MIDlet database for the presence of the URI included in the header (step 56).

After checking the MIDlet database, the message handling application can determine (step 57) if the identified MIDlet, in this example the postcard displaying MIDlet, is available on the mobile phone 1.

If the identified MIDlet is available, the message handling application starts the postcard displaying MIDlet (step 58). The message handling application then sends the data in the message body to the postcard displaying MIDlet (step 59) which uses it to display the postcard as selected and composed by subscriber A, including the image on the picture1.jpg file and the personal text "Hi there, how are you doing?" (step 59A in Figure 5).

If the URI identified MIDlet was not found in the MIDlet database in step 56, the message handling application connects e.g. via GPRS to the address in the URI at which the identified midlet can be downloaded and downloads the identified MIDlet. In this example the postcard displaying MIDlet is downloaded from the MIDlet server 26 (step 60). In the download request the message handling application may provide information about the requesting phone. The MIDlet sever 26 uploads the postcard handling MIDlet to the mobile phone 1.

Next, the message handling application adds the URI of the downloaded MIDlet to the MIDlet database and verifies that the certificate accompanying the MIDlet is signed and issued by an recognized certificate authority to ensure the integrity of the MIDlet (step 61).

A certificate issued by a recognized certificate authority is added to the signed MIDlet. The carrier, or the software developer, creates a signing-key pair and obtains a certificate from a recognized certificate authority. The carrier or developer computes a signature of the MIDlet suite JAR, then places that signature and the corresponding certificate in the application descriptor.

The signed MIDlet suite assures the user that the contents of the MIDlet suite have not been tampered with, and that the MIDlet suite comes from an trusted source. The MIDP implementation on the device can verify the identity of the developer by verifying the developer's signature. It can use the developer's public key added to the Java Application Descriptor (JAD) to verify the integrity of the MIDlet suite itself. For further details on the certification of MIDlets reference is made to the MIDP 2.0 specification (hereby incorporated by reference).

The MIDlet is then handled in accordance with the permission levels indicated in the certificate. The permissions may comprise allowed permissions and user permissions (the ones for which the user will be consulted). The permission levels are stepped in the following order: Network operators (highest level), OEM (mid level), signed but not by Network operator or OEM (lowest level). Depending on these levels the phone prompts for permission for sensitive operations to e.g. opening an HTTP connection, to delete or change phone numbers, etc.

After the certificate verification the message handling application starts the postcard displaying MIDlet (step 58), sends the data in the message body to the postcard displaying MIDlet (step 59) and the postcard is displayed.

The procedure can be repeated if subscriber B replies by sending an e-postcard back to subscriber A, a function that may be built into the postcard displaying application. Otherwise, the message handling application ends in step 62.

There can be more than one MIDlet identifier (URI) included in a single J-SMS. The message application will execute the identified MIDlets in the order in which they are listed in the J-SMS. In the above example the URI has been used both to identify the MIDlet and to provide the address at which the MIDlet can be downloaded. It is however possible to use a separate identifier and address. The MIDlet that is started by the J-SMS may also download further information or other data.

Another example of the use of the present invention is illustrated in Fig. 6 with the following scenario. An e-mail provider wishes to send e-mail messages to mobile subscribers. The standard SMS e-mail message is not sufficient for the operator's requirements because more features should be implemented e.g. starting an xhtml browser to read the e-mail, displaying the header of the new received e-mail, displaying the provider logo, showing an in-tray with received e-mails in every user's e-mail folder. After receipt of an e-mail intended for a mobile subscriber, the operator's e-mail server 27 sends a J-SMS that starts a MIDlet that displays the text "e-mail received" on the display of the mobile phone together with an audible notification and prompts the user if the e-mail should be opened. If the user affirms but the required enhanced e-mail MIDLET (an xhtml Java™ browser) is not installed on the user's mobile phone, the mobile phone requests a download of the enhanced e-mail MIDlet from the URI listed in the e-mail message, processes the download to install the enhanced e-mail MIDLET, and thereafter executes the enhanced e-mail MIDLET to process the e-mail data. The xhtml browser exchanges e-mail data via GPRS between the mobile phone 1 and the e-mail server 27 and displays the e-mail data. The xhtml browser operates as a sophisticated e-mail client that offers the user more flexibility and comfort

than the simple e-mail displaying capacities of conventional SMS. The steps of requesting the MIDlet from the MIDlet server and the subsequent download as shown in Fig. 6 are bypassed if the xhtml browser MIDlet is already available on the mobile phone 1.

A further example of the use of the present invention is illustrated in Fig. 7 with the following scenario. A network operator wishes to offer a new service to its customers. This new service sends special offers from the operator's web-shop to the mobile phone of the customers. This service is realized by the provider sending J-SMSs including name, price and description (photo) of the offered items from its web-shop server (e.g., block 28 of Figure 1). The J-SMS includes an identifier of an advertisement displaying MIDlet that displays this information in a clean way, stores past offers for reference and allows the subscriber to order the items at the web-shop. The steps of requesting the MIDlet from the MIDlet server and the subsequent download as shown in Fig. 7 are bypassed if the advertisement displaying MIDlet is already available on the mobile phone 1.

The integrity verification does not need to be exclusively applied to the MIDlets, it can also be implemented in the J-SMS itself by adding a certificate from a recognized certificate authority and an encrypted checksum of the whole message to the J-SMS. The validity of the certificate can be verified by opening the signature with the public key that is included in the J-SMS. In this embodiment of the J-SMS the verification can be carried out before downloading the MIDlet concerned. Thus, some unnecessary downloads of uncertified MIDlets can be avoided.

As illustrated above, the messaging system provides a message format for use in a mobile phone system wherein mobile phones are capable of running a variety of applications to process a variety of files, and are capable of running a message handling application for receiving messages. The message format comprises a header portion for identifying the message to the message handling application and a message data portion. The message data portion further comprises (1) a message data file portion which may optionally contain message text files, message images, message audio, message database files or the like, or identification of message files and locations from which said message files or the like may be downloaded to the phone, as desired by the originator of the message and (2) a message data header portion which contains an identification for any application needed in order to process files contained or identified in the message data file portion, and also contains information regarding locations from which said application may be downloaded to the phone. In addition, the message format may comprise a user data header according the SMS specification, and various other headers as dictated by the particular message contents.

Although the present invention has been described in detail for purpose of illustration, it is understood that such detail is solely for that purpose, and variations can be made therein by those skilled in the art without departing from the scope of the invention. The message type is not limited to the SMS standard, and may be implemented in MMS or EMS standards. The applications that are executed after receipt of a message do not need to be MIDlets, they could just as well be Java™ applets or other applications in platform independent code. The platform independent runtime environment does not need to be Java™ based, other runtime environments for platform

independent code can be used. Thus, while the preferred embodiments of the devices and methods have been described in reference to the environment in which they were developed, they are merely illustrative of the principles of the inventions. Other embodiments and configurations may be devised without departing from the scope of the appended claims.

CLAIMS:

1. A method of handling incoming messages received on a mobile communication terminal via a wireless network, the terminal having native software and a virtual machine capable of executing platform independent object code, comprising the steps of:

receiving and storing a message that comprises a header and a message body, the header containing an identifier for an application in platform independent object code that can be executed by the virtual machine,

verifying if the identified application is available on the terminal, and

starting the identified application when available on the terminal

2. A method according to claim 1, wherein the header further contains an address at which the identified application can be downloaded from a server that is accessible through the wireless network, and further comprising the steps of:

connecting to the terminal to the server at the address contained in the header and downloading the identified application when the identified application was not available on the terminal, and

starting the identified application when downloaded.

3. A method according to claim 1, wherein the message body contains data to be used by the identified application.

4. A method according to claim 2, wherein the message body contains data to be used by the identified application.

5. A method according to claim 3, wherein the message body contains greeting card data that is to be used by a greeting card displaying application identified in the header.

6. A method according to claim 4, wherein the message body contains greeting card data that is to be used by a greeting card displaying application identified in the header.

7. A method according to claim 3, wherein the message body contains phone number data that is to be used by a phonebook updating application identified in the header.

8. A method according to claim 4, wherein the message body contains phone number data that is to be used by a phonebook updating application identified in the header.

9. A method according to claim 3, wherein the message body contains e-mail data that is to be used by an e-mail displaying application identified in the header.

10. A method according to claim 4, wherein the message body contains e-mail data that is to be used by an e-mail displaying application identified in the header.

11. A method according to any of claims 1 to 10, wherein the platform independent object code is Java™, preferably in the Java™ 2, Micro Edition format.

12. A method according to any of claims 1 to 10, wherein the virtual machine is a Java Virtual Machine, preferably a K Virtual Machine™ (KVM) .

13. A method according to any of claims 1 to 10, wherein the identified application is a MIDlet.

14. A method according to any of claims 1 to 10, further comprising the step of verifying the certification of the identified application.

15. A mobile communication terminal for operation with a wireless network, the terminal having:

native software,

a virtual machine capable of executing platform independent object code,

a message handling application in the native software or in an application under the virtual machine, the message handling application being capable of sending and receiving messages via the wireless network, and

the message handling application being programmed to start an application written in the independent object code when a corresponding identifier is contained the header of a received message.

16. A mobile communication terminal according to claim 15, wherein the message handling application is programmed to download the identified application from a server that is accessible via the wireless network at an address contained in the header when the identified application is not already available on the terminal.

17. A mobile communication terminal according to claim 15, wherein the platform independent object code is Java™, preferably in the Java™ 2, Micro Edition format.

18. A mobile communication terminal according to claim 17, wherein the virtual machine is a Java™ Virtual Machine, preferably a K Virtual Machine™ (KVM).

19. A mobile communication terminal according to any of claims 15 to 18, wherein the identified application is a MIDlet.

20. A mobile communication terminal according to any of claims 15 to 18, wherein the message handling application is programmed to verify the certification of the downloaded application.

21. A mobile communication terminal according to any of claims 15 to 18, wherein the message application is programmed to send the data in the message body to the identified application.

22. A mobile communication terminal according to any of claims 15 to 18, further comprising an application identifier database listing the identifiers of all the applications in platform independent object code that are available on the terminal.

23. A message for transmission through a wireless network to a mobile communication terminal, the terminal having native software and a virtual machine capable of executing applications in platform independent object code, the message having a syntax comprising:

a header part, and

a message body part,

the header containing an identifier for an application in platform independent object code to be executed by the virtual machine on the mobile communication terminal that receives the message.

24. A message according to claim 23, wherein the header includes an address at which the identified application can be downloaded from a server that is accessible through the wireless network.

25. A message according to claim 23 or 24, wherein the message header contains a URI that serves as identifier and contains the address at which the identified application can be downloaded from a server.

26. A message according to any of claims 23 or 24, wherein the message body contains data to be used by the identified application.

27. A message according to any of claims 23 or 24, wherein the message is an SMS message with a port address in octets 4-5 that identifies it as a message containing an identifier for an application to be started upon receipt of the message.

28. A message according to any of claims 23 or 24, wherein the identified application is a Java™ applet or a MIDlet, preferably in the Java™ 2, Micro Edition, Mobile Information Device Profile (MIDP) format.

29. A message according to any of claims 23 or 24, further containing a signed certificate issued by a recognized certification authority that includes a public key from the signatory.

30. A method of enabling an application in platform independent object code to be run on a mobile communication terminal comprising the steps of:

sending a message from a server via the wireless network to the mobile communication terminal that is provided with a virtual machine capable of executing applications in platform independent object code, the message containing:

a header with an identifier for the application to be executed by the virtual machine and

a message body with the data to be used by the identified application.

31. A method according to claim 30, wherein the message header further contains an address at which the identified application can be obtained from a server that is accessible through the wireless network, further comprising the step of:

uploading the identified application to the mobile communication terminal when the mobile terminal connects to the server at the address contained in the header.

32. A method according to claim 30, wherein the server that uploads the identified application is not the same as the server sending the message.

33. A method according to claim 30, wherein the uploaded application is a MIDLet, preferably in the Java™ 2, Micro Edition, Mobile Information Device Profile (MIDP) format.

34. A message format for use in a mobile phone system wherein mobile phones are capable of running a variety of applications to process a variety of files, and are capable of running a message handling application for receiving messages, said message format comprising:

a header portion for identifying the message to the message handling application;

a message data portion, said message data portion further comprising;

a message data file portion which may optionally contain message text files, message images,

message audio, message database files or the like, or identification of message files and locations from which said message files or the like may be downloaded to the phone, as desired by the originator of the message; and

a message data header portion, wherein said message data header portion contains an identification for any application needed in order to process files contained or identified the message data file portion, and also contains information regarding locations from which said application may be downloaded to the phone.

35. A method of transmitting messages to a mobile phone in a mobile phone system wherein mobile phones are capable of running a variety of applications to process a variety of files, and are capable of running a message handling application for receiving messages; said method comprising the steps of:

creating a message in a message format comprising:

a header portion for identifying the message to the message handling application

a message data portion, said message data portion further comprising;

a message data file portion which may optionally contain message text files, message images, message audio, message database files or the like, or identification of message files and locations from which said message files or the like may be downloaded to the phone, as desired by the originator of the message; and

a message data header portion, wherein said message data header portion contains an

identification for any application needed in order to process files contained or identified the message data file portion, and also contains information regarding locations from which said application may be downloaded to the phone; and

transmitting the message to a mobile phone.

36. A method of operating a mobile phone comprising;

programming the phone to receive messages having a format such that the messages comprise an SMS header portion and an SMS data portion, wherein the SMS data portion comprises a first portion comprising message handling information and a second portion comprising message data for eventual display to the mobile phone user, wherein the message handling information comprises information identifying an application needed to display the message data or otherwise process the message data with an application, and information identifying a location from which the application may be downloaded to the phone; and wherein the message data comprises message files comprising message text files, message images, message audio, message database files or the like, or identification of locations from which said message files or the like may be downloaded to the phone;

further programming the phone to determine if the application needed to display or otherwise use the message data is installed on the phone, and, if not, to download the application from the

location identified in the message handling information;

further programming the phone to display or otherwise use the message files or the like if they are already in the message data, or, if not, to download the message files from the locations identified in the message data;

operating the phone to receive a message, and thereafter operating the phone to determine if the application needed to use the message files is installed on the phone, and, if not, to download the application; and thereafter operating the phone to display or otherwise use the message files if they are contained in the message data, and, if not, to download the message files from the location identified in the message data and thereafter display or otherwise use the message files.

37. The message format of claim 34 wherein the messages are provided in an SMS format.

38. The message format of claim 34 wherein the messages are provided in an MMS format.

39. The message format of claim 34 wherein the messages are provided in an EMS format.

40. The method of claim 35 or 36 wherein the messages are provided in an SMS format.

41. The method of claim 35 or 36 wherein the messages are provided in an MMS format.

42. The method of claim 35 or 36 wherein the messages are provided in an EMS format.

43. The message format of claim 34 wherein the message header is an SMS header, and wherein the message format further comprises a user data header.

44. The method of claim 35 further comprising creating the message in a message format comprising a user data header.

45. The method of claim 36 wherein the message header is an SMS header, and wherein the message format further comprises a user data header.

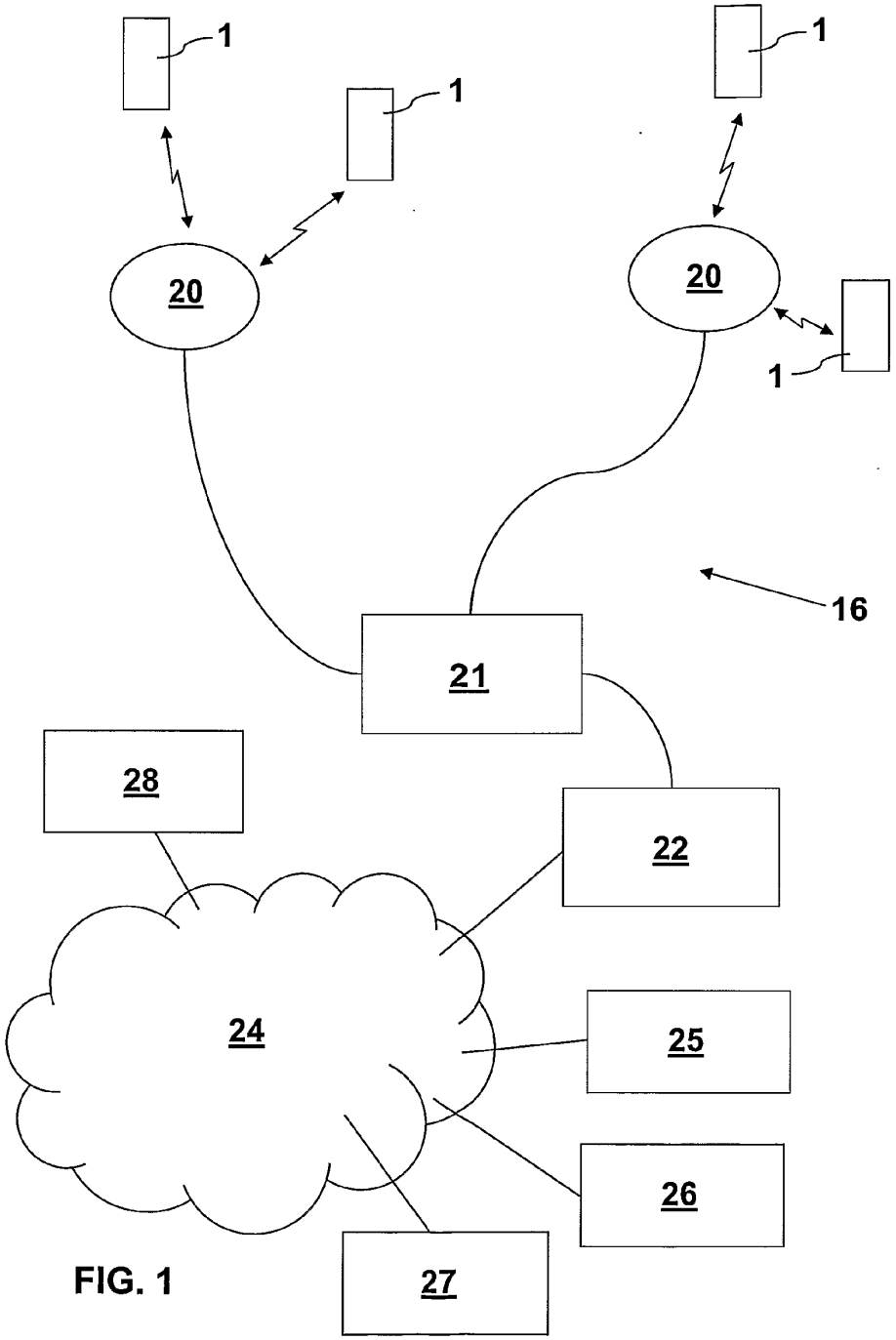


FIG. 1

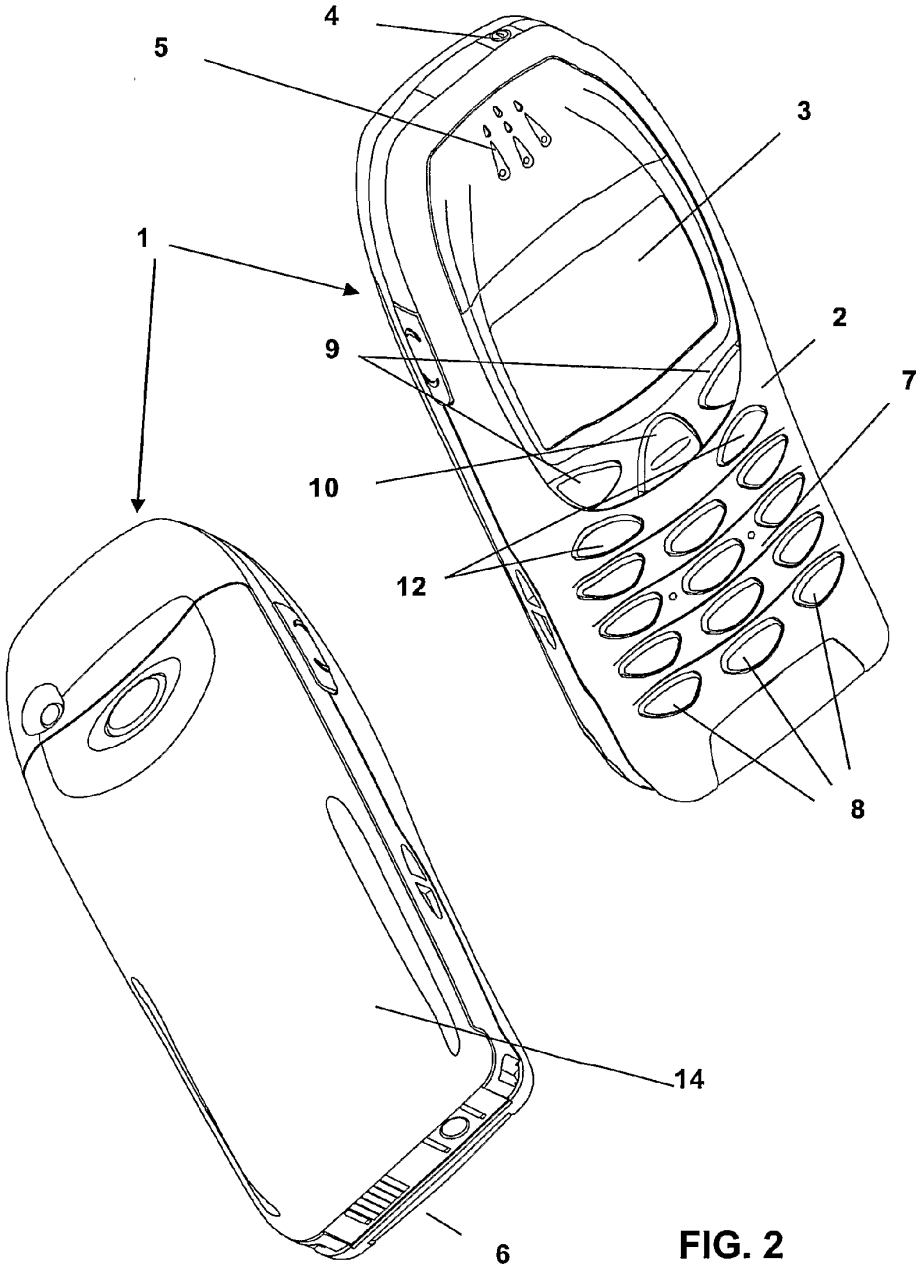


FIG. 2

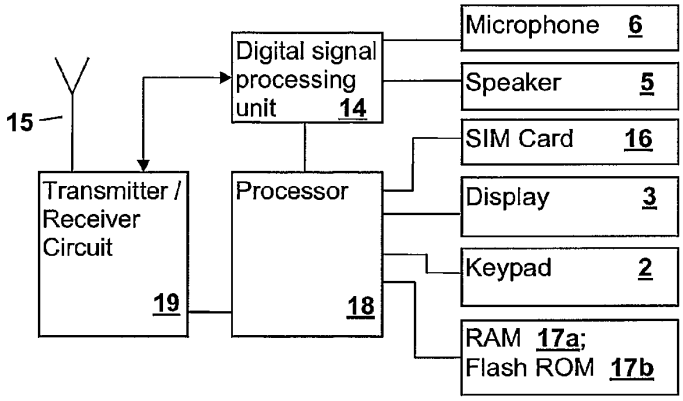

15
Digital signal processing unit 14
Microphone 6
Speaker 5
SIM Card 16
Display 3
Keypad 2
RAM 17a; Flash ROM 17b
Transmitter / Receiver Circuit 19
Processor 18

FIG. 3

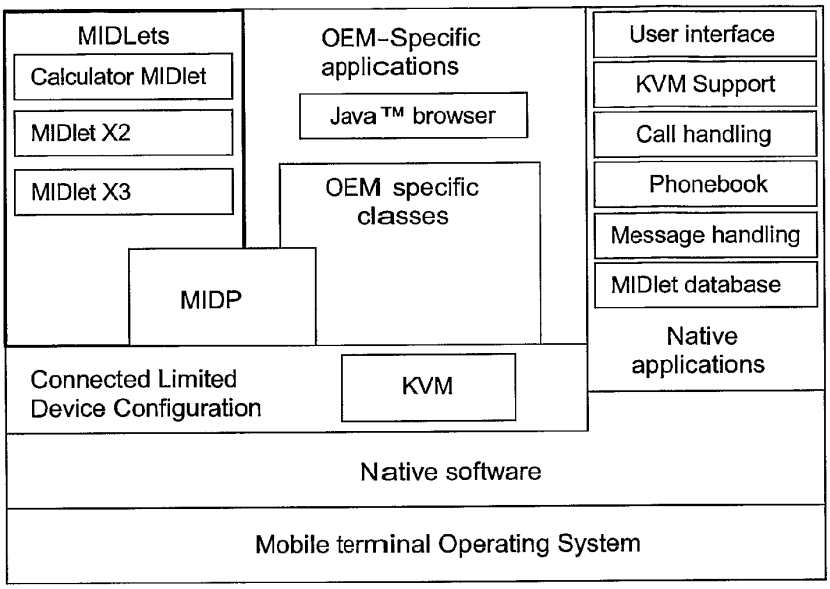

MIDLets
Calculator MIDlet
MIDlet X2
MIDlet X3
OEM-Specific applications
Java™ browser
OEM specific classes
MIDP
User interface
KVM Support
Call handling
Phonebook
Message handling
MIDlet database
Native applications
Connected Limited Device Configuration
KVM
Native software
Mobile terminal Operating System

FIG. 4

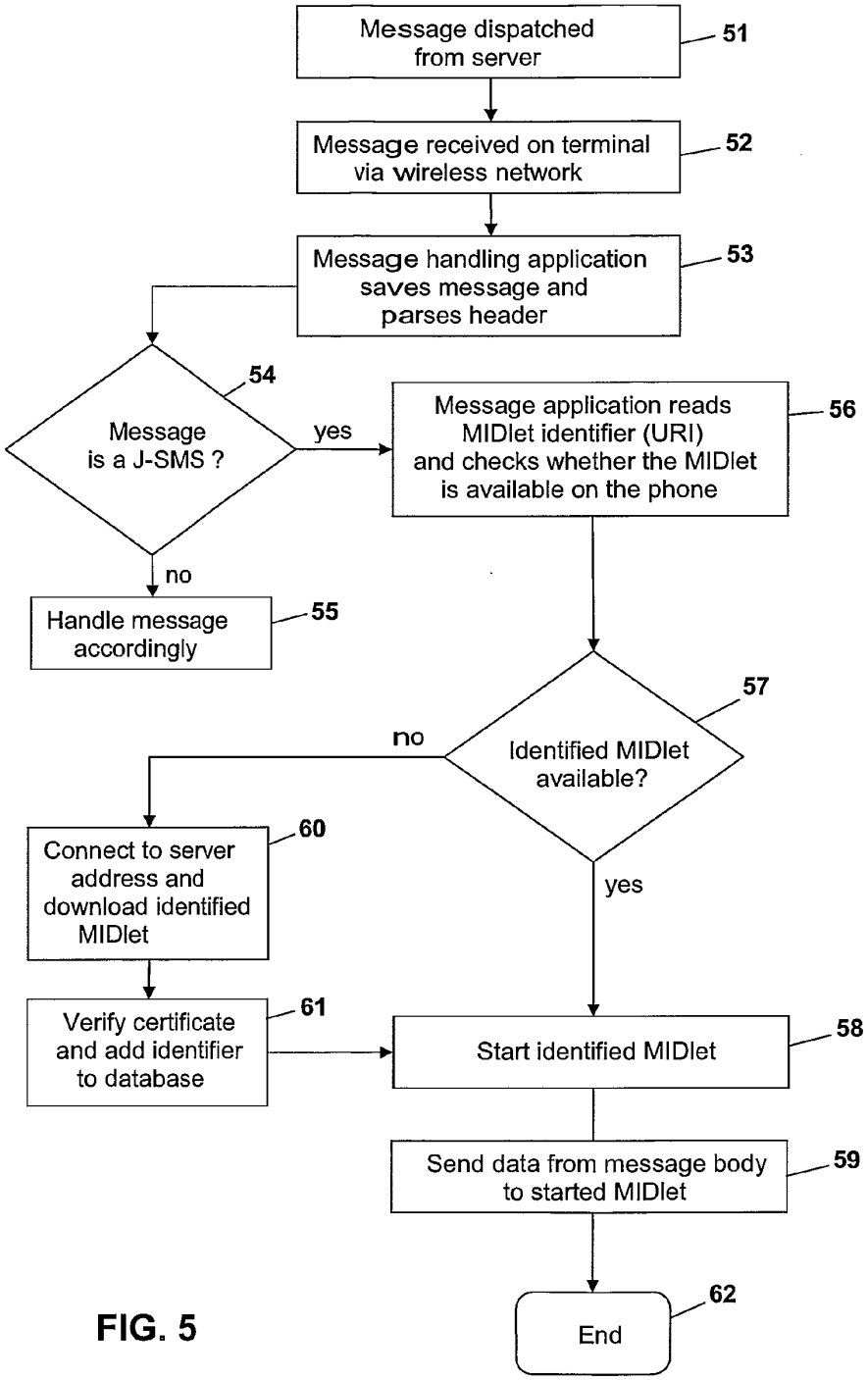

Message dispatched from server
51
Message received on terminal via wireless network
52
Message handling application saves message and parses header
53
54
Message is a J-SMS ?
yes
Message application reads MIDlet identifier (URI) and checks whether the MIDlet is available on the phone
56
no
Handle message accordingly
55
57
Identified MIDlet available?
no
yes
Connect to server address and download identified MIDlet
60
Verify certificate and add identifier to database
61
Start identified MIDlet
58
Send data from message body to started MIDlet
59
End
62

FIG. 5

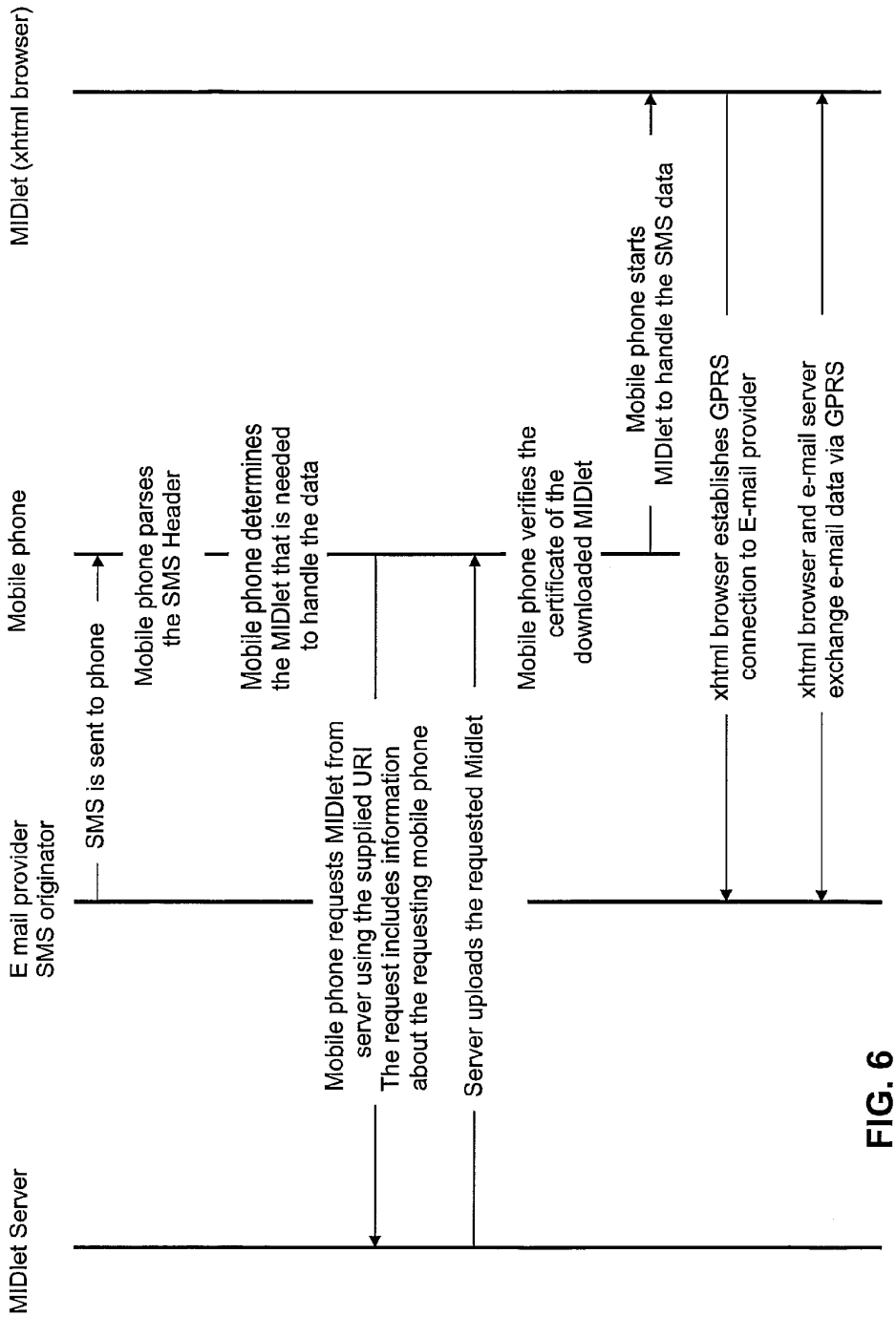

MIDlet Server
E mail provider
SMS originator
Mobile phone
MIDlet (xhtml browser)
SMS is sent to phone
Mobile phone parses the SMS Header
Mobile phone determines the MIDlet that is needed to handle the data
Mobile phone requests MIDlet from server using the supplied URI
The request includes information about the requesting mobile phone
Server uploads the requested Midlet
Mobile phone verifies the certificate of the downloaded MIDlet
Mobile phone starts MIDlet to handle the SMS data
xhtml browser establishes GPRS connection to E-mail provider
xhtml browser and e-mail server exchange e-mail data via GPRS

FIG. 6

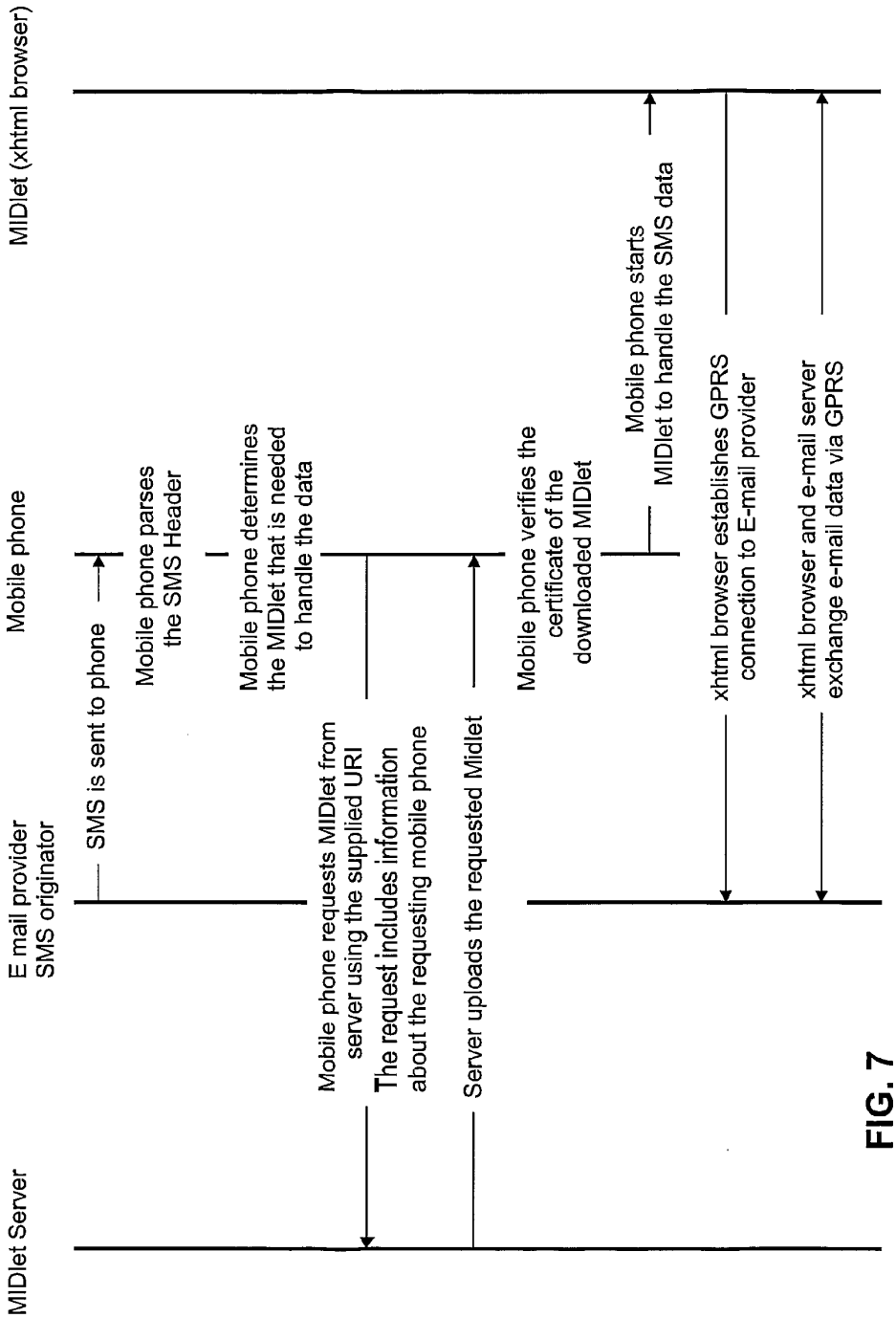

MIDlet Server
E mail provider
SMS originator
Mobile phone
MIDlet (xhtml browser)
SMS is sent to phone
Mobile phone parses the SMS Header
Mobile phone determines the MIDlet that is needed to handle the data
Mobile phone requests MIDlet from server using the supplied URI
The request includes information about the requesting mobile phone
Server uploads the requested Midlet
Mobile phone verifies the certificate of the downloaded MIDlet
Mobile phone starts MIDlet to handle the SMS data
xhtml browser establishes GPRS connection to E-mail provider
xhtml browser and e-mail server exchange e-mail data via GPRS

FIG. 7

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2004/013101

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04Q7/32

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 7 H04Q

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, WPI Data, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 98/34422 A (NOKIA MOBILE PHONES LIMITED; WELLS, MARK; HUBER, ROLF) 6 August 1998 (1998-08-06) page 5, line 4 - line 17 page 15, line 5 - page 17, line 2 page 27, line 7 - last line figure 4 ----- -/--	1,3,5,7, 9,11-15, 17-23, 26-30, 32,33

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in 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 document 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

"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
11 March 2005	30/03/2005

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Müller, N

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Form PCT/ISA/210 (second sheet) (January 2004)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2004/013101

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	SONERA MEDIALAB: "Mobile Java Application Development White Paper" 'Online! 12 September 2002 (2002-09-12), , XP002320888 Retrieved from the Internet: URL:http://www.medialab.sonera.fi/workspace/MobileJavaAppDevelopment.pdf> 'retrieved on 2005-03-10! Chapters 1 and 2 -----	1,3,5,7, 9,11-15, 17-23, 26-30, 32,33
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A	US 2002/123335 A1 (LUNA MICHAEL E.S ET AL) 5 September 2002 (2002-09-05) page 1, paragraph 13 - paragraph 14 page 2, paragraph 16 page 2, paragraph 21 - paragraph 23 page 3, paragraph 27 figure 2 -----	1-45
A	US 2002/138545 A1 (ANDREAKIS DEAN W ET AL) 26 September 2002 (2002-09-26) page 1 - page 2, paragraph 10 page 2 - page 3, paragraph 19 page 3, paragraph 22 - paragraph 24 -----	1-45

2

Form PCT/ISA/210 (continuation of second sheet) (January 2004)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP2004/013101

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Form PCT/ISA/210 (patent family annex) (January 2004)

Electronic Acknowledgement Receipt	
EFS ID:	29176304
Application Number:	15287603
International Application Number:	
Confirmation Number:	1013
Title of Invention:	Enterprise Access Control and Accounting Allocation for Access Networks
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:	RALEP037D1C1
Receipt Date:	10-MAY-2017
Filing Date:	06-OCT-2016
Time Stamp:	18:05:10
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	Information Disclosure Statement (IDS) Form (SB08)	P037D1C1.pdf	1053952 b1049718b33fcd616ad5e172d035335dbfed79be	no	4
Warnings:					

Information:					
2	Foreign Reference	2093.pdf	3514622 c65fb898082d5782c1d6c4ab30f0d6f6ceb5ae6b	no	45
Warnings:					
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			Total Files Size (in bytes):	4568574	

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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
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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 15/287,603

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))	1 minus 20 =	*	x 40 =	0.00	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	1 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).			0.00			
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	730		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.

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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
15/287,603	10/06/2016	2642	800	RALEP037D1C1	1	1

CONFIRMATION NO. 1013

106963
Headwater Research LLC
1011 Pruitt Place
Tyler, TX 75703

UPDATED FILING RECEIPT

OC000000090086495

Date Mailed: 03/24/2017

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;
Alireza Raissinia, Saratoga, CA;
Jeffrey Green, Sunnyvale, CA;

Applicant(s)

Headwater Partners 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 14/578,124 12/19/2014 PAT 9565707
which is a DIV of 13/248,028 09/28/2011 PAT 8924469
which claims benefit of 61/387,243 09/28/2010
and is a CIP of 12/380,778 03/02/2009 PAT 8321526
and is a CIP of 12/380,780 03/02/2009 PAT 8839388
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
and said 12/380,780 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: 10/19/2016

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 15/287,603**

Projected Publication Date: 06/29/2017

Non-Publication Request: No

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

Enterprise Access Control and Accounting Allocation for Access Networks

Preliminary Class

455

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

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
15/287,603	10/06/2016	Gregory G. Raleigh	RALEP037D1C1

CONFIRMATION NO. 1013

106963
Headwater Research LLC
1011 Pruitt Place
Tyler, TX 75703

POA ACCEPTANCE LETTER

OC000000090086568

Date Mailed: 03/24/2017

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 03/21/2017.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/nton/

AMENDMENTS TO THE CLAIMS

1. (Canceled).

2. (New) A method of operating a wireless end-user device, the method comprising:

storing secure policy information indicative of an application-specific execution environment policy and a configurable communication security policy;

based on the secure stored information indicative of an application-specific execution environment policy, allowing a first set of multiple device application instances to run only in a first secure application environment on the wireless end-user device, and allowing a second set of device application instances to run only outside of the first secure application environment; and

based on the secure stored information indicative of a configurable communication security policy, initiate a first secure tunnel to a network tunnel endpoint, and direct all network data communications to and from device application instances executing in the first secure application environment through the first secure tunnel.

3. (New) The method of claim 2, wherein the configurable communication security policy defines a first configuration, which indicates that application instances in the second set of device application instances are not allowed to use the first secure tunnel, the method further comprising, based on the secure stored information indicative of a configurable communication security policy indicating the first configuration, directing all network data communications to and from device application instances executing outside of the first secure application environment through a network path outside of the first secure tunnel.

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	15287603
Filing Date	2016-10-06
First Named Inventor	Raleigh
Art Unit	2642
Examiner Name	not yet assigned
Attorney Docket Number	RALEP037D1C1

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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	Art Unit	2642
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	Attorney Docket Number	RALEP037D1C1

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	Art Unit	2642
	Examiner Name	not yet assigned
	Attorney Docket Number	RALEP037D1C1

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	Attorney Docket Number	RALEP037D1C1

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Attorney Docket Number	RALEP037D1C1

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	Art Unit	2642
	Examiner Name	not yet assigned
	Attorney Docket Number	RALEP037D1C1

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	Filing Date	2016-10-06
	First Named Inventor	Raleigh
	Art Unit	2642
	Examiner Name	not yet assigned
	Attorney Docket Number	RALEP037D1C1

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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Art Unit	2642
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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).

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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)	2017-03-21
Name/Print	James E. Harris	Registration Number	40013

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Filing Date	2016-10-06
First Named Inventor	Raleigh
Art Unit	2642
Examiner Name	not yet assigned
Attorney Docket Number	RALEP037D1C1

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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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	51	20050228985		2005-10-13	YLIKOSKI et al.	
	52	20050238046		2005-10-27	HASSAN et al.	
	53	20050246282		2005-11-03	NASLUND et al.	
	54	20050250508		2005-11-10	GUO et al.	
	55	20050254435		2005-11-17	MOAKLEY et al.	
	56	20050266825		2005-12-01	CLAYTON, Steve	
	57	20050266880		2005-12-01	GUPTA, Vivek G.	
	58	20060014519		2006-01-19	MARSH et al.	
	59	20060019632		2006-01-26	CUNNINGHAM et al.	
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	61	20060034256		2006-02-16	ADDAGATLA et al.	
	62	20060040642		2006-02-23	BORIS et al.	
	63	20060045245		2006-03-02	AARON et al.	
	64	20060048223		2006-03-02	LEE et al.	
	65	20060072646		2006-04-06	FEHER, Kamilo	
	66	20060085543		2006-04-20	HRASTAR et al.	
	67	20060112016		2006-05-25	ISHIBASHI, Yoshihito	
	68	20060143098		2006-06-29	LAZARIDIS, Mihal	
	69	20060165060		2006-07-27	DUA, Robin	
	70	20060178917		2006-08-10	MERRIAM et al.	
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	73	20060190314		2006-08-24	HERNANDEZ, Rick	
	74	20060199608		2006-09-07	DUNN et al.	
	75	20060206904		2006-09-14	WATKINS et al.	
	76	20060218395		2006-09-28	MAES, Stephane H.	
	77	20060233108		2006-10-19	KRISHNAN, Murali R.	
	78	20060233166		2006-10-19	BOU-DIAB et al.	
	79	20060236095		2006-10-19	SMITH et al.	
	80	20060242685		2006-10-26	HEARD et al.	
	81	20060258341		2006-11-16	MILLER et al.	
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	84	20070022289		2007-01-25	ALT et al.	
	85	20070036312		2007-02-15	CAI et al.	
	86	20070055694		2007-03-08	RUGE et al.	
	87	20070061243		2007-03-15	RAMER et al.	
	88	20070076616		2007-04-05	NGO et al.	
	89	20070093243		2007-04-26	KAPADEKAR et al.	
	90	20070100981		2007-05-03	ADAMCZYK et al.	
	91	20070101426		2007-05-03	LEE et al.	
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	95	20070140275		2007-06-21	BOWMAN et al.	
	96	20070198656		2007-08-23	MAZZAFERRI et al.	
	97	20070220251		2007-09-20	ROSENBERG et al.	
	98	20070226225		2007-09-27	YIU et al.	
	99	20070243862		2007-10-18	COSKUN et al.	
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	102	20070255848		2007-11-01	SEWALL et al.	
	103	20070259673		2007-11-08	WILLARS et al.	
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	107	20070294395		2007-12-20	STRUB et al.	
	108	20070298764		2007-12-27	CLAYTON, Steve	
	109	20080005285		2008-01-03	ROBINSON et al.	
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	112	20080039102		2008-02-14	SEWALL et al.	
	113	20080049630		2008-02-28	KOZISEK et al.	
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	121	20080066150		2008-03-13	LIM, Keng	
	122	20080082643		2008-04-03	STORRIE et al.	
	123	20080083013		2008-04-03	SOLIMAN et al.	
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	128	20080127304		2008-05-29	GINTER et al.	
	129	20080130534		2008-06-05	TOMIOKA, Tazuko	
	130	20080130656		2008-06-05	KIM et al.	
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	143	20080184127		2008-07-31	RAFEY et al.	
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	150	20080229385		2008-09-18	FEDER et al.	
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	162	20090013157		2009-01-08	BEAULE, Stephane	
	163	20090054030		2009-02-26	GOLDS, David	
	164	20090068984		2009-03-12	BURNETT, R. Alan	
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	177	20100042675		2010-02-18	FUJII, Hiroshi	
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	183	20100188990		2010-07-29	RALEIGH, Gregory G.	
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	196	20110126141		2011-05-26	KING et al.	
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Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ None

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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.

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	Attorney Docket Number	RALEP037D1C1

	7	2009-218773	JP		2009-09-24	Advanced Telecommunication Research Institute Inte		
	8	2006093961	WO		2006-09-08	Kyocera Wireless Corp.		
	9	2007-318354	JP		2007-12-06	Fujitsu Ten Ltd.		
	10	2007126352	WO		2007-11-08	Telefonaktiebolaget LM Ericsson		
	11	2009-212707	JP		2009-09-17	Fujitsu Ltd.		
	12	2008-301121	JP		2008-12-11	Kyocera Corp.		
	13	101335666A	CN		2008-12-31	Hangzhou H3C Technologies Co., Ltd.		
	14	101080055A	CN		2007-11-28	Tencent Technology (Shenzhen) Co., Ltd.		
	15	2009-232107	JP		2009-10-08	Fujitsu Ltd.		
	16	2009-111919	JP		2009-05-21	Kyocera Communications Systems		
	17	2009008817	WO		2009-01-15	Ericsson		

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15287603
	Filing Date	2016-10-06
	First Named Inventor	Raleigh
	Art Unit	2642
	Examiner Name	not yet assigned
	Attorney Docket Number	RALEP037D1C1

	18	2002045315	WO		2002-06-06	Micromuse		
	19	2009091295	WO		2009-07-23	Telefonaktiebolaget LM Ericsson		
	20	2002093877	WO		2002-11-21	Nokia Corp.		
	21	2006004784	WO		2006-01-12	Japan Communications Inc.		
	22	2005339247A	JP		2005-12-08	Secured Communications		
	23	2006155263A	JP		2006-06-15	NEC Corporation		
	24	1345154A	CN		2002-04-17	Datang Microelectronics Tech. Co.		
	25	2006-197137	JP		2006-07-27	NTT Docomo Inc.		
	26	2006-344007	JP		2006-12-21	Hitachi Ltd.		
	27	2005083934	WO		2005-09-09	Research In Motion Limited		
	28	2007120310	WO		2007-10-25	Qualcomm Inc.		

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	Filing Date	2016-10-06
	First Named Inventor	Raleigh
	Art Unit	2642
	Examiner Name	not yet assigned
	Attorney Docket Number	RALEP037D1C1

	29	2003017063	WO		2003-02-27	Apogee Networks		
	30	2002067616	WO		2002-08-29	Sonera Oyj		
	31	2011002450	WO		2011-01-06	Alcatel-Lucent USA Inc.		
	32	2003017065	WO		2003-02-27	Apogee Networks		
	33	1545114	EP		2005-06-22	Alcatel		
	34	1887732	EP		2008-02-13	Huawei Technologies Co., Ltd.		
	35	2007065	EP		2008-12-24	Huawei Technologies Co., Ltd.		
	36	2006-041989	JP		2006-02-09	Fujitsu Ltd.		
	37	1289326	EP		2003-03-05	Motorola, Inc.		

If you wish to add additional Foreign Patent Document citation information please click the Add button [Add]

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

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Filing Date	2016-10-06
	First Named Inventor	Raleigh
	Art Unit	2642
	Examiner Name	not yet assigned
	Attorney Docket Number	RALEP037D1C1

	1	Dixon et al., "Triple Play Digital Services: Comcast and Verizon (Digital Phone, Television, and Internet), August 2007	
	2	3rd Generation Partnership Project; "Technical Specification Group Services and System Aspects; IP Flow Mobility and seamless WLAN offlload; Stage 2," Release 10, Document No. 3GPP TS 23.261, V1.0.0, March 2010	
	3	3rd Generation Partnership Project, "Technical Specification Group Core Network and Terminals; Access Network Discovery and Selection Function (ANDSF) Management Object (MO)," Release 9, Document No. 3GPP TS 24.312, V9.1.0, March 2010	
	4	Ahmed et al., "Multi Access Data Network Connectivity and IP Flow Mobility in Evolved Packet System (EPS)," 2010 IEEE	

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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.

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	Application Number	15287603
	Filing Date	2016-10-06
	First Named Inventor	Raleigh
	Art Unit	2642
	Examiner Name	not yet assigned
	Attorney Docket Number	RALEP037D1C1

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.

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)	2017-03-21
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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	Raleigh et al.	Examiner:	not yet assigned
Serial No.:	15/287,603	Art Unit:	2642
Filed:	October 6, 2017	Conf. No.:	1013
Title:	Enterprise Access Control and Accounting Allocation for Access Networks		

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

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. 14/578,124 filed December 19, 2014 and U.S. Patent Application No. 13/248,028 filed September 28, 2011, of which the instant application is from the same direct family. Any foreign or non-patent references not submitted in that parent application 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: March 21, 2017

By: /James E. Harris/
James E. Harris
Reg. No. 40013
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 21, 2017 By: /Ann Taylor/
Ann Taylor

PTO/AIA/96 (08-12)
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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Headwater Research LLC

Application No./Patent No.: 15/287,603 Filed/Issue Date: 10/6/2016

Titled: Enterprise Access Control and Accounting Allocation for Access Networks

Headwater Research 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):

1. ☑ The assignee of the entire right, title, and interest.

2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):

   ☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

B. ☑ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: Inventors (Raleigh et al.) To: Headwater Partners I LLC

   The document was recorded in the United States Patent and Trademark Office at

   Reel 040049, Frame 0238, or for which a copy thereof is attached.

2. From: Headwater Partners I LLC To: Headwater Research LLC

   The document was recorded in the United States Patent and Trademark Office at

   Reel 041268, Frame 0108, or for which a copy thereof is attached.

This collection of information is required by 37 CFR 3.73(b). 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 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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STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

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5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

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6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

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☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☑ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[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/	2017-03-21
Signature	Date
James E. Harris	40013
Printed or Typed Name	Title or Registration Number

[Page 2 of 2]

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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.
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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

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 Research 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	January 3, 2017
Name	David R. Johnson	Telephone	650-517-2782
Title	Chief Financial 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.**

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EUROPEAN PATENT OFFICE

Patent Abstracts of Japan

PUBLICATION NUMBER : 2006041989
PUBLICATION DATE : 09-02-06

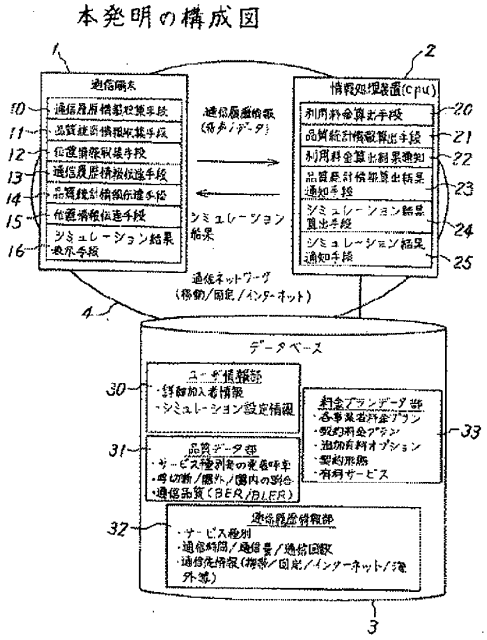
APPLICATION DATE : 28-07-04
APPLICATION NUMBER : 2004219784

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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BNSDOCID: <JP_____2006041989A_AJ_>

(19)日本国特許庁(JP)　(12)公開特許公報(A)　(11)特許出願公開番号
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)
(22)出願日　平成16年7月28日 (2004.7.28)

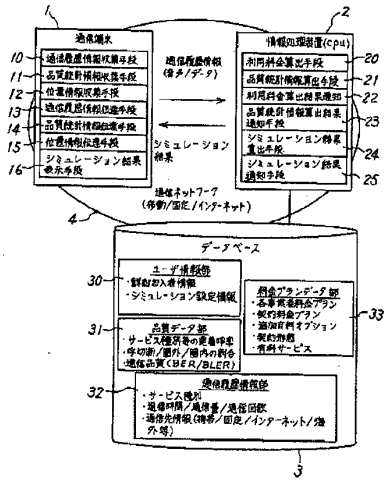
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(54)【発明の名称】料金プラン通知装置

(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



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【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。

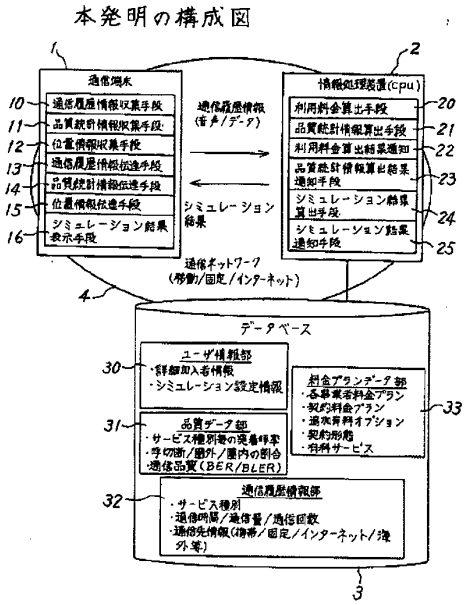
【符号の説明】

【0116】

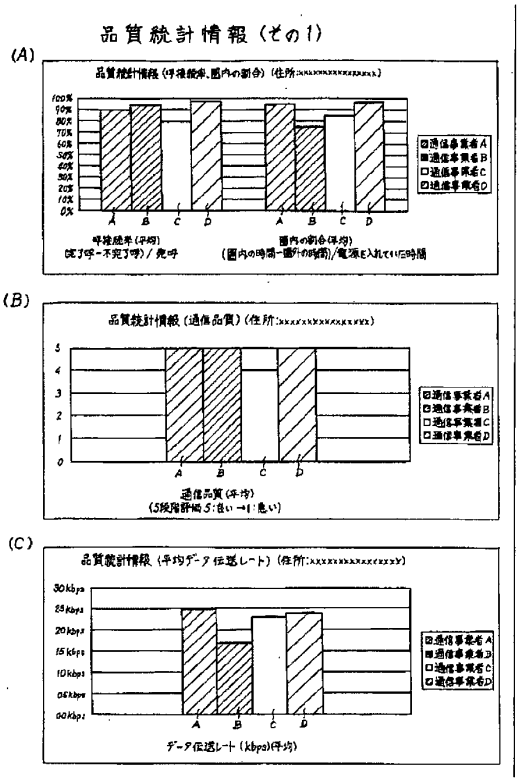
1　通信端末
2　情報処理装置
3　データベース
4　通信ネットワーク

BNSDOCID: <JP_____2006041989A__I_>

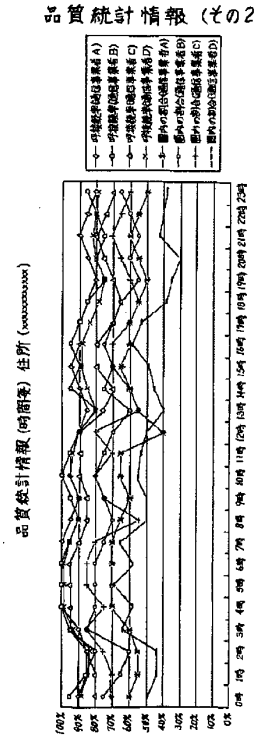
【図1】



【図2】



【図3】



BNSDOCID: <JP_____2006041989A__I_>

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Ｆターム(参考) 5K025 AA08　BB06　CC01　JJ02　JJ16　JJ18

BNSDOCID: <JP_____2006041989A__I_>

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 289 326 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
05.03.2003 Bulletin 2003/10

(51) Int Cl.7: **H04Q 7/32**

(21) Application number: **01402259.4**

(22) Date of filing: **30.08.2001**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

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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.

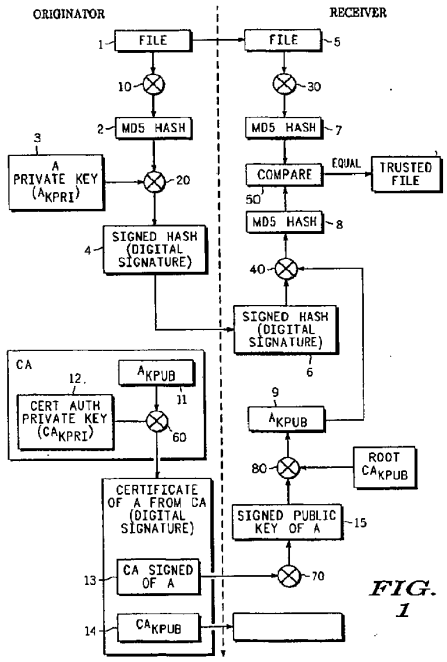


FIG. 1

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Printed by Jouve, 75001 PARIS (FR)

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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

BNSDOCID: <EP_____1289326A1_I_>

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.

BNSDOCID: <EP_____1289326A1_I_>

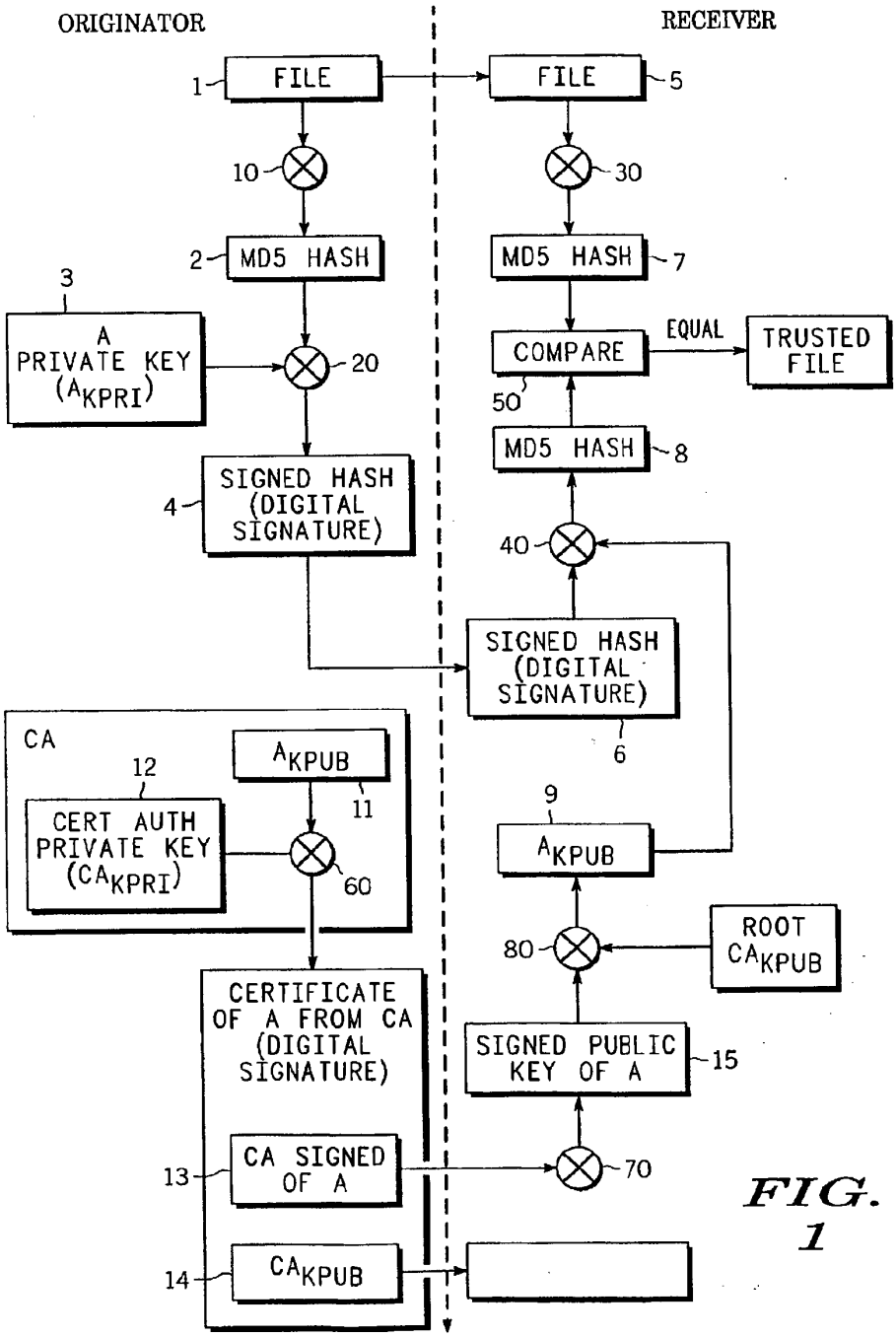


FIG. 1

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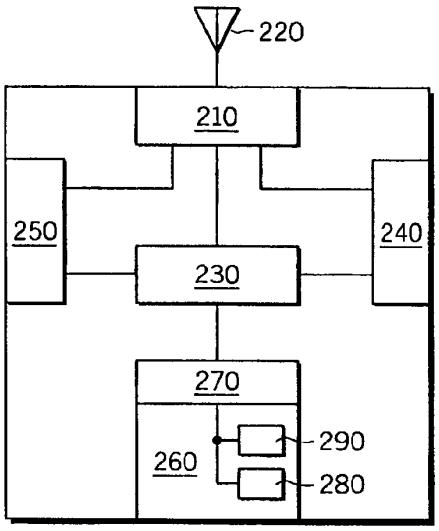


FIG. 2

BNSDOCID: <EP_____1289326A1_I_>

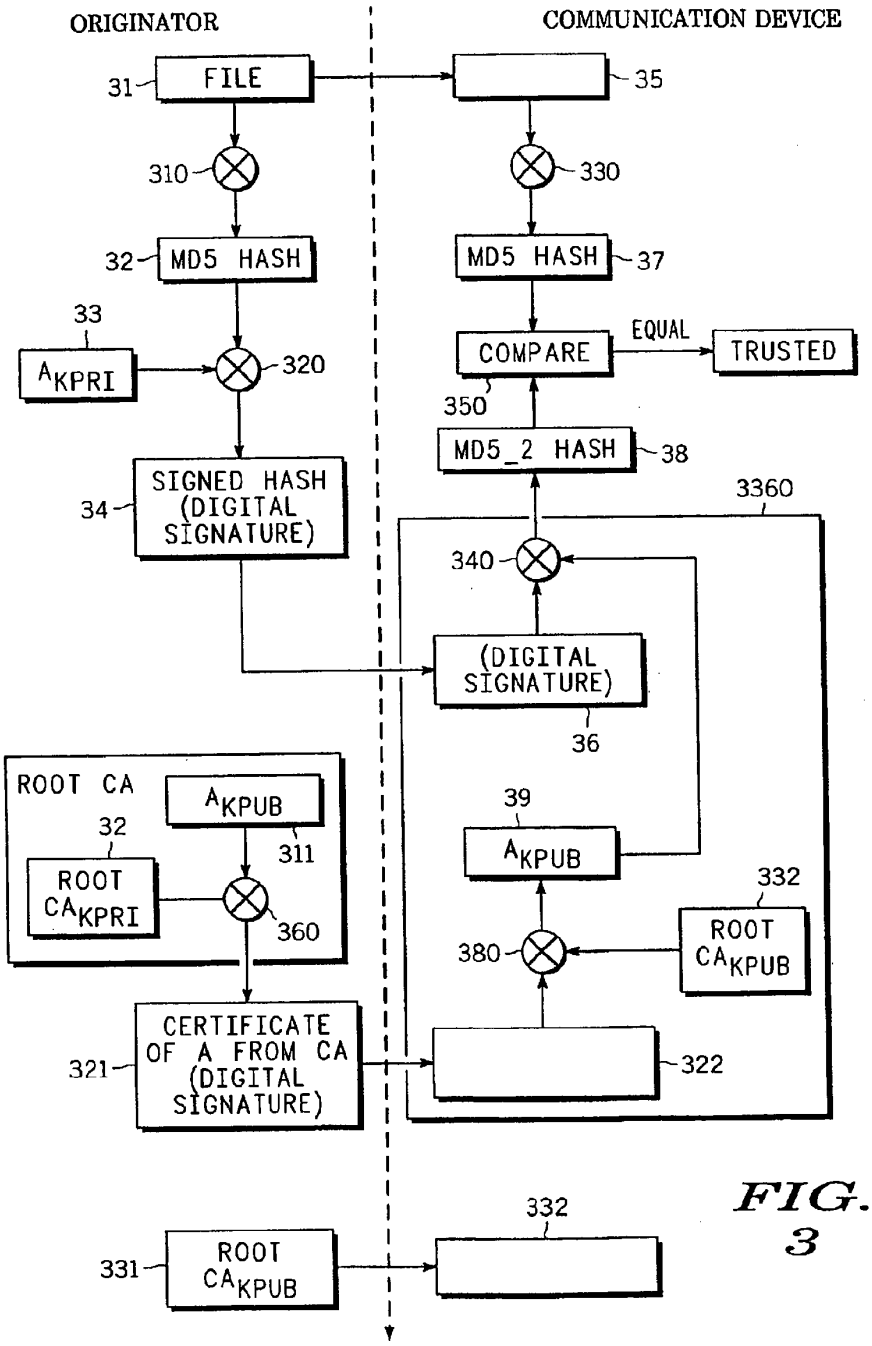


FIG. 3

BNSDOCID: <EP_____1289326A1_I_>

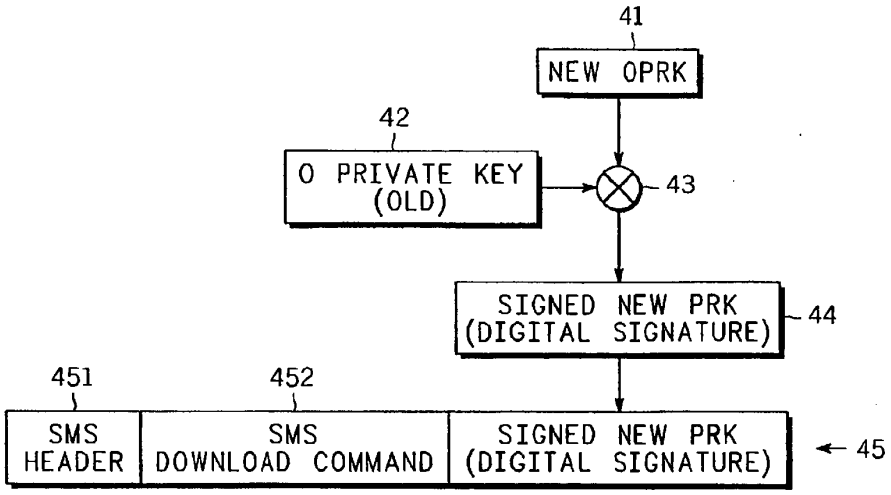
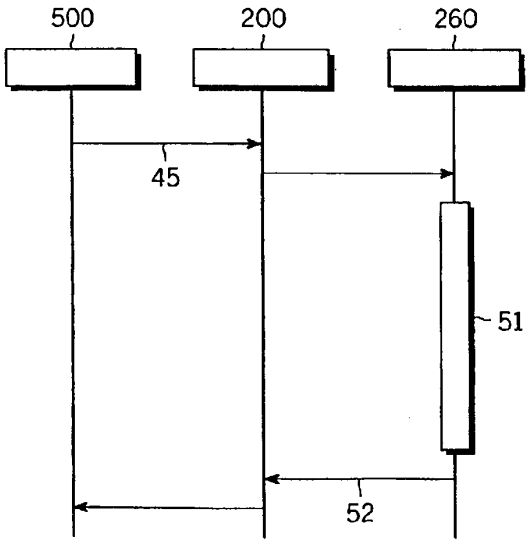


FIG. 4

FIG. 5



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European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 40 2259

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 6 124 799 A (PARKER JOHN PATRICK) 26 September 2000 (2000-09-26) * the whole document *	1-4,6-9	H04Q7/32
X	EP 0 562 890 A (HUTCHISON MICROTEL LIMITED) 29 September 1993 (1993-09-29) * column 4, line 30 - column 5, line 32 *	1,6	
A	EP 1 124 401 A (LUCENT TECHNOLOGIES INC) 16 August 2001 (2001-08-16) * paragraphs '0002!-'0019! * * abstract; claims 1-13 *	2-4,7-9	
A	EP 0 977 452 A (LUCENT TECHNOLOGIES INC) 2 February 2000 (2000-02-02) * the whole document *	2-4,7-9	
A	EP 0 463 384 A (CIT ALCATEL) 2 January 1992 (1992-01-02) * the whole document *	1,6	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)
H04Q

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22 February 2002	Coppieters, S

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 01 40 2259

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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22-02-2002

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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Electronic Patent Application Fee Transmittal

Application Number:	15287603
Filing Date:	06-Oct-2016
Title of Invention:	Enterprise Access Control and Accounting Allocation for Access Networks
First Named Inventor/Applicant Name:	Gregory G. Raleigh
Filer:	James E. Harris/Ann Taylor
Attorney Docket Number:	RALEP037D1C1

Filed as Small Entity

Filing Fees for Utility 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
Pages:				
Claims:				
Miscellaneous-Filing:				
LATE FILING FEE FOR OATH OR DECLARATION	2051	1	70	70
Petition:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 3 months with $0 paid	2253	1	700	700
Miscellaneous:				
		Total in USD ($)		**1500**

Electronic Acknowledgement Receipt	
EFS ID:	28691142
Application Number:	15287603
International Application Number:	
Confirmation Number:	1013
Title of Invention:	Enterprise Access Control and Accounting Allocation for Access Networks
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:	RALEP037D1C1
Receipt Date:	21-MAR-2017
Filing Date:	06-OCT-2016
Time Stamp:	13:50:00
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$1500
RAM confirmation Number	032217INTEFSW00000087505876
Deposit Account	505876
Authorized User	Ann Taylor
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.16 (National application filing, search, and examination fees) 37 CFR 1.17 (Patent application and reexamination processing fees)	

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

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1	Extension of Time	P037D1C1_Ext.pdf	163916 cbe68a14bc3fd37457ae20ddc6e7336c96530c23	no	2
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2		P037D1C1_Response.pdf	150152 1d4fd167915de80c8720e8461b0313339a49c061	yes	5

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Applicant Response to Pre-Exam Formalities Notice	1	1
	Preliminary Amendment	2	2
	Applicant Response to Pre-Exam Formalities Notice	3	5

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3	Information Disclosure Statement (IDS) Form (SB08)	P037D1C1_IDS1.pdf	623012 adfe2f3c47c4fa38b7b02f1c5f9e59c853bc350f	no	37
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6	Information Disclosure Statement (IDS) Form (SB08)	P037D1C1_IDS4.pdf	619012 e96d06f8cb1b0312dbe1478862fe3b90e8f332d0	no	31
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8	Transmittal Letter	P037D1C1_IDSTransLtr.pdf	59822 f2498ef5248f96307bde5962c41f790c9a231a37	no	2
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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.

PTO/AIA/22 (03-13)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)	Docket Number (Optional) RALEP037D1C1
Application Number 15/287,603	Filed October 6, 2016
For Enterprise Access Control and Accounting Allocation for Access Networks	
Art Unit 2642	Examiner not yet assigned

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above-identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

		Fee	Small Entity Fee	Micro Entity Fee	
☐	One month (37 CFR 1.17(a)(1))	$200	$100	$50	$
☐	Two months (37 CFR 1.17(a)(2))	$600	$300	$150	$
☑	Three months (37 CFR 1.17(a)(3))	$1,400	$700	$350	$ 700
☐	Four months (37 CFR 1.17(a)(4))	$2,200	$1,100	$550	$
☐	Five months (37 CFR 1.17(a)(5))	$3,000	$1,500	$750	$

☑ Applicant asserts small entity status. See 37 CFR 1.27.

☐ Applicant certifies micro entity status. See 37 CFR 1.29.
Form PTO/SB/15A or B or equivalent must either be enclosed or have been submitted previously.

☐ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☑ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 505876.

☑ Payment made via EFS-Web.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the

☐ applicant.

☑ attorney or agent of record. Registration number 40013.

☐ attorney or agent acting under 37 CFR 1.34. Registration number _____.

/James E. Harris/ — Signature

March 21, 2017 — Date

James E. Harris — Typed or printed name

903-201-6212 — Telephone Number

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.

☐ * Total of _____ forms are submitted.

This collection of information is required by 37 CFR 1.136(a). 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 6 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: Mail Stop PCT, 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 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.

REMARKS

Claim 1 has been canceled, and new claims 2-3 have been added. No new matter has been added. Applicant respectfully requests the entry of the amendments herein.

Applicant is also submitting the required fees and surcharge, as noted in the Notice.

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

Respectfully submitted,

Date: March 21, 2017

By: /James E. Harris/

James E. Harris
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1011 Pruitt Place
Tyler, TX 75703
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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:

Date: March 21, 2017 By: /Ann Taylor/
Ann Taylor

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	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
15/287,603	10/06/2016	Gregory G. Raleigh	RALEP037D1C1

CONFIRMATION NO. 1013

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

FORMALITIES LETTER

OC000000086615201

Date Mailed: 10/21/2016

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The statutory basic filing fee is missing.
- The application search fee must be submitted.
- The application examination fee must be submitted.
- Surcharge as set forth in 37 CFR 1.16(f) must be submitted.
  The surcharge is due for any one of:
  - late submission of the basic filing fee, search fee, or examination fee,
  - late submission of inventor's oath or declaration,
  - filing an application that does not contain at least one claim on filing, or
  - submission of an application filed by reference to a previously filed application.

SUMMARY OF FEES DUE:

The fee(s) required within **TWO MONTHS** from the date of this Notice to avoid abandonment is/are itemized below. Small entity discount is in effect. If applicant is qualified for micro entity status, an acceptable Certification of Micro Entity Status must be submitted to establish micro entity status. (See 37 CFR 1.29 and forms PTO/SB/15A and 15B.)

- $ **70** basic filing fee.
- $ **70** surcharge.
- $ **300** search fee.
- $ **360** examination fee.
- $(**0**) previous unapplied payment amount.
- $ **800** TOTAL FEE BALANCE DUE.

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

Mail Stop Missing Parts
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P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web, including a copy of this Notice and selecting the document description "Applicant response to Pre-Exam Formalities Notice". https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html

For more information about EFS-Web please call the USPTO Electronic Business Center at 1-866-217-9197 or visit our website at http://www.uspto.gov/ebc.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/hachristian/

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	Raleigh et al.	Examiner:	not yet assigned
Serial No.:	15/287,603	Art Unit:	2642
Filed:	October 6, 2016	Conf. No.:	1013
Title:	Enterprise Access Control and Accounting Allocation for Access Networks		

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P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE TO NOTICE TO FILE MISSING PARTS AND PRELIMINARY AMENDMENT

In response to the Notice to File Missing Parts dated October 21, 2016 (the "Notice"), the no-fee deadline for response being December 21, 2016, please enter the following amendments and remarks:

Amendments to the Claims begin on page 2.

Remarks begin on page 3.

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
15/287,603	10/06/2016	2642	0.00	RALEP037D1C1	1	1

CONFIRMATION NO. 1013

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

FILING RECEIPT

OC000000088815200

Date Mailed: 10/21/2016

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;
Alireza Raissinia, Saratoga, CA;
Jeffrey Green, Sunnyvale, CA;

Applicant(s)

Headwater Partners I LLC, Tyler, TX;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 14/578,124 12/19/2014
which is a DIV of 13/248,028 09/28/2011 PAT 8924469
which claims benefit of 61/387,243 09/28/2010
and is a CIP of 12/380,778 03/02/2009 PAT 8321526
and is a CIP of 12/380,780 03/02/2009 PAT 8839388
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
and said 12/380,780 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: 10/19/2016

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 15/287,603**

Projected Publication Date: To Be Determined - pending completion of Missing Parts

Non-Publication Request: No

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

Enterprise Access Control and Accounting Allocation for Access Networks

Preliminary Class

455

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).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

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).

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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.

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  - late submission of inventor's oath or declaration,
  - filing an application that does not contain at least one claim on filing, or
  - submission of an application filed by reference to a previously filed application.

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- $ **70** basic filing fee.
- $ **70** surcharge.
- $ **300** search fee.
- $ **360** examination fee.
- $(**0**) previous unapplied payment amount.
- $ **800** TOTAL FEE BALANCE DUE.

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For more information about EFS-Web please call the USPTO Electronic Business Center at 1-866-217-9197 or visit our website at http://www.uspto.gov/ebc.

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Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/hachristian/

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 15/287,603

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))	1 minus 20 =	*	x 40 =	0.00	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	1 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).			0.00			
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	730		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.

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	RALEP037D1C1
	Application Number	
Title of Invention	Enterprise Access Control and Accounting Allocation for Access Networks	

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
	Alireza		Raissinia	

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

City	Saratoga	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
	Jeffrey		Green	

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	RALEP037D1C1
	Application Number	
Title of Invention	Enterprise Access Control and Accounting Allocation for Access Networks	

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

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	Enterprise Access Control and Accounting Allocation for Access Networks		
Attorney Docket Number	RALEP037D1C1	**Small Entity Status Claimed**	☒
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	28	**Suggested Figure for Publication (if any)**	

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.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	RALEP037D1C1
	Application Number	
Title of Invention	Enterprise Access Control and Accounting Allocation for Access Networks	

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	14578124	2014-12-19	

Prior Application Status	Patented			Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
14578124	Division of	13248028	2011-09-28	8924469	2014-12-30

Prior Application Status	Expired			Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)	
13248028	Claims benefit of provisional	61387243	2010-09-28	

Prior Application Status	Patented			Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
13248028	Continuation in part of	12380778	2009-03-02	8321526	2012-11-27

Prior Application Status	Patented			Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
13248028	Continuation in part of	12380780	2009-03-02	8839388	2014-09-16

PTO/AIA/14 (11-15)
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	RALEP037D1C1
	Application Number	
Title of Invention	Enterprise Access Control and Accounting Allocation for Access Networks	

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
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
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
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	RALEP037D1C1
	Application Number	
Title of Invention	Enterprise Access Control and Accounting Allocation for Access Networks	

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).

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Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)

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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.
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	RALEP037D1C1
	Application Number	
Title of Invention	Enterprise Access Control and Accounting Allocation for Access Networks	

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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.

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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.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	RALEP037D1C1
	Application Number	
Title of Invention	Enterprise Access Control and Accounting Allocation for Access Networks	

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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.

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● Assignee	Legal Representative under 35 U.S.C. 117	Joint Inventor
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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. ☒

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	RALEP037D1C1
	Application Number	
Title of Invention	Enterprise Access Control and Accounting Allocation for Access Networks	

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Signature	/James E. Harris/			Date (YYYY-MM-DD)	2016-10-06
First Name	James E.	Last Name	Harris	Registration Number	40013

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	RALEP037D1C1
	Application Number	
Title of Invention	Enterprise Access Control and Accounting Allocation for Access Networks	

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.**

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ENTERPRISE ACCESS CONTROL AND ACCOUNTING ALLOCATION FOR ACCESS NETWORKS

BACKGROUND

[0001] With the advent of mass market digital communications and content distribution, many access networks such as wireless networks, cable networks and DSL (Digital Subscriber Line) networks are pressed for user capacity, with, for example, EVDO (Evolution-Data Optimized), HSPA (High Speed Packet Access), LTE (Long Term Evolution), WiMax (Worldwide Interoperability for Microwave Access), and Wi-Fi (Wireless Fidelity) wireless networks increasingly becoming user capacity constrained. Although wireless network capacity will increase with new higher capacity wireless radio access technologies, such as MIMO (Multiple-Input Multiple-Output), and with more frequency spectrum 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, wire line user service consumption habits are trending toward very high bandwidth applications 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.

BRIEF DESCRIPTION OF THE DRAWINGS

[0003] Various embodiments of the invention are disclosed in the following detailed description and the accompanying drawings.

[0004] **Figure 1** illustrates a functional diagram of a network architecture for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0005] **Figure 2** illustrates a functional diagram of another network architecture for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0006] **Figure 3** illustrates a functional diagram of another network architecture for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0007] **Figure 4** illustrates a functional diagram of another network architecture for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0008] **Figure 5** illustrates a functional diagram of another network architecture for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0009] **Figure 6** illustrates a functional diagram of another network architecture for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0010] **Figure 7** illustrates a functional diagram of another network architecture for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0011] **Figure 8** illustrates a functional diagram of another network architecture for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0012] **Figure 9** illustrates a functional diagram of another network architecture for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0013] **Figure 10** illustrates a functional diagram of another network architecture for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0014] **Figure 11** illustrates a functional diagram of another network architecture for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0015] **Figure 12** illustrates a functional diagram of another network architecture for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0016] **Figure 13** illustrates a functional diagram of a secure device application architecture for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0017] **Figure 14** illustrates a functional diagram of another secure device virtual machine architecture for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0018] **Figure 15** illustrates a functional diagram of another secure device hardware execution partition architecture for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0019] **Figure 16** illustrates a functional diagram of another secure device service processor architecture for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0020] **Figure 17** illustrates a functional diagram of another network architecture for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0021] **Figure 18** illustrates a functional diagram of another network architecture for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0022] **Figure 19** illustrates a functional diagram of another network architecture for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0023] **Figure 20** illustrates a functional diagram of another network architecture for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0024] **Figure 21** illustrates a functional diagram of another network architecture for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0025] **Figure 22** illustrates a functional diagram of another network architecture for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0026] **Figure 23** illustrates a functional diagram of a secure device application architecture with device based service usage monitoring for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0027] **Figure 24** illustrates a functional diagram of a secure device virtual machine architecture with device based service usage monitoring for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0028] **Figure 25** illustrates a functional diagram of a secure device hardware execution partition architecture with device based service usage monitoring for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0029] **Figure 26** illustrates a functional diagram of a secure device service processor architecture with device based service usage monitoring for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0030] **Figure 27** illustrates a flow diagram for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0031] **Figure 28** illustrates another flow diagram for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0032] **Figure 29** illustrates another flow diagram for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

[0033] **Figure 30** illustrates another flow diagram for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments.

DETAILED DESCRIPTION

[0034] 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.

[0035] 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.

[0036] Some enterprises only allow certain specialized wireless devices to be used for connection to their enterprise network. Such devices typically contain secure data storage and enterprise program execution environments to protect enterprise information and network access. This approach is generally directed towards maintaining enterprise data integrity and enterprise network security. However, this approach does not address the various problems associated with

allocating service usage or billing between consumer or non-enterprise service usage activities and enterprise service usage activities.

[0037] Accordingly, there is a need to provide for an enterprise and consumer billing allocation for wireless communication device service usage activities. There is also a need to address various issues with enterprise policies that can vary from employee to employee. For example, roaming policies can be configured differently for a global sales person than for a finance administrator who does not travel as much on enterprise business. Furthermore, some enterprises may not elect to pay for employee wireless communication device purchase or all employee wireless communication service usage needs or desires. As a result, some enterprises would benefit from techniques that allowed such enterprises to piggy back on consumer device or service purchases while maintaining an enterprise and consumer billing allocation for wireless communication device service usage activities.

[0038] Also, some consumers prefer to select their own wireless communication device that may not be an enterprise approved wireless communication device or a specialized enterprise device specified by enterprise IT managers. For example, certain enterprises may only offer certain Blackberry smart phone devices, and certain employees may prefer Apple iPhone and/or various Android based smart phone devices. Another trend suggests that a growing number of enterprise employees desire to use a single wireless communication device for their enterprise mobile communication, enterprise information access, and enterprise network access as well as for, for example, their personal mobile communication, access, and application needs (e.g., consumer/personal, that is, non-enterprise, use of cellular calls, text messaging, web browsing, social networking, games, and various other service usage activities). Such dual persona devices, where a first persona is oriented to enterprise access and/or application needs and a second persona is oriented to personal access and/or application needs, are enabled by the disclosure herein.

[0039] As a result, enterprise network managers generally need a way to safely allow consumers to perform consumer mobile access services that the enterprise can specify that will not be paid for by the enterprise. Various network architectures and techniques are described herein that allow an enterprise to determine how much service usage (e.g., how much of a

corresponding service bill) should be allocated to device user services or consumer services and how much should be allocated to enterprise services in which the enterprise sponsors the enterprise access. Various design approaches and techniques are described herein for allocating enterprise and consumer billing in a secure manner that works with both specialized enterprise wireless communication devices as well as other wireless communication devices. For example, crediting a user bill with sponsored enterprise service usage is provided using various techniques described herein. As another example, providing enterprise employee reimbursement for enterprise services used on the employee wireless communication device or allowing an enterprise to deduct employee consumer service usage from their paycheck is provided using various techniques described herein. As yet another example, allowing a consumer to select from an instant activation platform on a wireless communication device that comes pre-loaded with various enterprise services is provided using various techniques described herein. As yet a further example, providing for a capability to install or download an enterprise application that provides secure enterprise mobile services access and allocating enterprise and consumer billing for consumer wireless communication devices is provided using various techniques described herein.

[0040] Various techniques for monitoring service usage and providing for secured and verifiable device assisted services (DAS), including DAS based service usage monitoring, are disclosed in co-pending U.S. Patent Application No. 12/380,758 (Attorney Docket No. RALEP003), entitled VERIFIABLE DEVICE ASSISTED SERVICE USAGE MONITORING WITH REPORTING, SYNCHRONIZATION, AND NOTIFICATION, filed on March 2, 2009, published as U.S. Pub. App. No. 20100191612, co-pending U.S. Patent Application No. 12/695,019 (Attorney Docket No. RALEP022), entitled DEVICE ASSISTED CDR CREATION, AGGREGATION, MEDIATION and BILLING, filed on January 27, 2010, published as U.S. Pub. App. No. 20100197266, co-pending U.S. Patent Application No. 12/695,020 (Attorney Docket No. RALEP024), entitled ADAPTIVE AMBIENT SERVICES, filed on January 27, 2010, published as U.S. Pub. App. No. 20100198698, co-pending U.S. Patent Application No. 12/694,445 (Attorney Docket No. RALEP025), entitled SECURITY TECHNIQUES FOR DEVICE ASSISTED SERVICES, filed on January 27, 2010, published as U.S. Pub. App. No. 20100199325, co-pending U.S. Patent Application No. 12/694,451 (Attorney Docket No. RALEP026), entitled DEVICE GROUP PARITIONS AND SETTLEMENT PLATFORM, filed

on January 27, 2010, published as U.S. Pub. App. No. 20100197267, which are incorporated herein by reference for all purposes.

[0041] In some embodiments, allocating enterprise and consumer billing for service usage activities on a wireless communication device is provided for service usage activities that an enterprise configures as approved and/or sponsored for enterprise billing (e.g., such service usage activities are paid for at least in part by the enterprise) and consumer applications and service usage activities that the device user chooses to use from the wireless communication device and that the enterprise does not sponsor. Various embodiments are disclosed herein describing a wide range of devices that users and enterprises may desire to use for such dual-purpose application scenarios. In some embodiments, devices for such applications can include a less specialized and secure device program execution environment as further described herein.

[0042] Accordingly, enterprise and consumer billing allocation for wireless communication device service usage activities is provided. In some embodiments, enterprise and consumer billing allocation for wireless communication device service usage activities includes monitoring a service usage activity of a wireless communication device (e.g., the monitoring can be performed in the wireless communication device and/or the monitoring of enterprise application service usage can be performed using a secure application server in the enterprise network), and determining an enterprise and consumer billing allocation for the monitored service usage activity. In some embodiments the allocation is determined by classifying the service usage activities as associated with a consumer service usage activity (e.g., in a consumer service usage activity list) or associated with an enterprise service usage activity (e.g., in an enterprise service usage activity list; or, as another example, if the monitored service usage activity is not included in the enterprise service usage activity list, then it can be automatically classified as a consumer service usage activity by default).

[0043] In some embodiments, enterprise and consumer billing allocation for wireless communication device service usage activities includes providing a service design center (SDC) for configuring an enterprise and consumer billing allocation of monitored service usage activities for a plurality of wireless communication devices associated with an enterprise account, and implementing the configured enterprise and consumer billing allocation for

monitored service usage activities for the plurality of wireless communication devices associated with the enterprise account.

[0044] In some embodiments, enterprise and consumer billing allocation for wireless communication device service usage activities includes monitoring service usage of a wireless communication device, and determining whether a user is acting as a consumer (e.g., personal service usage activities on the wireless communication device) or a professional (e.g., enterprise service usage activities on the wireless communication device, that is, the user is working on the wireless communication device in his or her capacity as an employee for an enterprise, in which the wireless communication device is associated with an enterprise account for the enterprise) based on the monitored service usage activity (e.g., based on place, time of day, application or service activity, and/or other criteria or factors). In some embodiments, enterprise and consumer billing allocation for wireless communication device service usage activities differentially charges and/or allocates billing between the enterprise and the consumer based on a classification of the monitored service usage activity as allocated to the enterprise or to the consumer for billing/charging purposes. Such embodiments enable a dual persona device user experience.

[0045] In some embodiments, enterprise and consumer billing allocation for wireless communication device service usage activities includes monitoring a service usage activity of a wireless communication device, and reporting the monitored service usage activity to a network element (e.g., a service controller, a service usage reconciliation function, another service control or billing/charging function in the network, or another network element), in which the network element determines an enterprise and consumer billing allocation for the monitored service usage activity. In some embodiments, the network element (e.g., a service controller, a service usage reconciliation function, another service control or billing/charging function in the network, or another network element) determines an enterprise and consumer billing allocation for the monitored service usage activity. In some embodiments, a service usage reconciliation function determines how much service usage is due to enterprise service usage activities and how much is due to consumer service usage activities. In some embodiments, after determining the allocation between consumer and enterprise service usage activities, the service usage reconciliation function provides the information to a service usage accounting function (e.g., a carrier billing

server or an enterprise service usage accounting server), which in turn delivers a consumer usage report or bill and/or an enterprise usage report or bill. In some embodiments, the service usage reconciliation function determines the amount of enterprise service usage and creates a service usage credit record so that a device user's account can be credited or a device user can be compensated or reimbursed for enterprise service usage costs. In some embodiments, a service usage monitor is configured to monitor service usage activities of a device. In some embodiments, the service usage monitor is configured to classify the monitored service usage activities as enterprise service usage activities. In some embodiments, the service usage monitor is configured to classify the monitored service usage activities as consumer service usage activities. In some embodiments, the service usage monitor is configured to monitor a first group of service usage activities for service usage allocation to a device user (e.g., using a list of service usage activities associated with a consumer service usage), and a second group of service usage activities for service usage allocation to an enterprise (e.g., using a list of service usage activities associated with an enterprise service usage). In some embodiments, service usage activities (e.g., service activities, such as applications, network, and/or voice based activities that use wireless network service usage resources) are classified using various techniques described herein, such as based on application (e.g., application credential), device (e.g., device credential), time of day, network destination, network traffic protocol and/or port, and various other criteria/factors. In some embodiments, the service usage monitor is implemented in the network (e.g., on one or more network elements in the carrier network and/or enterprise network, as described herein). In some embodiments, the service usage monitor is implemented in the device (e.g., using various techniques described herein, including verifiable and/or secured device-based implementations). In some embodiments, the service usage monitor is implemented using both network-based and device-based techniques, as described herein with respect to various embodiments.

[0046] In some embodiments, a set of service activities that will be sponsored by an enterprise (e.g., a specified or configured list of enterprise sponsored service activities) is managed by an enterprise service design center. In some embodiments, a list of service activities and the associated service policies for each service activity are compiled to form an enterprise sponsored service activity policy set. For example, enterprise email, enterprise calendar, and enterprise contacts can be configured as sponsored service activities. In some embodiments, the sponsored

enterprise services list includes a list of network destinations that are associated with the services (e.g., an enterprise mail server address and/or an enterprise internal corporate network). For example, the enterprise email can be a sponsored service that is associated with an enterprise sponsored email service policy, which can limit destinations for corporate email, sizes of emails and/or email attachments, and/or other email related usage criteria or factors (e.g., a service usage charging policy).

[0047] In some embodiments, the monitored service usage is reported to the reconciliation function by a carrier network service usage monitoring element (e.g., a home agent (HA), access network gateway, or other network element, such as a deep packet inspection (DPI) function). In some embodiments, the monitored service usage is reported to the reconciliation function by an enterprise network service usage monitoring element (e.g., a carrier network gateway or a mobile services gateway/server or other element in the enterprise network that can measure service usage and associate it with a given device credential or application credential). In some embodiments, the monitored service usage is reported to the reconciliation function by an element in the mobile device (e.g., a service usage monitor in a secure enterprise mobile services application or a Service Processor function, which can be securely implemented and/or verified using various techniques described herein).

[0048] In some embodiments, a service design center for implementing enterprise and consumer billing allocation for wireless communication device service usage activities is provided. For example, an enterprise manager can use the service design center to select one or more services that the enterprise agrees to pay for/is responsible for paying for and to select one or more other services that the employees of the enterprise must agree to pay for/are responsible for paying for (e.g., if the employee elects to use/have such services that are not charged to the enterprise, or included as enterprise services that are charged to or paid for by the enterprise).

[0049] In some embodiments, a service design center that facilitates configuration of sponsored enterprise services for implementing enterprise and consumer billing allocation for wireless communication device service usage activities is provided. In some embodiments, a service design center for implementing enterprise and consumer billing allocation for wireless communication device service usage activities includes providing a service design center for a

carrier network and another service design center for an enterprise network (e.g., in some cases, these service design centers can be combined).

[0050] In some embodiments, an enterprise sponsored service activity policy set is created by an enterprise network administrator through an enterprise service design center user interface (UI). In some embodiments, the enterprise sponsored service activity policy set includes a list of network destination addresses that corresponds to the desired sponsored service activity list, along with an access policy or service usage charging policy for the service activities. In some embodiments, all service activities in the enterprise sponsored service activity policy set receive the same access policies or charging policies. In some embodiments, a first subset of one or more of the service activities in the enterprise sponsored service activity policy set receive access policies or charging policies that are different than that of a second subset of service activities. For example, a sponsored enterprise email service can be in the first subset, and sponsored mobile voice services can be in the second subset, as certain employees (e.g., traveling sales personnel and/or executives) can be granted international and/or roaming mobile voice services, and other employees can be granted more limited sponsored mobile voice services.

[0051] In some embodiments, the enterprise network administrator uses the enterprise service design center to create an enterprise sponsored service device group list that includes device credentials or device application credentials that the carrier network and/or the enterprise network can use to identify a device or an application on a device as belonging to the group of devices for which the enterprise desires to sponsor enterprise service activities. In some embodiments, a sponsored service activity policy set is created by an enterprise network administrator through an enterprise service design center UI, and an enterprise sponsored service device group list is created by an enterprise network administrator through an enterprise service design center UI, and the two lists are stored in the enterprise service design center in which they are associated with one another for the purpose of provisioning the carrier network, the enterprise network, and/or the devices to provide the desired enterprise sponsored services policy set to the enterprise sponsored services device group, as described herein with respect to various embodiments.

[0052] In some embodiments, the association between an enterprise sponsored services device group and an enterprise sponsored service policy set is used by a service design center to create a provisioning table, in which the provisioning table is a list of the provisioning programming required for the various carrier network elements, enterprise network elements, and/or device elements to implement the desired sponsored service activity policy set for the enterprise sponsored services device group.

[0053] For example, an enterprise can use the service design center to configure certain destinations/services as enterprise services or potentially enterprise services based on various factors (e.g., corporate sites, corporate email/email servers, corporate web pages/intranet, and can, for example, agree to pay for a certain level of general web browsing by usage/time of day and/or other factors, corporate contacts/calendars, corporate videoconferencing; and certain applications, such as web conferencing applications or other applications; certain telephone service usages, etc.). As another example, the service design center can present a configuration interface that allows users to select from one or more service plans that include various consumer and enterprise allocations and/or to select an enterprise only service plan.

[0054] In some embodiments, the service design center specifies one or more service plans the device user can select from and these service plan selection options are configured into a configuration interface on a device software application that allows users to select from one or more service plans that includes various consumer and enterprise allocations and/or to select an enterprise only service plan. In some embodiments, the configuration interface is made available directly on the device via a device client that provides a service plan selection user interface that displays one or more service plan options configured in the service design center or the enterprise service design center. In some embodiments, the configuration interface is presented directly on a device user interface (UI) when the user attempts to use an access service usage activity that requires a service plan to be activated or purchased. In some embodiments, the configuration interface presented via the device UI accepts a user response, transmits it to a carrier network element responsible for provisioning a new user service plan that in turn activates the service plan chosen by the user, possibly after confirming service payment credit for the user or enterprise entity. In some embodiments, the carrier network element responsible for provisioning a new user service plan is a carrier usage accounting server. In some

embodiments, the carrier network element responsible for provisioning a new user service plan is a consumer internet services element. In some embodiments, the carrier network element responsible for provisioning a new user service plan is a carrier gateway or home agent. In some embodiments the carrier network element responsible for provisioning a new user service plan is a billing system or service plan provisioning system. In some embodiments, the configuration interface is made available to the user in the form of a web site that provides a service plan selection user interface that displays one or more service plan options configured in the service design center or the enterprise service design center.

[0055] In some embodiments, the initial configuration of the end-user device includes one or more enterprise access service plans that allow the user to access certain applications or network destinations associated with enterprise access services, and the user can choose from one or more additional consumer oriented service plans offered directly on the device UI by a device software application in communication with a carrier network element responsible for provisioning a new user service plan that in turn activates the service plan chosen by the user, possibly after confirming service payment credit for the user or enterprise entity. In some embodiments, these access service plan options are configured with a service design center. In some embodiments, these access service plan options are configured with an enterprise service design center.

[0056] In some embodiments, enterprise data locally stored on the wireless communication device is secured and access to an enterprise network from the wireless communication device is secured so that only authorized devices or applications can access the network. In some embodiments, security for enterprise data and network access is accomplished by connecting the wireless communication device to the enterprise network via a secure mobile services application on the wireless communication device that connects via a secure channel to a secure mobile services gateway server in the enterprise network. In some embodiments, the SDC is programmed to provision the network and/or device apparatus to detect service usage communication with the mobile services gateway server and record that as a usage charge for network services. In some embodiments, such service usage communication with the mobile services gateway server is credited to the user's carrier account or used as a reimbursement to the user bill.

[0057] In some embodiments, determining the enterprise and consumer billing allocation for wireless communication device service usage activities is performed using a classifier implemented on the wireless communication device that classifies the monitored service usage activity (e.g., service usage can also be measured by the classifier and/or another function implemented on the wireless communication device, which can similarly be implemented in a secure execution area or in a secure memory), in which the classifier is executed in a secure execution area or a secure memory of the wireless communication device. In some embodiments, the security of the classifier is verified, periodically or at other times, using various techniques, such as by comparing a local service usage measure with a network based service usage measure and/or comparing a secured local service usage measure with another local service usage measure. In some embodiments, a secured application protects one or more enterprise applications (e.g., email, calendar, contacts, intranet access, and/or other enterprise specified applications, such as applications configured as approved or authorized enterprise applications for a particular enterprise by an enterprise manager using a service design center) from unauthorized use or tampering.

[0058] In some embodiments, the secure mobile services application also provides for usage monitoring of the enterprise service usage of the device. In some embodiments, the secure mobile services application also provides for service access control for the enterprise services of the device so that enterprise network access policies can be locally enforced on the device.

[0059] In some embodiments, security for enterprise data and network access is provided by connecting to the enterprise network via a secure mobile services application executed securely (e.g., in a virtual machine or in a hardware secured execution partition) on the wireless communications device that connects via a secure channel to a secure mobile services gateway server in the enterprise network. In some embodiments, security for enterprise data and network access is provided by connecting to the enterprise network via a secure mobile services application executed on a wireless communications device that includes a service processor, as described herein, that connects via a secure channel to a secure mobile services gateway server in the enterprise network. In some embodiments, the SDC is programmed to provision the network and/or wireless communications device apparatus to detect service usage communication with the mobile services gateway server, and record that as a usage charge for network services. In

some embodiments, such service usage communication with the mobile services gateway server is credited to the user's carrier account or used as a reimbursement to the user bill.

[0060] In some embodiments, the service processor also provides for service usage monitoring of the enterprise service usage of the device, as described herein with respect to various embodiments. In some embodiments, the service processor also provides for service access control for the enterprise services of the device so that enterprise network access policies can be enforced on the device, as described herein with respect to various embodiments.

[0061] In some embodiments, enterprise and consumer billing allocation for wireless communication device service usage activities includes associating the wireless communication device and/or an authorized user of the wireless communication device (e.g., using device/user credentials) with an enterprise account (and, in some embodiments, a consumer account), associating an application with a service, and associating the service with the enterprise account (e.g., a service for the wireless communication device that the enterprise agreed to pay for). In some embodiments, enterprise and consumer billing allocation for wireless communication device service usage activities further includes using application-based monitoring and/or control using, for example, device assisted services.

[0062] In some embodiments, enterprise and consumer billing allocation for wireless communication device service usage activities includes crediting an associated consumer account for service usage allocated to an enterprise account. In some embodiments, enterprise and consumer billing allocation for wireless communication device service usage activities includes billing the enterprise for service usage allocated to the enterprise account. In some embodiments, enterprise and consumer billing allocation for wireless communication device service usage activities includes reporting to the enterprise (and, in some embodiments, the consumer) service usage allocated to the enterprise account, and the enterprise can, for example, provide an expense reimbursement to the consumer (e.g., employee, partner, associate, or contractor of the enterprise).

[0063] In some embodiments, enterprise and consumer billing allocation for wireless communication device service usage activities includes associating the wireless communication device with an enterprise account and a consumer account, associating an application with a

service, and associating the service with the consumer account (e.g., a service for the wireless communication device that the consumer, such as an employee of the enterprise, agreed to personally pay for). In some embodiments, enterprise and consumer billing allocation for wireless communication device service usage activities further includes using application-based monitoring and/or control using, for example, device assisted services.

[0064] In some embodiments, enterprise and consumer billing allocation for wireless communication device service usage activities includes crediting an associated enterprise account for service usage allocated to a consumer account. In some embodiments, enterprise and consumer billing allocation for wireless communication device service usage activities includes billing the consumer for service usage allocated to the consumer account. In some embodiments, enterprise and consumer billing allocation for wireless communication device service usage activities includes reporting to the enterprise (and, in some embodiments, the consumer) service usage allocated to the consumer account, and the enterprise can, for example, deduct the cost for such service usage as an expense from the consumer's periodic/next paycheck.

In some embodiments, enterprise and consumer billing allocation for wireless communication device service usage activities does not require a network element or a device element to control services. For example, a user with a device associated with a bulk service usage plan can be automatically credited for sponsored enterprise service usage. If the bulk service usage plan has a service plan cap associated with the user's consumer service plan, then the service usage classified as sponsored enterprise service usage can be deducted from the total service usage such that the sponsored enterprise service usage does not count towards the user's capped consumer service plan usage. As another example, an enterprise account associated with the wireless communication device and/or user can allow the user to exceed a monthly or other service plan cap for sponsored enterprise service usage (e.g., based on various criteria and/or other factors, such as a more restrictive enterprise service policy to avoid potential misuse of sponsored enterprise services for personal use).

[0065] In some embodiments, enterprise and consumer billing allocation for wireless communication device service usage activities is provided using network-based and/or device-based techniques as described herein with respect to various embodiments. For example, using

various techniques described herein, an enterprise manager can control the services for wireless communication devices for the enterprise, including access to such services and/or charging for such services (e.g., services used by employees in which some are charged to the enterprise on behalf of the employee and some are charged to the employee as a consumer of such services) and user notification messages. For example, the enterprise manager or another network element/function can cap and/or control service usage for consumer services and/or enterprise services.

[0066] In some embodiments, a service usage reconciliation function is provided. In some embodiments, the service usage reconciliation function implements the rules for a billing split for the enterprise and consumer billing allocation for wireless communication device service usage activities, as described herein with respect to various embodiments. In some embodiments, the service usage reconciliation function also facilitates fraud detection, as described herein with respect to various embodiments.

Carrier Managed Billing Allocation With Service Usage Monitoring In Carrier Network

[0067] **Figure 1** illustrates a functional diagram of a network architecture 100 for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. In some embodiments, a wireless communication device 110 includes a memory, an application processor (e.g., or more than one application processor or general processor), and a wireless modem, shown as an access modem 151. As shown, the wireless communication device 110 includes an operating system application space 131 for executing applications and communicating wirelessly using operating system lower layers 130, network stack 136, and the access modem 151. As used herein, application space refers to a portion of memory and a portion of a processor operating system execution environment for executing application programs. As also shown, the wireless communications device 110 includes operating system lower layers 130. As used herein, operating system lower layers refers to one or more OS layers that typically implement networking functions (e.g., network stack 136). In some embodiments, operating system lower layers 130 is where certain application data and communications security functions are implemented as described herein. In some embodiments, operating system lower layers 130 is

where certain service usage monitoring and reporting functions are implemented as described herein. In some embodiments, operating system application space 131 executes various user applications, including one or more of user data application 111 and user voice application 112, and various enterprise applications, including enterprise data application 124 and enterprise voice application 126. In some embodiments, the execution environment for user applications and enterprise applications is the same (e.g., as shown in Figures 1 through 7). For example, a consumer Internet browser can execute in the operating system application space 131 for providing Internet web site browsing or web based email service via network stack 136 and wireless access modem 151 (e.g., a wireless modem), and an enterprise email program can also execute in the operating system application space 131 to communicate with an enterprise email server also via network stack 136 and wireless access modem 151. In some embodiments, the execution environment for user applications and enterprise applications are not the same (e.g., as shown in Figures 8 through 12).

[0068] In some embodiments, device 110 accesses various network-based voice services, such as consumer voice services 167 and/or enterprise sponsored/paid-for consumer voice services usage, via voice network 165. As shown, voice network 165 is in communication with carrier access network 150 via carrier gateway/home agent (HA) 152. In some embodiments, device 110 accesses various Internet based services, such as consumer Internet services 162 and/or enterprise sponsored/paid-for consumer Internet services usage, via Internet 160.

[0069] As also shown in Figure 1, device 110 is in wireless communication (e.g., 2G/3G/4G access) with carrier access network 150. The carrier provides a carrier usage accounting server 154 (e.g., a carrier billing server) in communication with carrier access network 150. Carrier network access 150 is shown in communication with both Internet 160 and enterprise network 170 via Internet 160. Enterprise network 170 is shown in communication with Internet 160 as via enterprise firewall and secure access gateway 171 for protecting enterprise network 170 from unauthorized access. In some embodiments, to access enterprise network 170 through enterprise firewall and secure access gateway 171, device 110 includes a secure data application or a virtual private network application/function to facilitate secure authorization with enterprise firewall and secure access gateway 171 and to also protect the communication (e.g., encrypt such data communications). As also shown, behind enterprise firewall and secure access gateway 171,

enterprise network 170 provides communication with secure enterprise mobile services gateway/server 172 in communication with enterprise network 170. As shown, secure enterprise mobile services gateway server 172 includes various enterprise applications/functions, including as shown, mobile email 173, mobile synchronization 174, mobile contacts 175, mobile calendar 176, mobile communications 177, and mobile intranet 178. In some embodiments, secure enterprise mobile services gateway server 172 provides mobile device mobile access to various enterprise network intranet services via enterprise intranet servers 180. In some embodiments, the enterprise mobile services include email, contacts, calendar, enterprise communications, mobile device synchronization services, intranet internal web sites, internal enterprise applications, enterprise file systems, and/or other enterprise networking services. In some embodiments, secure enterprise mobile services gateway server 172 provides optimized mobile application formatting of the enterprise information or synchronization services to synchronize the enterprise database for the above services in an efficient and/or timely manner.

[0070] In some embodiments, carrier usage accounting server 154 (e.g., the carrier billing server) communicates (e.g., using secure communication techniques) with service usage reconciliation server function 158 to obtain reconciled service charging reports (e.g., reconciled billing reports) and/or enterprise service usage charging credit reports. In some embodiments, the reconciled service charging reports (e.g., reconciled billing reports) and/or enterprise service usage charging credit reports are processed by carrier usage accounting server 154 and reported as user usage record(s) 155 and/or enterprise usage record(s) 156. For example, mediating such charging and credit reports can be based on various factors as described herein (e.g., by application, time of day/day of week, and/or other factors). For example, the service usage charges that occur due to communication with the servers or services that are part of enterprise network 170, including secure enterprise mobile services gateway server 172 and intranet servers 180, can be counted as an enterprise service usage credit.

[0071] In some embodiments, enterprise service design center 194 issues device provisioning instructions for the device credential list from the enterprise services device group, and for each of the credentials, a service control policy is set on enterprise firewall/secure gateway 171 to allow properly authorized devices to reach the desired destinations listed on the enterprise service activity policy set. The provisioning of enterprise firewall/secure gateway 171 with the

enterprise service device group credentials and the enterprise service policy set is illustrated in Figure 1 by the "C" input designator.

[0072] In some embodiments, enterprise service design center UI 196 and enterprise service design center 194 are provided as shown in Figure 1. In some embodiments, enterprise service design center UI 196 and enterprise service design center 194 provide dedicated enterprise control of the network policy provisioning for configuring the service charging, accounting or billing allocation policies for differentiating between enterprise device service usage activities and consumer device service usage activities. Furthermore, in some embodiments, the portion of the enterprise network policy provisioning information that is needed to provision the carrier network elements to implement various techniques for allocating device service usage between enterprise and consumer activities is communicated between enterprise service design center 194 and carrier service design center 190.

[0073] A carrier provisioning system is typically not capable of providing direct access to an enterprise network administrator (e.g., carrier or enterprise personnel) for the purpose of provisioning such service charging capabilities. For example, such direct access is often not provided due to concerns related to the risk to the entire network that exists if network provisioning controls are made available to many different administrators to program charging allocation policies for many enterprises. However, as described herein, by isolating the required carrier network provisioning information to a secure service design center UI and policy configuration that only influences a small portion of the carrier network policy provisioning available to the carrier service design center and UI, the risk of causing such problems with the carrier network configuration is significantly reduced. Additionally, the process of performing the carrier side of the necessary provisioning is simplified for an administrator or in some cases can be automated.

[0074] The service design centers (e.g., carrier service design center 190 and enterprise service design center 194) are shown in Figure 1 and various other figures as separate network elements in order to more clearly define and discuss the functions of the service design centers. In some embodiments, enterprise service design center 194 is implemented in various other network elements (e.g., in enterprise network management apparatus, such as management

functions of secure enterprise mobile services gateway server 172 or other enterprise network management apparatus). In some embodiments, enterprise service design center 194 is implemented as a securely partitioned and managed device group interface to a subset of the provisioning capabilities of carrier network service design center 190. In some embodiments, enterprise service design center 194 is implemented as a securely partitioned and managed device group interface to a subset of the provisioning capabilities of a cloud-based secure enterprise mobile services network that is run by a centralized enterprise services provider such as an ASP or MVNO. As would be appreciated by one of ordinary skill in the art in view of the various embodiments described herein, enterprise service design center 194 can be implemented using various network and software/hardware architectures while providing for secure and controlled access as described herein.

[0075] In some embodiments, the enterprise service design center administrator creates or imports the enterprise service device group credentials and the enterprise service policy set using enterprise service design center UI 196. In some embodiments, the information included in the enterprise service device group credentials and the enterprise service policy set is also communicated from enterprise service design center 194 to carrier service design center 190 via the "C" connection designator as shown. For each of the device credentials listed in the enterprise services device group, carrier service design center 190 determines the information it needs to properly provision carrier gateway/home agent 152 with the proper access policy allowances and service usage charging policies to provide enterprise service access and usage credit for communications from device 110 to the enterprise network destination addresses specified in the enterprise service policy set. Programming of this provisioning information to carrier gateway/home agent 152 is indicated by the "A" information connector from carrier service design center 190 to carrier gateway/home agent 152. In some embodiments, this provisioning (e.g., programming) information sent via provisioning communication link "A" to carrier gateway/home agent 152 includes information to facilitate programming the enterprise device group credentials to: (i) receive the desired access service policy permissions, and (ii) implement the desired service usage accounting/charging policy settings. From the enterprise device group credentials list and the enterprise service activity policy set information provided in "C," carrier service design center 190 determines the information needed to properly provision the service usage reconciliation server function 158. Programming of this provisioning

information to service usage reconciliation server function 158 is indicated by the "B" information connector from carrier service design center 190 to service usage reconciliation server function 158. In some embodiments, service usage reconciliation function 158 is part of the carrier network, and service usage reconciliation function 158 implements the charging reconciliation rules to determine how much of the recorded device 110 service usage to place on the user's usage record or service bill (e.g., consumer service usage cost allocation) and how much to place on the enterprise's usage record or service bill (e.g., enterprise service usage cost allocation).

[0076] An enterprise may wish to allow consumer services on an end-user device that also allows an employee to access enterprise services over the access network. In some such embodiments, service design center 190 specifies one or more service plans from which the device user can select, and these service plan selection options are configured into a configuration interface on a device software application (e.g., user data app 111, user voice app 112 or service processor framework program 139 (shown, e.g., in Figure 16)) that allows users to select from one or more service plans, for example, one or more plans with both consumer and enterprise allocations, and/or an enterprise-only service plan. In some embodiments, the configuration interface is made available directly on the device via a device client that provides a service plan selection user interface that displays one or more service plan options configured in service design center 190 or enterprise service design center 194. In some embodiments, the configuration interface is presented directly on the device user interface (UI) when the user attempts an access service usage activity that requires a service plan to be activated or purchased. In some embodiments, the configuration interface presented to the device UI accepts a user response and assists in sending the user response to a carrier network element responsible for provisioning a new user service plan that in turn activates the service plan chosen by the user, possibly after confirming service payment credit for the user or enterprise entity. In some embodiments, the carrier network element responsible for provisioning a new user service plan is carrier usage accounting server 154. In some embodiments, the carrier network element responsible for provisioning a new user service plan is consumer Internet services elements 162. In some embodiments, the carrier network element responsible for provisioning a new user service plan is a carrier gateway/home agent 152. In some embodiments, the carrier network element responsible for provisioning a new user service plan is a billing system or service plan

provisioning system. In some embodiments, the configuration interface is made available to the user in the form of a web site that provides a service plan selection user interface that displays one or more service plan options configured in service design center 190 or enterprise service design center 194.

[0077] In some embodiments, the initial configuration of device 110 includes one or more enterprise access service plans that allow the user to access certain applications or network destinations associated with enterprise access services, and the user can choose from one or more additional consumer-oriented service plans offered directly on the device UI by a device software application (e.g., user data app 111, user voice app112, or service processor framework program 139) in communication with a carrier network element responsible for provisioning a new user service plan that in turn activates the service plan chosen by the user, possibly after confirming service payment credit for the user or enterprise entity. In some embodiments, these access service plan options are configured using service design center 190. In some embodiments, these access service plan options are configured using enterprise service design center 194.

[0078] In some embodiments in which a user has selected a consumer-oriented service plan in addition to an enterprise service plan, service usage reconciliation function 158 distinguishes between data usage within the enterprise service plan and data usage within the consumer-oriented service plan. In some embodiments, the enterprise does not pay for, backhaul, process, or police data usage associated with the consumer-oriented plan. In some embodiments, service usage reconciliation function 158 determines how much data usage by device 110 is enterprise data usage, and how much data usage by device 110 is consumer data usage. In some embodiments, service usage reconciliation function 158 allocates data usage associated with applications and/or services specified by the enterprise service plan to the enterprise, and data usage associated with applications and/or services specified by the consumer-oriented data plan to the consumer.

[0079] The various embodiments described herein with respect to Figure 1 support a variety of techniques for allocating service usage accounting or billing between enterprise services and consumer services. For example, service usage reconciliation function 158 can report measured

total usage, measured consumer usage, and/or measured enterprise usage to carrier usage accounting server 154. In some embodiments, the reconciliation service usage function (e.g., provided by service usage reconciliation function 158 and/or another element/function) implements the business rules that determine how much of the service usage to charge the user (e.g., a consumer service usage allocation) and how much of the service usage to charge the enterprise (e.g., an enterprise service usage allocation). In some embodiments, the service usage reconciliation service usage function records total device service usage, records total enterprise service activity service usage, and then subtracts the enterprise service usage from the total device service usage to determine a consumer service usage (e.g., a consumer service usage allocation). In some embodiments, service usage reconciliation function 158 passes on the enterprise service usage as a credit to the consumer account. In some embodiments, this credit is accounted for by the carrier billing the user at a reduced amount according to the credit and billing the enterprise for an increased amount according to the credit. In some embodiments, the credit is accounted for by communicating the credit to the enterprise so the enterprise can reimburse the consumer (e.g., generating an expense reimbursement for the credit to the consumer as an employee or contractor of the enterprise, directly paying the enterprise allocation of the carrier bill for the consumer, and/or various other approaches as described herein). In some embodiments, the credit is reported to the enterprise so that the enterprise can seek payment for the non-enterprise service usage (e.g., consumer service usage allocation) from the consumer (e.g., who can be an employee or contractor of the enterprise).

[0080] As another example, an enterprise allocation can also include providing an allowance for a certain level of monthly usage of data and/or voice. In some embodiments, carrier usage accounting server 154 generates a bill for the associated consumer account (e.g., associated with device 110, such as based on the device/user credentials) that reflects the cost of the service usage allocated to consumer service usage and a credit for the cost of service usage allocated to enterprise service usage (e.g., to offset the cost of the enterprise service usage, which can be billed to the enterprise account associated with the enterprise service usage for the device 110). As described herein, based on an allocation of enterprise and consumer service usage, various techniques for billing/charging and generating credits/reporting (e.g., the enterprise can generate the user/employee monthly expense reimbursements to compensate the user/employee for the determined cost of the enterprise service usage and/or other approaches as described herein) can

be provided using the network architecture 100 and/or other network architectures, as described herein.

[0081] In some embodiments, an enterprise manager manages service usage by specifying an access network service usage limit for a service usage activity (such as data service, voice service, text service, a roaming service, or a more detailed classification of data service such as one or more websites or one or more device applications), and, when that usage limit is reached for a device that is managed by the enterprise manager, a service usage notification message is generated. In some embodiments, the service usage notification message is configured through enterprise service design center UI 196. In some embodiments, the service usage notification message is delivered to device 110. In some embodiments, the service usage notification message is presented to the user via a user interface of device 110.

[0082] In some embodiments, the service usage notification message provides information about data usage or the status of device 100. In some embodiments, the service usage notification message is triggered by an event, e.g., detection that device 110 reaches a data usage ceiling, determination that device 110 is roaming, etc. In some embodiments, the service usage notification message provides real-time or near-real-time information about data usage. In some embodiments, the service usage notification message provides information about remaining data usage availability or entitlement. In some embodiments, the service usage notification message comprises a detailed report of enterprise usage by user, user group, device, device group, or location.

[0083] In some embodiments, secure enterprise mobile services gateway server 172 is a dedicated enterprise application server for a particular enterprise (e.g., company, government organization, school/university, or another entity). In some embodiments, secure enterprise mobile services gateway server 172 is a carrier or a third party service provider (e.g., a carrier for wireless network services, such as AT&T, Sprint, T-Mobile, and/or various other wireless network service providers/carriers or third party service providers) controlled/managed application server that performs the application server functions for various different enterprises (e.g., as a service/outsourced IT services model). In some embodiments, device 110 is partitioned (e.g., associated with a particular enterprise/MVNO partition and associated

enterprise account) based on device credentials and/or VPN to determine a service plan for managing (e.g., to determine how to allocate enterprise/consumer service usage for) device 110. In some embodiments, based on the partition determination of device 110, and the associated service plan for managing device 110, appropriate service usage monitoring and classification can be determined for providing an enterprise and consumer allocation for service usage activities of device 110 based on the associated service plan(s).

[0084] For example, by programming the business rules in service usage reconciliation function 158 that determine the service usage accounting allocation between enterprise services and consumer services, many approaches can be provided for creating a service that provides an enterprise service to a device when the device user has selected a consumer service plan or elected to pay for a consumer service plan. As an example, if the device user has chosen a service plan, the enterprise service usage accounted for in enterprise usage record 156 can be billed to the enterprise rather than the consumer. As another example, if the device user has chosen a service plan, the consumer service usage accounted for in user usage record 155 can be billed to the device user rather than the enterprise. As yet another example, if the device user has selected a service plan, the enterprise service usage can be communicated to the enterprise (e.g., and/or the device user), and the enterprise can issue a reimbursement to the device user for the enterprise portion of the user's bill, or pay the carrier directly for a portion of the user's bill, thus reducing the amount the user must pay. In some embodiments, the business rules in service usage reconciliation function 158 are programmed to provide the device user with a certain amount of service usage that may or may not be directly related to enterprise services.

[0085] For example, the user can be allocated a certain amount of general purpose browsing that includes network destinations that are not specified in the enterprise service activity policy set. In some embodiments, there is a cap to such general purpose browsing, and carrier service design center 190 can provision the network and/or the device to alert the user regarding how much of the enterprise sponsored browsing remains or when the enterprise sponsored internet browsing cap is reached or exceeded. In some embodiments, the business rules in service usage reconciliation function 158 are programmed to deduct the service usage associated with the enterprise sponsored general purpose browsing, up to the specified cap, from the user's bill. In this way, the user can be allocated an allowance for services that either the enterprise sponsors to

account for enterprise related service usage that may not be included in the enterprise service activity policy set or that the enterprise simply desires to sponsor to reduce the device user's consumer service plan billing.

[0086] In a similar manner, services other than browsing that are not necessarily associated with enterprise service usage can also be sponsored by the enterprise by properly provisioning the business rules in service usage reconciliation function 158. For example, a catch-all enterprise sponsored allowance (e.g., or cap) for "bulk" internet usage can be provided. The fact that the user is provided with such an allowance may be pointed out to the user if the user disputes how much of his or her device service usage cost should be covered by the enterprise and how much the user should cover personally. Another example is to provide a certain amount of voice minutes to any phone number or to phone numbers not in the enterprise service activity policy set.

[0087] In some embodiments, the business rules in service usage reconciliation function 158 are provisioned so that the enterprise specifically does not allow, sponsor, or pay for certain device service usage activities. In some embodiments, these service usage activities can include access to network destinations, applications, or services that pose security risks to enterprise data stored on device 110 or pose security risks to enterprise network 170. In some embodiments, these activities include access to network destinations, applications, or services that the enterprise does not wish to sponsor or that are potentially associated with user activity that violates enterprise policy or laws. For example, the business rules may be configured to allow only transmission of business data on approved networks, e.g., excluding free or unknown WiFi hotspots, or only when device 110 is connected to the network via a VPN. In some embodiments, such service usage activities that violate enterprise security policies or other service usage policies are blocked by the business rules programmed into the network or the device as specified in the enterprise service activity policy set.

[0088] By programming the business rules in service usage reconciliation function 158 that determine the service usage accounting allocation between enterprise services and consumer services, many approaches can be provided for creating a service that provides an enterprise service to a device when the device user has not selected a consumer service plan or elected to

pay for a consumer service plan. For example, if the device user has not chosen to select or pay for a consumer service plan, carrier gateway/home agent 152 can be programmed to allow service usage for the enterprise service policy set but deny all other access until the user chooses a consumer service plan. In some embodiments, when/if the consumer chooses a consumer service plan then access would be expanded beyond just the enterprise services, because when the service plan activation occurs, consumer service policy set in carrier gateway/home agent 152 will be updated to allow service (e.g., as the carrier administrator user of carrier service design center 190 programs a different set of consumer service access policies for each consumer service plan that can be chosen). In some embodiments, the user is allocated a certain amount of general purpose data access or voice minutes as described above even though the user does not have a consumer data plan. Another example is to provide the user with a certain monetary allowance that is sponsored by the enterprise rather than a service usage amount.

[0089] Although enterprise service design center 194 is shown provisioning mobile server usage counter 179 (e.g., shown in Figure 5) and enterprise firewall/secure gateway 171, it should be understood that not all device provisioning connections as shown from secure enterprise mobile services gateway/server 172 to device 110 are shown for device functions including secure mobile services application access, communication link provisioning (e.g., cryptographic encryption keys, VPN settings, and various other security/communication provisioning), security programs, service control programs, and program settings for enterprise service applications, such as email, calendar, contacts, mobile synchronization services, and traffic control. As shown, the labeled provisioning connections are provided as exemplary embodiments to assist in identifying the network elements that are provisioned for network access control and network service usage charging reporting. Those of ordinary skill in the art will appreciate that these additional device provisioning functions are not necessarily specifically called out with provisioning connection labels in each figure, and it will be apparent to one of ordinary skill in the art which of these device provisioning functions and connections are needed from enterprise service design center 194 and device 110. It will also be apparent to one of ordinary skill in the art in view of the various embodiments described herein that the various device provisioning connections and device element programming configurations needed to provision these device functions can be managed by secure enterprise mobile services gateway/server 172 via a device management communications link. It will also be apparent to one of ordinary skill in the art that,

in some embodiments, the flow of policy provisioning information for the various device elements that participate in establishing service usage monitoring and reporting policies or service access control policies starts in enterprise service design center 194 and flows through secure enterprise mobile services gateway/server 172 over a device management link, and through the device management link on device 110 to the device 110 functional elements that need to be provisioned. In various embodiments described herein, the device elements that are provisioned in some embodiments to set up enterprise services, service usage monitoring and reporting policies, or service usage access control policies include one or more of enterprise data application 124, enterprise voice application 126, secure mobile enterprise application environment 120 (shown, e.g., in Figure 8), secure network interface 128 (shown, e.g., in Figure 8), secure enterprise mobile services application 125 (shown, e.g., in Figure 13), virtual machine #2 secure enterprise application environment 118 (shown, e.g., in Figure 14), enterprise application secured hardware execution partition 106 (shown, e.g., in Figure 15), device service usage monitor 119 (shown, e.g., in Figure 17), service processor framework program 139 (shown, e.g., in Figure 16), and/or service processor kernel program 138 (shown, e.g., in Figure 16).

[0090] In some embodiments, service usage reconciliation function 158, or secure enterprise mobile services gateway/server 172, or another similar network function, is programmed to review traffic usage patterns of mobile device 110 for the purpose of determining if the device may have fallen into unauthorized hands or if the device secure enterprise communications and data management software may have been hacked or tampered with in a way that endangers enterprise security or causes the enterprise to be billed for usage that is not enterprise usage. For example, service usage reconciliation function 158 (e.g., or secure enterprise mobile services gateway/server 172) can be programmed to monitor "bulk" enterprise service usage for the enterprise device group and trigger a fraud detection alert for a device that exhibits enterprise usage that is higher than a pre-determined "normal" limit. As another example, service usage reconciliation function 158 can be programmed to monitor "bulk" enterprise service usage for the enterprise device group and trigger a fraud detection alert for a device that exhibits enterprise usage access patterns that are determined to be outside of "normal" limits. Examples of usage patterns can include usage as a function of time of day, duration of usage, usage above a certain

limit for a subset of service usage activities, and/or usage above a certain limit for all service usage activities.

[0091] In some embodiments, enterprise service design center 194 is configured to receive or accept a specification for an access network service usage limit (e.g., a service amount in minutes, bytes, or cost) for a service usage activity (such as a data service, a voice service, a text service, a roaming service, or a more detailed classification of a data service, such as one or more websites or one or more device applications), and the service usage limit is applied to one or more devices 110 or device groups (or users or user groups) managed by enterprise service design center 194. In some embodiments, enterprise service design center 194 is further configured to receive service usage records for device 110, which is managed by enterprise service design center 194, from a network element configured to monitor and report device 110 service usage (e.g., carrier usage accounting server 154, enterprise firewall/security gateway 171, or another network element), and when the usage limit is reached, to generate a service usage notification message. In some embodiments, enterprise service design center 194 is configured to deliver the service usage notification message to enterprise service design center UI 196. In some embodiments, enterprise service design center 194 is configured to deliver the service usage notification message to a software application of device 110 (e.g., service processor framework program 139 or user data app 111) for presentation to the device user through a user interface of device 110.

[0092] In some embodiments, enterprise service design center 194 is configured to receive or accept a specification for an access network service notification event consisting of a network access pattern achieved or attempted by device 110 that belongs to a device group (or user group) managed by enterprise service design center 194, wherein the network access pattern is access attempted or achieved by one or more pre-defined device applications, or access attempted or achieved by device 110 to one or more network destinations, websites or network servers. In some embodiments, enterprise service design center 194 is further configured to receive service usage records for device 110, which is managed by enterprise service design center 194, from a network element configured to monitor and report device 110 service usage (e.g., carrier usage accounting server 154, enterprise firewall/security gateway 171, or another network element), and when the service usage indicates that the network access pattern has

occurred, enterprise service design center 194 is further configured to send a notification message to enterprise service design center UI 196.

Carrier Managed Billing Allocation With Service Usage Monitoring In Carrier Network and Enterprise Firewall/Gateway

[0093] **Figure 2** illustrates a functional diagram of another network architecture 101 for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. Network architecture 101 of Figure 2 is similar to network architecture 100 of Figure 1, except that in network architecture 101 of Figure 2, service usage reconciliation function158 receives service usage information from enterprise firewall/secure gateway 171 in addition to carrier gateway/home agent 152. This allows for various techniques that augment the capabilities of carrier gateway/home agent 152. For example, in networks in which it is impractical or infeasible for carrier gateway/home agent 152 to keep track of the service usage accounting allocation between the enterprise service policy set and consumer services for the devices in the device group, service usage reconciliation function 158 can receive total device service usage from carrier gateway/home agent 152, and receive the enterprise service usage from enterprise firewall/secure gateway 171. With this information, service usage reconciliation service usage function 158 can perform the allocation between enterprise service usage and consumer service usage without any detailed service usage reports from carrier gateway/home agent 152.

[0094] There are several reasons that the carrier network may not support numerous enterprise service customers with an enterprise/consumer allocation architecture that requires carrier gateway/home agent 152 to perform the necessary traffic classification or service usage classification as in the Figure 1 embodiment. For example, these reasons can include: (i) carrier gateway/home agent 152 does not have the detailed service usage classification capability (e.g., deep packet inspection function(s)) required to allocate service usage between the enterprise service policy set and consumer services for the devices in the device group, (ii) carrier gateway/home agent 152 is capable of performing the service monitoring required but can only do it for a limited number of devices (e.g., scaling issues), and/or (iii) there are too many device groups being managed by enterprise partners of the carrier creating a situation where the number

of specialized profiles that must be supported by carrier gateway/home agent 152 is larger than can be accommodated by the profile management capacity of the gateway system (e.g., scaling issues). As would now be apparent to those of ordinary skill in the art in view of the embodiments described herein, there are other reasons that can make it advantageous to provide the enterprise service usage from the enterprise network.

[0095] In some embodiments, provisioning with the service design centers and UIs for the embodiment shown in Figure 2 is similar to that of Figure 1. In some embodiments, the billing allocation capabilities of the two embodiments are similar if carrier gateway/home agent 152 is fully capable of differentiating service usage between the enterprise service policy set and the consumer services, but if not, then as discussed above, the billing allocation capabilities of the Figure 2 embodiment can be preferable in such environments.

[0096] Because the enterprise service usage is monitored by the enterprise network elements in the embodiments depicted in Figure 2, various service accounting or billing policies are available to the enterprise or carrier. For example, the amount of service usage resulting from enterprise services that occur during roaming conditions can be accounted for even when the carrier network does not receive detailed classification of service usage from roaming network partners. The business rules programmed into service usage reconciliation function 158 that are determined by the enterprise service activity policy set can break-out enterprise-service-related roaming charges separately from consumer-service-related roaming charges so that the enterprise-service-related roaming charges are sponsored or paid by the enterprise and consumer roaming service usage activities are not subsidized or are only partially subsidized. In addition, in some embodiments, secure enterprise mobile services gateway/server 172 includes the capability to determine if device 110 is roaming so that the access control policies specified in the enterprise service activity policy set can include modification or denial of access to enterprise network 170 services allowed by enterprise firewall/secure gateway 171 or secure enterprise mobile services gateway/server 172 during roaming conditions even though the access is not controlled by the carrier home network.

[0097] In some embodiments, an active network detection function is included on the device to assist the network policy enforcement elements to determine the type of network the device is

connected to or to determine if the device is on a home or roaming network, as described herein. For example, the service usage policy allowances provided by the enterprise service activity policy set can be programmed so that the allowances change depending on the availability of a particular network or set of networks, the time of day, the congestion state of a network, or the current cost of service on the network. For example, if the carrier home network is not available and only a roaming network is available, the allowance may be decreased or removed. As another example, if a certain network type is not available but another network type is (e.g., 2G is available instead of 3G or 3G is available instead of 4G), then the allocation can be reduced. As yet another example, if a variable charging policy is in place with the carrier for access when the network is busy or during certain times of day, then the enterprise sponsored allowance can be reduced during times of higher charging.

Enterprise Managed Billing Allocation With Service Usage Monitoring in Carrier Network And Enterprise Firewall/Gateway

[0098] **Figure 3** illustrates a functional diagram of another network architecture 102 for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. Network architecture 102 of Figure 3 is similar to network architecture 101 of Figure 2, except that in network architecture 102 of Figure 3, service usage reconciliation function 158 receives overall device service usage information from carrier usage accounting server 154 and also receives enterprise device service usage information from enterprise firewall/secure gateway 171. In some embodiments, there is no interaction between the provisioning of the carrier network and the provisioning of the enterprise network, and it is assumed that service usage reconciliation function 158 and enterprise usage accounting server 159 are both under the control of the enterprise administrator. This approach allows for various techniques that provide for enterprise allocation of consumer service usage and enterprise service usage without the need to interface to the carrier network other than to get the overall usage summary. For example, service usage reconciliation function 158 can receive total or "bulk" usage from carrier usage accounting server 154, receive enterprise service usage from enterprise firewall/secure gateway 171, and determine the amount of consumer service usage, enterprise service usage, and/or an enterprise service usage credit.

[0099] In some embodiments, provisioning with the service design centers and UIs for the embodiment shown in Figure 3 is similar to that of Figure 1 except that no provisioning of enterprise service parameters is required in the carrier network. The billing allocation capabilities are also similar if carrier gateway/home agent 152 is fully capable of differentiating service usage between the enterprise service policy set and the consumer services, but if not, then as discussed above, the billing allocation capabilities of the Figure 3 embodiment can be preferable in such environments. For example, using network architecture 102, the enterprise can deal directly with its employees without the need to bring the carrier into the consumer-versus-enterprise allocation process. As an example, the enterprise could have a policy in which consumers purchase their own mobile device services and then get credit for enterprise mobile device services at the end of each billing period. This credit can be provided back to the employee in the form of an expense reimbursement or an increase in their next paycheck.

Enterprise Usage Credit With Service Usage Monitoring in Enterprise Firewall/Gateway

[00100] **Figure 4** illustrates a functional diagram of another network architecture 103 for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. Network architecture 103 of Figure 4 is similar to network architecture 102 of Figure 3, except that in network architecture 103 of Figure 4, service usage reconciliation server function 158 receives no overall device service usage information from the carrier network. As shown in Figure 4, the source of service usage information is enterprise network 170 (e.g., via the enterprise firewall/secure gateway 171). In some embodiments, there is no interaction between the provisioning of the carrier network and the provisioning of the enterprise network, and it is assumed that service usage reconciliation function 158 and enterprise usage accounting server 159 could both be under the control of the enterprise administrator. For example, network architecture 103 of Figure 4 can be less dependent on the carrier than network architecture 102 of Figure 3 in that no billing information feed is provided. Using various techniques described herein, an enterprise service usage credit can be determined, and the determined enterprise service usage credit can be reimbursed to the device user.

Carrier Managed Billing Allocation With Service Usage Monitoring In Carrier Gateway/Home Agent And Enterprise Mobile Services Gateway Server

[00101] **Figure 5** illustrates a functional diagram of another network architecture 200 for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. Network architecture 200 of Figure 5 is similar to network architecture 101 of Figure 2, except that in network architecture 200 of Figure 5, secure enterprise mobile services gateway/server 172 includes mobile server usage monitor 179, and the enterprise service usage reports from this function are sent to service usage reconciliation function 158 instead of usage reports being sent from enterprise firewall/secure gateway 171. In some embodiments, various specialized needs of monitoring, recording, and reporting enterprise service usage are confined to the special-purpose secure enterprise mobile services gateway/server 172 rather than requiring the often more general-purpose enterprise firewall/secure gateway 171 to perform these functions.

Enterprise Managed Billing Allocation With Service Usage Monitoring in Carrier Network And Enterprise Mobile Services Gateway Server

[00102] **Figure 6** illustrates a functional diagram of another network architecture 201 for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. Network architecture 201 of Figure 6 is similar to network architecture 102 of Figure 3, except that in network architecture 201 of Figure 6, secure enterprise mobile services gateway/server 172 includes mobile server usage monitor 179, and the enterprise service usage reports from this function are sent to service usage reconciliation function 158 instead of usage reports being sent from enterprise firewall/secure gateway 171. For example, this approach allows for the specialized needs of monitoring, recording, and reporting enterprise service usage to be performed by the special-purpose secure enterprise mobile services gateway/server 172 rather than requiring the often more general-purpose enterprise firewall/secure gateway 171 to perform such functions.

Enterprise Usage Credit With Service Usage Monitoring in Enterprise Mobile Services Gateway Server

[00103] **Figure 7** illustrates a functional diagram of another network architecture 202 for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. Network architecture 202 of Figure 7 is similar to network architecture 103 of Figure 4, except that in network architecture 202 of Figure 7, secure enterprise mobile services gateway/server 172 includes mobile server usage counter 179, and the enterprise service usage reports from this function are sent to service usage reconciliation function 158 instead of usage reports being sent from enterprise firewall/secure gateway 171. For example, this approach allows for the specialized needs of monitoring, recording and reporting enterprise service usage to be performed by the special-purpose secure enterprise mobile services gateway/server 172 rather than requiring the often more general-purpose enterprise firewall/secure gateway 171 to perform such functions.

Carrier Managed Billing Allocation With Device Mobile Enterprise Services Application Environment and Service Usage Monitoring In Carrier Network

[00104] **Figure 8** illustrates a functional diagram of another network architecture 300 for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. As shown, secure mobile enterprise application environment 120 and secure network interface 128 within secure mobile enterprise application environment 120 are included in device 110. Also, server secure network interface 127 is included in secure enterprise mobile services gateway/server 172. In some embodiments, secure mobile enterprise application environment 120 protects sensitive enterprise information that is stored on device 110 (e.g., email text and downloads, calendar information, contacts, intranet data, or any other enterprise data) and provides a secure communication channel function to allow for authentication with server secure network interface 127 on secure enterprise mobile services gateway/server 172. As also shown, a user services application environment in device 110 includes various user applications, such as user data application 111 and user voice application 112.

[00105] In some embodiments, provisioning of the various network architecture elements to facilitate the allocation between enterprise service usage accounting or billing and consumer service usage accounting or billing is established as follows. The device portion of secure

network interface 128 and the enterprise server portion of server secure network interface 127 are provisioned with connection "E." In some embodiments, this provisioning operation with the connection labeled "E" includes programming information for secure network interface 128 to direct enterprise network 170 access traffic associated with application functions running in secure mobile enterprise application environment 120 to enterprise network 170 destinations that are to be sponsored (and, in some embodiments, possibly intermediate network routes) according to the enterprise services policy set, including, for example, the addresses (e.g., IP, IP/port or other higher layer address identifiers) of secure enterprise mobile services gateway/server 172 or enterprise intranet servers 180. In some embodiments, the provisioning operation designated with the connection label "E" also establishes the parameters required for the secure communication of information between secure network interface 128 and server secure network interface 127. In some embodiments, this provisioning step sets up the policies for the authentication process, data encryption, and cryptographic key exchange processes take place to establish secure communication between secure mobile enterprise application environment 120 and secure enterprise services gateway/server 172.

[00106] In some embodiments, the enterprise network destinations that are to be sponsored according to the enterprise services policy set identified by provisioning connection "E" are also communicated to carrier service design center 190. For example, this allows carrier service design center 190 to determine and transmit the proper provisioning information to establish the access control policies or service usage accounting policies for these aspects of the enterprise services policy set. Carrier service design center provisioning connections "A" communicate the provisioning information (programming) to carrier gateway/home agent 152. Carrier service design center provisioning connections "B" communicate the provisioning information (programming) to service usage reconciliation function 158.

[00107] In some embodiments, the provisioning operation associated with the provisioning connection label "C" provisions enterprise firewall/secure gateway 171 to admit devices 110 with device credentials or application credentials that belong to the desired enterprise services device group associated with the enterprise service policy set. In some embodiments, the provisioning information labeled as "C" includes enterprise network 170 destinations that are to be sponsored (and, in some embodiments, possibly intermediate network routes) according to the

enterprise services policy set. In some embodiments, the provisioning information labeled as "C" includes only the network destinations for secure enterprise mobile services gateway/server 172, and devices 110 are not allowed access to other parts of enterprise network 170.

[00108] In some embodiments, network architecture 300 for providing enterprise and consumer billing allocation for wireless communication device service usage activities includes executing an enterprise application as a secure enterprise data application 124 in secure mobile enterprise application environment 120 of device 110 in which the secure applications are in network communication (e.g., secure network communication, such as via a virtual private network (VPN) or other secure network communication techniques) with secure enterprise mobile services gateway/server 172 (e.g., executing an enterprise server side of the enterprise authorized/sponsored applications, such as an enterprise email server, an enterprise calendar server, an enterprise contacts server, and/or an enterprise network access server) of the enterprise. In some embodiments, the secure enterprise mobile services gateway/server 172 performs application monitoring that includes counting application service usage (e.g., bytes used in communicating with the device's execution of secure enterprise application 124). In some embodiments, secure enterprise mobile services gateway/server 172 performs application monitoring that further includes classifying application service usage (e.g., classifying secure enterprise application 124 by application/service usage activity such as based on application name or using signed code/hash techniques, by time of day/day of week, enterprise server, destinations, enterprise intranet, and/or other factors).

Carrier Managed Billing Allocation With Device Mobile Enterprise Services Application Environment and Mobile Services Gateway Server With Service Usage Monitoring In Carrier Network

[00109] **Figure 9** illustrates a functional diagram of another network architecture 301 for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. Network architecture 301 of Figure 9 is similar to network architecture 300 of Figure 8, except that in network architecture 301 of Figure 9, secure enterprise mobile services gateway/server 172 is located between the Internet 160 and enterprise network 170. For example, this approach allows for server secure network interface

127 of secure enterprise mobile services gateway/server 172 to restrict access to enterprise network 170 and enterprise intranet servers 180 based on device authentication and/or various other security techniques (e.g., secure access, authentication, and/or communication techniques), as would be apparent to one of ordinary skill in the art in view of the various embodiments described herein.

Carrier Managed Billing Allocation With Device Mobile Enterprise Services Application Environment and Mobile Services Gateway Server With Service Usage Monitoring In Carrier Network And Mobile Services Gateway Server

[00110] **Figure 10** illustrates a functional diagram of another network architecture 302 for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. Network architecture 302 of Figure 10 is similar to network architecture 301 of Figure 9, except that in network architecture 302 of Figure 10, secure enterprise mobile services gateway/server 172 includes mobile service usage monitor 179 that reports enterprise service usage to the service usage reconciliation function 158. In some embodiments, various specialized needs of monitoring, recording, and reporting enterprise service usage are confined to the special-purpose enterprise mobile services gateway/server 172 rather than requiring the often more general-purpose enterprise firewall/secure gateway 171 and/or other network elements/functions to perform such functions.

Enterprise Managed Billing Allocation With Device Mobile Enterprise Services Application Environment and Mobile Services Gateway Server With Service Usage Monitoring In Mobile Services Gateway Server

[00111] **Figure 11** illustrates a functional diagram of network architecture 303 for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. Network architecture 303 of Figure 11 is similar to network architecture 302 of Figure 10, except that network architecture 303 of Figure 11 includes another carrier usage accounting server 154B that reports service usage to service usage reconciliation function 158. In some embodiments, carrier usage accounting server 154B receives overall or bulk service usage data from carrier gateway/home agent 152 and forwards such information to service usage reconciliation function 158. Service usage reconciliation

function 158 reconciles the overall or bulk service usage received from carrier accounting server 154B and the enterprise service usage received from mobile server usage monitor 179 and provides such reconciled service usage information to carrier usage accounting server 154A.

Enterprise Usage Credit With Device Mobile Enterprise Services Application Environment and Mobile Services Gateway Server With Service Usage Monitoring In Mobile Services Gateway Server

[00112] **Figure 12** illustrates a functional diagram of network architecture 304 for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. Network architecture 304 of Figure 12 is similar to network architecture 303 of Figure 11, except that in network architecture 304 of Figure 12, the only service usage reported to service usage reconciliation function 158 is the enterprise service usage received from mobile server usage monitor 179. In some embodiments, service usage reconciliation function 158 reconciles the enterprise service usage received from mobile server usage monitor 179 and provides such reconciled service usage information to carrier usage accounting server 154, which generates enterprise service usage record(s) 156.

Device Configurations Without Service Usage Monitoring and Reporting

[00113] **Figure 13** illustrates a functional diagram of a secure device application architecture for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. As shown, device 110 includes an operating system application space 131, operating system lower layers 130 including network stack 121, and access modem (e.g., wireless modem) 129. As also shown, operating system application space 131 includes various user applications, such as user data application 111 and user voice application 119, and service usage monitor 119. Operating system application space 131 also includes secure enterprise mobile services application 125, which includes various enterprise applications, such as email, synchronization, contacts, calendar communications, and intranet. Secure enterprise mobile services application 125 also includes secure network interface 128 (e.g., for securely communicating with an enterprise network).

[00114] **Figure 14** illustrates a functional diagram of another secure device virtual machine architecture for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. Figure 14 is similar to Figure 13, except that in Figure 14 the user applications are executed/stored within virtual machine (VM) #1 consumer application environment117, and secure enterprise mobile services application 125 is included within virtual machine (VM) #2 secure enterprise application environment 118. Device 110 also includes virtual machine operating system 115 that includes virtual OS instantiation #1 117A for VM #1 consumer application environment 117 and virtual OS instantiation #2 118A for VM #2 secure enterprise application environment 118. As also shown, virtual machine operating system 115 includes virtual machine OS network stack 116.

[00115] **Figure 15** illustrates a functional diagram of another secure device hardware execution partition architecture for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. Figure 15 is similar to Figure 14, except that in Figure 15 hardware partitions are provided instead of virtual partitions. As shown, the user applications are executed/stored within user application secured hardware execution partition 105 and secure enterprise mobile services application 125 is included within enterprise application secured hardware execution partition 106. Device 110 also includes secured hardware partition for OS 115 that includes secure hardware partition manager #1 107 for user application secured hardware execution partition 105 and secure hardware partition manager #2 108 for enterprise application secured hardware execution partition 106. As also shown, secured hardware partition for OS 115 includes OS network stack 116.

[00116] **Figure 16** illustrates a functional diagram of another secure device service processor architecture for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. As similarly described herein with respect to various embodiments, the device architecture of Figure 16 includes service processor framework program 139 (e.g., framework space agent/function) and network stack framework components 137 in operating system framework space 133, and service processor kernel program 138 (e.g., kernel space agent/function) and network stack kernel components 135 in operating system kernel space 132. In some embodiments, the service processor functions

provide a user interface function to communicate to a user of device 110 whether or not a service usage activity is an approved/authorized service usage activity, or whether it is a disallowed service usage activity for device 110 (e.g., the enterprise has disallowed the usage of device 110 for such service usage activities, such as online gaming and/or certain other online activities or certain long distance calling or voice usage during certain days, such as weekends) or whether such would/will be charged/billed to the user as a consumer under the user's consumer plan. In some embodiments, the service processor functions provide a user interface function to communicate to a user of device 110 an associated cost of certain service usage activities allocated to consumer service usage. In some embodiments, the service processor functions provide a user interface function to communicate to a user of device 110 an associated credit of certain service usage activities allocated to enterprise service usage. In some embodiments, the service processor functions provide a user interface function to communicate to a user of device 110 various other information as described herein with respect to providing an enterprise and consumer allocation for service usage activities. In some embodiments, the service processor shown in Figure 16 communicates with a service controller, such as described herein with respect to various embodiments.

Carrier Managed Billing Allocation With Device Mobile Enterprise Services Application Environment and Mobile Services Gateway Server With Service Usage Monitoring In Carrier Network And On Device

[00117] **Figure 17** illustrates a functional diagram of another network architecture 400 for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. Network architecture 400 of Figure 17 is similar to network architecture 302 of Figure 10, except that as shown in Figure 17, device 110 also includes service usage monitor 119 (e.g., agent/function) in secure mobile enterprise application environment 120. In some embodiments, service usage monitor 119 performs application monitoring that includes counting application service usage for secure data application 124 and secure voice application 126 (and, in some embodiments, for also counting application service usage for user applications that are not enterprise or secure enterprise applications 124 or 126). In some embodiments, counting application service usage includes counting bytes or network connection time used in communicating via carrier access network

150 during the device's execution of monitored data applications. In some embodiments, counting application service usage includes counting voice network connection time used in communicating via carrier access network 150 during the device's execution of monitored voice applications. In some embodiments, service usage monitor 119 performs application monitoring that further includes classifying application service usage for secure enterprise applications 124, 126 (e.g., classifying various secure enterprise applications 124, 126 and in some embodiments, including ambient services classification/determination, by application/service usage activity such as based on application name or using signed code/hash techniques, by time of day/day of week, enterprise server, destinations, enterprise intranet, and/or other factors).

[00118] In some embodiments, carrier usage accounting server 154 communicates (e.g., using secure communication techniques) with service usage monitor 119 to mediate billing/charging and credit reports, for example, using the various approaches and techniques as described herein.

[00119] In some embodiments, service usage monitor 119 and/or another function/agent executed in secure mobile enterprise application environment 120 of device 110 blocks user access for non-enterprise activities that the user has not agreed to pay for.

[00120] Because the enterprise service usage is monitored by the device network elements in the embodiments depicted in Figure 17, various service accounting or billing policies are available to the enterprise or carrier. For example, the amount of service usage resulting from enterprise services that occur during roaming conditions may be accounted for even when the carrier network does not receive detailed classification of service usage from roaming network partners. The business rules programmed into service usage reconciliation function 158 that are determined by the enterprise service activity policy set can break-out enterprise service related roaming charges separate from consumer service related roaming charges. In addition, in some embodiments, the device secure mobile enterprise environment includes an access control function so that the access control policies specified in the enterprise service activity policy set can be enforced on roaming networks that have access that is not controlled by the carrier home network.

[00121] For example, the allowances provided by the enterprise service activity policy set can be programmed so that the allowances change depending on the availability of a particular

network or set of networks, the time of day, the congestion state of a network, or the current cost of service on the network. As another example, if the carrier home network is not available and only a roaming network is available, the allowance can be decreased or removed. As yet another example, if a certain network type is not available but another network type is (e.g., 2G is available instead of 3G or 3G is available instead of 4G), then the allocation can be reduced. As yet a further example, if a variable charging policy is in place with the carrier for access when the network is busy or during certain times of day, then the enterprise sponsored allowance can be reduced during times of higher charging. As described herein, in some embodiments, an active network detection function can be included on the device to assist the network policy enforcement to determine the type of network the device is connected to or to determine if the device is on a home or roaming network. As also described herein, in some embodiments, a network busy state monitor function can be included on the device to assist the network policy enforcement to determine the network busy state or state of network congestion.

Carrier Managed Billing Allocation With Device Mobile Enterprise Services Application Environment and Mobile Services Gateway Server With Service Usage Monitoring In Carrier Network, On Device, And In Enterprise Mobile Services Gateway Server

[00122] **Figure 18** illustrates a functional diagram of another network architecture 401 for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. Network architecture 401 of Figure 18 is similar to network architecture 400 of Figure 17, except that in network architecture 401 of Figure 18, secure enterprise mobile services gateway/server 172 includes mobile server usage counter 179, and the enterprise service usage reports from this function are sent to service usage reconciliation function 158. In some embodiments, various specialized needs of monitoring, recording, and reporting enterprise service usage are confined to the special-purpose secure enterprise mobile services gateway/server 172.

Enterprise Managed Billing Allocation With Device Mobile Enterprise Services Application Environment and Mobile Services Gateway Server With Service Usage Monitoring On Device And In Enterprise Mobile Services Gateway Server

[00123] **Figure 19** illustrates a functional diagram of another network architecture 402 for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. Network architecture 402 of Figure 19 is similar to network architecture 401 of Figure 18, except that network architecture 402 of Figure 19 does not include the service usage feed from carrier gateway/home agent 152, and service usage reconciliation function 158 relies solely on a device service usage feed from device 110 usage monitors 119 and secure enterprise mobile services gateway/server 172 mobile service usage monitor 179. In some embodiments, service usage reconciliation function 158 and enterprise service usage accounting server 159 are under the control of the enterprise or the carrier. For example, an enterprise entity can establish enterprise service and consumer service usage allocation accounting without the need to tie into the carrier network for usage feeds and usage accounting. Using various techniques described herein, an enterprise service usage credit can be determined, and the determined enterprise service usage credit can be reimbursed to the device user.

Enterprise Managed Billing Allocation With Device Mobile Enterprise Services Application Environment and Mobile Services Gateway Server With Service Usage Monitoring On Device

[00124] **Figure 20** illustrates a functional diagram of another network architecture 403 for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. Network architecture 403 of Figure 20 is similar to network architecture 402 of Figure 19, except that in network architecture 403 of Figure 20, service usage reconciliation function 158 receives feeds from device 110 service usage monitors 119 and there is no feed from the secure enterprise mobile services gateway server.

Enterprise Usage Credit With Device Mobile Enterprise Services Application Environment and Mobile Services Gateway Server With Service Usage Monitoring On Device And In Enterprise Mobile Services Gateway Server

[00125] **Figure 21** illustrates a functional diagram of another network architecture 404 for providing enterprise and consumer billing allocation for wireless communication device service

usage activities in accordance with some embodiments. Network architecture 404 of Figure 21 is similar to network architecture 402 of Figure 19, except that in network architecture 404 of Figure 21, there is no service usage monitor function 119 in user services application environment 122 providing service usage reports/information to service usage reconciliation function 158, and enterprise usage accounting server 159 only generates enterprise usage records 156.

Enterprise Usage Credit With Device Mobile Enterprise Services Application Environment and Mobile Services Gateway Server With Usage Monitoring On Device

[00126] **Figure 22** illustrates a functional diagram of another network architecture 405 for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. Network architecture 405 of Figure 22 is similar to network architecture 404 of Figure 21, except that network architecture 405 of Figure 22 does not include mobile server usage monitor 179 providing enterprise service usage reports/information to service usage reconciliation function 158.

Device Configurations With Service Usage Monitoring and Reporting

[00127] In some embodiments, secure enterprise mobile services application 125 and network stack 121 can be implemented in access modem 129, as described below with respect to Figures 23 through 26.

[00128] **Figure 23** illustrates a functional diagram of a secure device application architecture with device-based service usage monitoring (and in some embodiments, access control) for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. Figure 23 is similar to Figure 13 except that in Figure 23 usage monitor 119 is provided as shown, and secure enterprise mobile services application 125 and network stack 121 can be implemented in access modem 129 as also shown.

[00129] **Figure 24** illustrates a functional diagram of a secure device virtual machine architecture with device-based service usage monitoring (and in some embodiments, access control) for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. Figure 24 is similar to

Figure 14 except that in Figure 24, usage monitor 119 is provided as shown, and secure enterprise mobile services application 125 and virtual machine OS network stack 116 can be implemented in access modem 129 as also shown.

[00130] **Figure 25** illustrates a functional diagram of a secure device hardware execution partition architecture with device-based service usage monitoring (and in some embodiments access control) for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. Figure 25 is similar to Figure 15 except that in Figure 25 usage monitor 119 is provided as shown, and secure enterprise mobile services application 125 and virtual machine OS network stack 116 can be implemented in access modem 129 as also shown.

[00131] **Figure 26** illustrates a functional diagram of a secure device service processor architecture with device based service usage monitoring (and in some embodiments, access control) for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. Figure 263 is similar to Figure 16 except that in Figure 26 usage monitor 119 is provided as shown, and secure enterprise mobile services application 125, service processor framework 139, and service processor kernel program 138, can be implemented in the access modem 129 as also shown.

[00132] In some embodiments, service processor framework program 139 (or service processor kernel program 138) interacts with network stack framework components 137 or network stack kernel components 135 to inspect traffic for service usage classification and service policy enforcement (e.g., access control policy enforcement, traffic control policy enforcement, service usage accounting, charging policy enforcement, or service notification policy enforcement) purposes. In some embodiments, one or more of network stack framework components 137 and network stack kernel components 135 provides classification information on one or more traffic flows to service processor framework program 139 (or service processor kernel program 138). In some embodiments, service processor framework program 139 (or service processor kernel program 138) seeks to match the classification information to one or more classification parameters contained in the service policy definitions in order to determine the service policy enforcement actions that may be required for a traffic flow. In some embodiments, a traffic flow

is a flow of data packets. In some embodiments, a traffic flow is a flow of one or more data packets that are associated with a device application, the association of a traffic flow to a device application being identified by network stack framework components 137 or network stack kernel components 135 or service processor framework program 139 (or service processor kernel program 138). In some embodiments, the service usage classification determines that the traffic flow is associated with a combination of one or more of: a device application, a network destination, a traffic type, a content type, a QoS level, a roaming network, a home network.

[00133] In some embodiments, the association of traffic flow to a specific device application is used to determine a service policy enforcement action that is dependent on the specific device application. In some embodiments, a specific device application identifier (e.g., an application name, application signature, application hash or application certificate) forms an application credential that is used to index a service policy enforcement action that is intended to be implemented following a service usage activity or attempted service usage activity by the specific device application. In some embodiments, a specific device application is verified as consistent with an application credential in order to ensure that an application service policy enforcement action intended to be applied to the specific device application is applied to the correct application. In some embodiments, the verification that a specific application is consistent with an application credential associated with a service policy enforcement action is performed in service processor framework program 139 (or service processor kernel program 138) to ensure that ensure that an application service policy enforcement action intended to be applied to the specific device application is applied to the correct application. In some embodiments, the verification that a specific application is consistent with an application credential associated with a service policy enforcement action is performed in network stack framework components 137 or network stack kernel components 135, and service processor framework program 139 (or service processor kernel program 138) ascertains the application credential verification to ensure that ensure that an application service policy enforcement action intended to be applied to the specific device application is applied to the correct application.

[00134] In some embodiments, the association of traffic flow to a specific device application is used to determine a service policy enforcement action that is dependent on the specific device application, and service processor framework program 139 (or service processor kernel program

138) instructs network stack framework components 137 or network stack kernel components 135 to implement the service policy enforcement action on the traffic flow associated with the specific device application. In some embodiments, the association of traffic flow to a specific device application is used to determine a service policy enforcement action that is dependent on the specific device application, and service processor framework program 139 (or service processor kernel program 138) implements the service policy enforcement action. In some embodiments, a traffic flow is buffered pending classification (e.g., buffered in one or more of network stack framework components 137, network stack kernel components 135, service processor framework program 139, or service processor kernel program 138). In some embodiments, upon classification of the traffic flow (e.g., determination of an association of the traffic flow to a specific device application), a service policy enforcement action that is dependent on the specific device application is determined by service processor framework program 139 (or service processor kernel program 138) and implemented in one or more of network stack framework components 137, network stack kernel components 135, service processor framework program 139, and service processor kernel program 138. In some embodiments, the service policy enforcement action for the traffic flow is implemented in service processor framework program 139 (or service processor kernel program 138). In some embodiments, service processor framework program 139 (or service processor kernel program 138) instructs a device UI program that displays a device service notification (e.g., a service usage notification, a service plan offer notification, or an indication of a service usage event or attempted service usage event that requires a user notification) to implement the service policy enforcement action for the traffic flow. In some embodiments, service processor framework program 139 (or service processor kernel program 138) instructs a service usage monitor (e.g., accounting traffic to bulk classification or a more detailed classification of service usage) to implement the service policy enforcement action for the traffic flow.

[00135] In some embodiments, the network destination of a traffic flow is used to determine if a service policy enforcement action that is dependent on a specific network destination should be applied to the traffic flow. In some embodiments, a traffic flow is inspected by network stack framework components 137 or network stack kernel components 135, and one or more traffic characteristics (e.g., an address, a socket/flow tuple, a layer-7 packet information, or a packet header string) are passed to service processor framework program 139 (or service processor

kernel program 138), wherein the one or more traffic characteristics are matched against one or more classification parameters contained in a service policy definition, and if a match is present then a service policy enforcement action is implemented for the traffic flow. In some embodiments, a traffic flow is inspected by service processor framework program 139 (or service processor kernel program 138), and one or more traffic characteristics (e.g., an address, a socket/flow tuple, a layer-7 packet information, or a packet header string) are matched against one or more classification parameters contained in a service policy definition, and if a match is present then a service policy enforcement action is implemented for the traffic flow. In some embodiments, the service policy enforcement action for the traffic flow is implemented in service processor framework program 139 (or service processor kernel program 138). In some embodiments, service processor framework program 139 (or service processor kernel program 138) instructs network stack framework components 137 or network stack kernel components 135 to implement the service policy enforcement action for the traffic flow. In some embodiments, the service policy enforcement action for the traffic flow is implemented by a device UI program that displays a device service notification (e.g., a service usage notification, a service plan offer notification, or an indication of a service usage event or attempted service usage event that requires a user notification). In some embodiments, the service policy enforcement action for the traffic flow is implemented by a service usage monitor (e.g., accounting traffic to bulk classification or a more detailed classification of service usage).

[00136] In some embodiments, an enterprise manger can define or select service plan policies that confine enterprise-sponsored access services to a pre-defined list of device applications. For example, an enterprise manager might choose to define or select a service plan wherein only corporate applications may be accessed (e.g., email, contacts, intranet services, text, and/or voice). In such embodiments, enterprise service design user interface 196 may be used by the enterprise manager to define or select the allowable applications that are to have access. In some embodiments, an enterprise access manager may define or select a different set of applications to be accessible when device 110 is roaming than when device 110 is on a home network or on a WiFi network. In some embodiments, an enterprise manager may define or select a set of applications that are to be not allowed access when a device is on a certain network (e.g., a roaming network). For example, many modern smart phone, tablet, and laptop operating systems have background services that have the potential to incur large roaming charges during

roaming conditions (e.g., Google Android "gallery" functions that share device data with the Google network, Microsoft "system" functions that do the same, software update programs, etc.). In such cases, enterprise service design center 194 may be used to specify the device applications that are not allowed to access the network during certain network conditions.

[00137] In some embodiments, the identification and network access control for a device application is performed with a device software program or agent (e.g., service processor framework program 139 or service processor kernel program 138), and enterprise service design center 194 programs the device agent with the application identification parameters and associated access policies. In some embodiments, the device agent identifies the application using an application name, certificate, signature, or hash for an application running on the device and a policy instruction stored on the device.

[00138] In some embodiments, the identification and network access control for a device application is performed with one or more network access policy enforcement elements (e.g., carrier gateway/home agent 152, carrier usage accounting server 154, enterprise firewall/security gateway 171), and enterprise service design center 194 causes the one or more network access policy enforcement elements to be provisioned with the application identification parameters and associated access policies. In some embodiments, the one or more network access policy enforcement elements identify an application by observing the traffic headers inserted by the application. In some embodiments, the one or more network access policy enforcement elements identify an application by observing the network destinations or destination patterns accessed by the application. In some embodiments, the one or more network access policy enforcement elements identify an application by routing or tunneling the application traffic to one or more network gateways or servers associated with the application (e.g., APN routes, dedicated application addressing, or a device agent that steers the application traffic to a server). In some embodiments, the device assists in this routing or tunneling with a device agent that is programmed to route or re-direct the traffic for an application.

[00139] In some embodiments, an enterprise manger can define or select service plan policies that confine enterprise-sponsored access services to a pre-defined list of network destinations, servers, or resources. For example, an enterprise manager might choose to define or select a

service plan wherein only corporate network destinations may be accessed (e.g., email server, contacts server, intranet servers, text service servers, and VOIP servers). In some embodiments, enterprise service design center interface 196 may be used by an enterprise manager to define or select the allowable network destinations that device 110 may access. In some embodiments, the enterprise access manager may define or select a different set of network destinations when device 110 is roaming than when device 110 is on a home network or on a WiFi network. In some embodiments, an enterprise manager may define or select a set of network destinations that device 110 cannot access when device 110 is on a certain network (e.g., a roaming network). For example, many websites and enterprise services exhibit network access service usage behavior that can incur large roaming charges during roaming conditions (e.g., software update websites or servers, contact database synchronization websites, email download synchronization websites, video conference websites, etc.). In such cases, enterprise service design center 194 may be used to specify the device applications, services, and/or websites that are not to be accessed or used during certain network connection conditions.

[00140] In some embodiments, a device agent identifies the network destination and applies the appropriate access policy by comparing traffic characteristics with pre-defined characteristics in the access policy instructions provisioned on device 110, and then applies the corresponding traffic control rule, and enterprise service design center 194 performs the provisioning of the device agent. In some embodiments, the identification and network access control for a network destination is performed with one or more network access policy enforcement elements (e.g., carrier gateway/home agent 152, carrier usage accounting server 154, enterprise firewall/security gateway 171) and enterprise service design center 194 performs the provisioning of the one or more network elements.

[00141] In some embodiments, enterprise service design center 194 is configured to receive or accept a specification for an access network service usage limit (e.g., a service amount in minutes, bytes, or cost) for a service usage activity (such as a data service, a voice service, a text service, a roaming service, or a more detailed classification of data service such as one or more websites or one or more device applications), and the service usage limit is applied to one or more devices 110 or device groups (or users or user groups) managed by enterprise service design center 194. In some embodiments, enterprise service design center 194 is further

configured to receive service usage records for device 110, which is managed by enterprise service design center 194, from a device-based element that monitors and reports device 110 service usage (e.g., one or more device usage monitors 119, device service processor framework program 139, or service processor kernel program 138, network stack 134, or access modem 151), and when the usage limit is reached a service usage notification message is generated. In some embodiments, enterprise service design center 194 is configured to deliver the service usage notification message to enterprise service design center UI 196. In some embodiments, enterprise service design center 194 is configured to deliver the service usage notification message to a device 110 software application (e.g., service processor framework program 139 or user data app 111) for presentation to the device user via a user interface.

[00142] In some embodiments, enterprise service design center 194 is configured to receive or accept a specification for an access network service usage limit (e.g., a service amount in minutes, bytes, or cost) for a service usage activity (such as a data service, a voice service, a text service, a roaming service, or a more detailed classification of data service such as one or more websites or one or more device applications), and the service usage limit is applied to one or more devices 110 or device groups (or users or user groups) managed by enterprise service design center 194. In some embodiments, enterprise service design center 194 is further configured to receive service usage records for device 110, which is managed by the enterprise service design center 194, from a device-based element configured to monitor and report device 110 service usage (e.g., one or more device usage monitors 119, device service processor framework program 139 or service processor kernel program 138, network stack 134, or access modem 151), and when the usage limit is reached a restriction or limitation on further usage is applied by the service design center by provisioning one or more network elements responsible for enforcing network access policy (e.g., carrier gateway/home agent 152, carrier usage accounting server 154, enterprise firewall/security gateway 171). In some embodiments, enterprise service design center 194 is configured to send the user a notification message or a message to contact an enterprise manager.

[00143] In some embodiments, secure network interface 128 on device 110 is configured with a VPN device client function to securely communicate between one or more approved enterprise applications (e.g., enterprise data app 124, enterprise voice app 126, secure enterprise mobile

services app 125) and a counterpart VPN function that secures access to enterprise network 170 (e.g., enterprise firewall/security gateway 171 or server secure network interface 127). In some embodiments, a device software application or agent (e.g., service processor framework program 139 or service processor kernel program 138, secure network interface 128, secure hardware partition manager 108) is configured to identify network access activity associated with individual applications and allow network access to one or more approved enterprise applications when a VPN device client function is in operation, or not allow network access to one or more approved enterprise applications when a VPN device client function is not in operation. In some embodiments, service design center 190 or enterprise service design center 194 is configured to provision a device 110 software application or agent (e.g., service processor framework program 139 or service processor kernel program 138, secure network interface 128, secure hardware partition manager 108) with application access policy rules to identify network access activity associated with individual applications and allow network access to one or more approved enterprise applications when a VPN device client function is in operation, or not allow network access to one or more approved enterprise applications when a VPN device client function is not in operation. In this manner, enterprise applications that might be subject to spoofing by network elements, websites, servers, or programs operating outside the secure enterprise environment are not placed in communication with such network elements.

[00144] In some embodiments, a device software application or agent (e.g., service processor framework program 139 or service processor kernel program 138, secure network interface 128, secure hardware partition manager 108) is configured to identify network access activity associated with individual applications and not allow network access to one or more non-approved applications when a VPN device client function is in operation, or allow network access to one or more non-approved applications when a VPN device client function is not in operation. In some embodiments, service design center 190 or enterprise service design center 194 is configured to provision a device 110 software application or agent (e.g., service processor framework program 139 or service processor kernel program 138, secure network interface 128, secure hardware partition manager 108) with application access policy rules to identify network access activity associated with individual applications and not allow network access to one or more non-approved applications when a VPN device client function is in operation, or allow network access to one or more enterprise applications when a VPN device client function is not

in operation. In this manner, applications that might maliciously access enterprise network resources when the VPN is running are not permitted to do so.

[00145] In some embodiments, the application access policy rules are enforced by allowing or not allowing an application to access the network. In some embodiments, the application access policy rules are enforced by allowing or not allowing the application to run. In some embodiments, the identification of approved enterprise applications associated with traffic flows is confirmed or secured by identifying the application certificate and comparing it to an application signature or hash on the device. In some embodiments, the identity of an approved enterprise application is confirmed by inspecting an application certificate, signature or hash that is provided by service design center 190 or enterprise service design center 194.

[00146] In some embodiments, secure network interface 128 is configured with a split-tunnel VPN device client function, wherein an enterprise side of the split tunnel is configured to securely communicate between one or more enterprise applications (e.g., enterprise data app 124, enterprise voice app 126, secure enterprise mobile services app 125) and a counterpart VPN function that secures access to the enterprise network 170 (e.g., enterprise firewall/security gateway 171 or server secure network interface 127), and a consumer side of the split tunnel is configured to communicate without encryption for access network services provided to consumer applications on the device. In some embodiments, a device software application or agent (e.g. service processor framework program 139 or service processor kernel program 138, secure network interface 128, secure hardware partition manager 108) is configured to identify network access activity associated with individual applications and route or direct traffic associated with one or more enterprise applications to the enterprise side of the split VPN tunnel, and route or direct traffic associated with one or more consumer applications to the consumer side of the VPN tunnel. In some embodiments, service design center 190 or enterprise service design center 194 is configured to provision a device 110 software application or agent (e.g., service processor framework program 139 or service processor kernel program 138, secure network interface 128, secure hardware partition manager 108) with application access policy rules to identify network access activity associated with individual applications and specify which applications are to be routed or directed to the enterprise side of the VPN tunnel and which applications are to be routed or directed to the consumer side of the VPN tunnel. In some

embodiments, the identification of applications associated with traffic flows is secured by identifying the application certificate and comparing it to an application signature or hash on the device. In some embodiments, the application certificate, signature or hash is provided by service design center 190 or enterprise service design center 194.

[00147] In some embodiments, the policy rules only enable secure applications on device 110 to access enterprise data. In some embodiments, an enterprise manager sets policy rules that do not allow secure applications on device 110 to upload data to unsecure destinations.

[00148] In some embodiments, service design center 190 is configured to provide enterprise service design center 194. In some embodiments, enterprise service design center 194 comprises a policy management system configured to select a set of access network policies to be enforced for one or more device groups (or user groups) where the set of access network policies consists of a subset of the full set of access network policies capable of being enforced by the access network policy enforcement elements. In some embodiments, the subset of the full set of policies capable of being enforced by the access network policy enforcement elements comprises a pre-defined subset of the policy configuration capabilities. In some embodiments, the enterprise service design center policy management subset limitations for enterprise service design center 194 provide the ability to define and manage one or more of the policies that define a service policy set or service plan that is applied to a given device, user, device group or user group. In some embodiments, the enterprise service design center policy management subset limitations for enterprise service design center 194 can provide the ability to enroll a device, user, device group or user group in a set limited to one or more pre-defined service policy configurations or service plans.

[00149] As an example embodiment, the enterprise service design center policy management subset limitations for enterprise service design center 194 may provide the following policy definition and management capabilities for a device (or user) or device group (or user group): specify service usage limits (caps) for bulk access service or for a specific classification of access service activities, require all traffic or certain traffic associated with enterprise-critical applications or content to be communicated via an enterprise VPN, define controls for which applications that can access the network or certain defined destinations on the network, specify

network destinations that are allowed or not allowed, specify roaming service limitations, specify WiFi networks that are allowed or not allowed, specify security settings in the device access control or I/O access control ports, specify service usage notification triggers and notification content associated with the triggers (e.g., warnings when a specified service usage activity occurs, access is not allowed for a given attempted service usage activity, or service usage reaches a limit), and other such examples that are allowed to be managed under the policy management subset limitations. In some embodiments, the charging rates for such services may not be allowed to be managed under the policy management subset limitations.

[00150] In some embodiments, enterprise service design center 194 has an allowable subset of the full set of policies capable of being enforced by the access network policy enforcement elements that comprises a pre-defined set of one or more access network policy configurations (e.g., service plans). As an example embodiment, the set of pre-configured service plans may be defined for a certain implementation of enterprise service design center 194 comprising multiple pre-defined service plans, each of which provides variations in one or more of service notification policy, access control policy, service classification policy, service QoS policy, or service charging policy.

[00151] In some embodiments, enterprise service design center 194 is configured to allow a service design administrator to select one or more pre-configured access network policy configurations (or service plans) to be applied to a device, a user, a device group or a user group.

[00152] In some embodiments, enterprise service design center 194 comprises a device enrollment management system configured to enroll a device credential into a device group (or a user credential into a user group), where the set of device credentials (or user credentials) that enterprise service design center 194 is capable of managing is a subset of the device credentials (or user credentials) allowed on the access network. In some embodiments, the subset of device credentials (or user credentials) that are subject to management by enterprise service design center 194 is defined using service design center 190.

[00153] As an example embodiment, the set of pre-defined service plans that are made available to a first enterprise service design center 194 implementation managed by a first enterprise entity might consist of three service plans, wherein the first service plan comprises

network policies (e.g., access policies, charging policies, or notification policies) that provide for limited or restricted home network access service but do not provide for roaming access services, the second service plan comprises network policies that provide for unlimited or unrestricted home network access service and also provide for limited roaming access services, and the third service plan comprises network policies that provide for unlimited or unrestricted home network access service and also provide for unlimited or unrestricted roaming access services. In another example embodiment, on the same carrier access network as the previous example, a second enterprise service design center 194 implementation managed by a second enterprise entity might consist of two service plans, wherein the two service plans might be the same as two of the service plans from the previous example embodiment, or they might be completely different.

[00154] Given these examples, it will now be understood and appreciated by one of ordinary skill in the art that enterprise service design center 194 provides a convenient means of designing and distributing custom service plans to different enterprise entities that meet the needs of each enterprise entity, wherein the various policy definition capabilities disclosed herein can be used in a large number of combinations to create the service plans, with the number of combinations of service plan design capabilities being too numerous to list here. It will also now be understood and appreciated by one of ordinary skill in the art that each enterprise can effectively manage its devices (or users) and device groups (or user groups) to provide the appropriate level of policy control needed by the enterprise in a simplified manner, without the need to manage all the full policy capabilities of the access network.

[00155] For example, the embodiments of service design center 190 and enterprise service design center 194 disclosed herein support a carrier network business process wherein a carrier network manager utilizes service design center 190 to create a set of access network policies that consist of a subset of the full set of access network policies capable of being enforced by the access network policy enforcement elements (referred to as specialized enterprise service plans), and the specialized enterprise service plans are designed and offered to meet the special needs of one or more enterprise entities. In some embodiments, an enterprise manager uses enterprise service design center 194 to apply the one or more specialized enterprise service plans to one or more devices (or users) or device groups (or user groups) that belong to the enterprise entity's mobile device inventory (or employee list). The different needs of various employee groups (or

device types) can be among the factors that determine which service plan is assigned to a given user group (or device group). The specific needs of an employee can assist in determining which user group (or device group) the employee should be assigned to. The carrier manager can also create other specialized enterprise service plans for other enterprise entities to meet varied needs among enterprise market customers.

[00156] In some embodiments, an enterprise manager controls access network usage, costs, and access limits for an employee user group (e.g., a group of devices that could be as small as a single device or as large as all devices under the enterprise manager's control). In some embodiments, the enterprise manager establishes at least two user groups and establishes and manages different network-access policies for different employee user groups. For example, the enterprise manager may set and manage different policies for data usage on WiFi, 3G, 4G, or other networks for different employee user groups. Likewise, the enterprise manager may set different roaming privileges for different employee user groups.

[00157] In some embodiments, an enterprise manager sets expenditure ceilings by limiting allowed data usage for secure business applications to enforce security rules. In some embodiments, an enterprise manager tracks enterprise data access to improve compliance records. For example, the enterprise manager can track enterprise data usage by employee, device, application, location, network, or time of day.

[00158]

Process Flows For Providing Enterprise And Consumer Billing Allocation For Wireless Communication Device Service Usage Activities

[00159] **Figure 27 i**llustrates a flow diagram for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. At 402, the process begins. At 404, a service usage activity of a wireless communication device (e.g., application based service usage that uses a wireless network in which the wireless communication device has an associated service plan) is performed. In some embodiments, the monitoring is performed on the wireless communication device. In some embodiments, the monitoring is performed by a network element, such as a secure application

server for monitoring enterprise applications, as described herein with respect to various embodiments. At 406, an enterprise/consumer allocation is determined. In some embodiments, the monitored service usage activity is reported to a network element that determines the enterprise/consumer allocation based on the associated service plan that includes a defined enterprise/consumer allocation based on various factors, such as can be performed by a carrier billing server as described herein with respect to various embodiments. At 408, an associated consumer account is billed for the consumer service usage. At 410, the consumer account is credited for the enterprise service usage. At 412, the process is completed.

[00160] **Figure 28** illustrates another flow diagram for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. At 502, the process begins. At 504, a service usage activity of a wireless communication device (e.g., application based service usage that uses a wireless network in which the wireless communication device has an associated service plan) is performed. At 506, an enterprise/consumer allocation is determined. At 508, an associated enterprise account is billed for the enterprise service usage. At 510, the enterprise account is credited for the consumer service usage. At 512, the process is completed.

[00161] **Figure 29** illustrates another flow diagram for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. At 602, the process begins. At 604, a service usage activity of a wireless communication device (e.g., application based service usage that uses a wireless network in which the wireless communication device has an associated service plan) is performed. At 606, an enterprise/consumer allocation is determined. At 608, the enterprise service usage is reported. At 610, an expense reimbursement for the enterprise service usage is generated (e.g., by the enterprise for the consumer, who is, for example, an employee of the enterprise). At 612, the process is completed.

[00162] **Figure 30** illustrates another flow diagram for providing enterprise and consumer billing allocation for wireless communication device service usage activities in accordance with some embodiments. At 702, the process begins. At 704, a service usage activity of a wireless communication device (e.g., application based service usage that uses a wireless network in

which the wireless communication device has an associated service plan) is performed. At 706, the monitored service usage is reported. At 708, an enterprise/consumer allocation is determined. At 710, a bill/charge based on the enterprise/consumer allocation is generated. At 712, the process is completed.

[00163] 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. In particular, many of the embodiments are not limited to supporting an enterprise/consumer split. As would be appreciated by one of ordinary skill in the art, the disclosed embodiments may be applied, for example, when a sponsor entity subsidizes a cost associated with an end-user device's use of a sponsored (or ambient) data service or application, and the user pays for the end-user device's use of non-sponsored (or non-ambient) data services or applications. The sponsor entity may use enterprise service design center 194 to configure devices that may use the sponsored service, policies applicable to the sponsored service, etc. Moreover, the disclosed embodiments may be applied when a first sponsor subsidizes a cost associated with an end-user device's use of a first sponsored data service or application, a second sponsor subsidizes a cost associated with the end-user device's use of a second sponsored data service or application, and the user pays for the end-user device's use of non-sponsored data services or applications. The sponsor entities may use one or more enterprise service design centers to configure aspects of the sponsored services. As would be appreciated by one of ordinary skill in the art, there are many other environments in which the disclosed embodiments are useful or applicable.

[00164] Several advantageous combination embodiments are now disclosed for allocating enterprise service usage accounting and personal service usage accounting. These combinations are for example purposes, are not meant to be exhaustive or limiting in any way; as will be apparent to one of ordinary skill in the art, these combinations represent only a fraction of the embodiments provided herein.

[00165] In some embodiments, a network system for classifying the accounting of access network service usage for an end user device comprises (i) a first service design center

configured to receive an accounting split classification policy defining the classification rules for dividing an overall access network service usage into an enterprise service usage allocation and a personal service usage allocation, (ii) a network provisioning instruction translator configured to receive the accounting split classification policy and translate it to a set of network service usage classification and reporting instructions for one or more network elements responsible for classifying service usage, (iii) a network provisioning system for communicating the set of network service usage classification and reporting instructions to the one or more network elements responsible for classifying service usage, (iv) the one or more network elements responsible for classifying service usage configured to classify service usage to determine the enterprise service usage allocation and the personal service usage allocation, and generate service usage reports, and (v) a service usage accounting system that receives the service usage reports and (a) accrues the enterprise service usage allocation, and (b) accrues the personal service usage allocation.

[00166] In some embodiments, the network system for classifying the accounting of access network service usage for an end user device can be augmented wherein the first network access notification message policy is associated with a first device group defined by a first list of device credentials or a first user group defined by a first list of user credentials, and the service design center is further configured to obtain a second network access notification message policy comprising a plurality of second network access trigger conditions and, for each of the plurality of second network access trigger conditions, an associated second network access notification message, the second network access notification message policy associated with a second device group defined by a second list of device credentials or a second user group defined by a second list of user credentials.

[00167] In some embodiments, the network system for classifying the accounting of access network service usage for an end user device further comprises a master service design center configured to define a first notification policy design capability set for the first service design center, the first notification policy design capability set comprising a first subset of a master policy capability set. This embodiment can be further augmented wherein the master service design center is further configured to define a second notification policy design capability set for a second service design center, the second notification policy design capability set comprising a

second subset of the master policy capability set, the second subset of the master policy capability set either identical to or different from the first subset of the master policy capability set.

[00168] In some embodiments, the network system for classifying the accounting of access network service usage for an end user device is further augmented wherein the first service design center is hosted on an operator network. In some embodiments, the network system for classifying the accounting of access network service usage for an end user device is optimized for smaller enterprise data center deployments wherein the first service design center is hosted on an enterprise business network.

[00169] In some embodiments, the network system for classifying the accounting of access network service usage for an end user device can be augmented wherein the enterprise service usage allocation comprises a classification of service usage that specifies one or more enterprise device software applications. In some embodiments, the enterprise applications can be one or more of email, calendar, contacts, enterprise intranet (e.g., a secure intranet browser with a secure SSL connection or other secure connection to enterprise services), mobile device synchronization or mobile enterprise communications.

[00170] In some embodiments, the network system for classifying the accounting of access network service usage for an end user device can be augmented wherein the enterprise service usage allocation comprises a classification of service usage that specifies one or more enterprise network destinations.

[00171] In some embodiments, the network system for classifying the accounting of access network service usage for an end user device can be augmented wherein the enterprise service usage allocation comprises a classification of service usage that specifies one or more enterprise network destinations and the one or more enterprise network destinations comprise an address or identifier for a secure enterprise gateway. In some embodiments, the enterprise gateway comprises a VPN server.

[00172] In some embodiments, the network system for classifying the accounting of access network service usage for an end user device can be augmented wherein the enterprise service

usage allocation comprises a classification of service usage that specifies one or more enterprise network destinations and the one or more enterprise network destinations comprise an address or identifier for one or more secure enterprise mobile services gateways or servers comprising one or more of an email server, a calendar server, a contacts server, an enterprise intranet access server, a mobile device synchronization services server or a mobile enterprise communication server.

[00173] In some embodiments, the network system for classifying the accounting of access network service usage for an end user device can be augmented wherein the one or more network elements responsible for classifying service usage and generating service usage reports comprises a service usage monitor located in a wireless operator network.

[00174] In some embodiments, the network system for classifying the accounting of access network service usage for an end user device can be augmented wherein the one or more network elements responsible for classifying service usage and generating service usage reports comprises a service usage monitor located in an enterprise access network.

[00175] In some embodiments, the network system for classifying the accounting of access network service usage for an end user device can be augmented wherein the one or more network elements responsible for classifying service usage and generating service usage reports comprises a service usage monitor located on a wireless device.

[00176] In some embodiments, the network system for classifying the accounting of access network service usage for an end user device can be augmented wherein the service usage accounting system is located in an enterprise network.

[00177] In some embodiments, the network system for classifying the accounting of access network service usage for an end user device can be augmented wherein the service usage accounting system is managed by an enterprise manager under the control of the entity that manages an enterprise business.

[00178] In some embodiments, the network system for classifying the accounting of access network service usage for an end user device can be augmented wherein the service usage accounting system is located in an operator network.

[00179] In some embodiments, the network system for classifying the accounting of access network service usage for an end user device can be augmented wherein the service usage accounting system is managed by an operator manager under the control of the entity that manages a network operator.

[00180] In some embodiments, the network system for classifying the accounting of access network service usage for an end user device can be augmented wherein the service usage accounting system is further configured to credit a user account with a service usage credit or monetary credit associated with the accrued enterprise service usage allocation.

[00181] In some embodiments, the network system for classifying the accounting of access network service usage for an end user device can be augmented wherein the service usage accounting system is further configured to debit a user account with a service usage debit or monetary cost associated with the accrued personal service usage allocation.

[00182] In some embodiments, the network system for classifying the accounting of access network service usage for an end user device can be augmented wherein the service usage accounting system is further configured to credit an enterprise account with a service usage credit or monetary credit associated with the accrued personal service usage allocation.

[00183] In some embodiments, the network system for classifying the accounting of access network service usage for an end user device can be augmented wherein the service usage accounting system is further configured to debit an enterprise account with a service usage debit or monetary cost associated with the accrued enterprise service usage allocation.

[00184] In some embodiments, the network system for classifying the accounting of access network service usage for an end user device can be augmented by further configuring the service design center to: (i) receive a personal service plan offer comprising one or more service plans for personal network access services accounted to the personal service usage allocation, (ii) configure a device user interface service plan offer notification message, (iii) communicate the device user interface service plan offer notification message to one or more device groups comprising a collection of devices identified by device credentials, (iv) receive a service plan selection option from an end user device user in response to the device user interface service plan

offer notification message, and (v) cause one or more network elements responsible for activating service plans to activate the service plan selection chosen by the end user device user.

[00185] In some embodiments the end-user device system in communication with the network system for classifying the accounting of access network service usage comprises: (i) a device software application environment comprising: (a) an enterprise application execution environment configured with: (1) an enterprise application execution memory and data memory to support secure execution of enterprise software applications, the enterprise software applications comprising applications approved to execute in the secure execution environment and to communicate with secure enterprise services, (2) a secure enterprise communication link configured to provide communication between the enterprise software applications and enterprise network services, the enterprise network services comprising enterprise network resources and servers, (b) a personal application execution environment configured with execution memory and data memory to support execution of personal software applications not approved to execute in the secure execution environment, (ii) a personal service plan selection user interface comprising a notification software agent configured to receive personal service plan offer from a network element and display the service plan offers, the personal service plan offer comprising one or more service plans for personal network access services accounted to a personal service usage allocation, and receive a service plan selection option from an end user device user and forward the service plan selection option to a network element.

[00186] In some embodiments, the end-user device system can be augmented wherein the secure enterprise communication link comprises a VPN client in communication with an enterprise VPN gateway.

[00187] In some embodiments, the end-user device system can be augmented wherein the enterprise network services comprise access to one or more secure enterprise mobile services gateways or servers comprising one or more of an email server, a calendar server, a contacts server, an enterprise intranet access server, a mobile device synchronization services server or a mobile enterprise communication server.

[00188] In some embodiments, the end-user device system can be augmented wherein the enterprise application execution environment is further configured to: (i) acquire a device

software application signature prior to allowing execution of the device software application in the virtual machine operating environment, (ii) compare the signature to an approved list of signatures, (iii) allow the application to execute if it is on the list, and (iv) not allow the application to execute if it is not on the list.

[00189] In some embodiments, the end-user device system can be augmented wherein enterprise application execution environment comprises a virtual machine operating environment.

[00190] In some embodiments, the end-user device system can be augmented wherein enterprise application execution environment comprises a secure CPU hardware execution partition.

[00191] In some embodiments, the end-user device system can be augmented wherein enterprise application execution environment comprises a secure operating system execution partition.

[00192] In some embodiments, the end-user device system can be augmented wherein enterprise application execution environment comprises a secure memory area protected by an enterprise application software program that encrypts the enterprise data stored on device memory and runs a secure encrypted communication protocol for communication with a secure mobile enterprise services gateway server.

[00193] Several advantageous combination embodiments are now disclosed for providing enterprise control of network access service to an end user device. These combinations are for example purposes, are not meant to be exhaustive or limiting in any way; as would be appreciated by one of ordinary skill in the art, these combinations represent only a fraction of the advantageous embodiment combinations provided herein.

[00194] In some embodiments, a network system for providing network access service control for an end user device comprising: (i) a first service design center configured to receive from an administrator user or a configuration file a first network access policy comprising a first set of network access service permissions associated with an end user device or end user device user, (ii) a network provisioning instruction translator configured to receive the first network access

policy and translate it to a set of network access policy enforcement instructions for one or more network elements responsible for controlling network access, (iii) a network provisioning system for communicating the set of network access policy enforcement instructions to the one or more network elements responsible for controlling network access, (iv) the one or more network elements responsible for controlling network access configured to execute the set of network access policy enforcement instructions to enforce network access service permissions and limits.

[00195] In some embodiments, the network system for providing network access service control can be augmented wherein the first network access policy is associated with a first device group defined by a first list of device credentials or a first user group defined by a first list of user credentials, and the service design center is further configured to obtain a second network access policy comprising a second set of network access service permissions and, the second network access policy associated with a second device group defined by a second list of device credentials or a second user group defined by a second list of user credentials.

[00196] In some embodiments, the network system for classifying the accounting of access network service usage for an end user device further comprises a master service design center configured to define a first network access policy design capability set for the first service design center, the first network access policy design capability set comprising a first subset of a master policy capability set. This embodiment can be further augmented wherein the master service design center is further configured to define a second network access policy design capability set for a second service design center, the second network access policy design capability set comprising a second subset of the master policy capability set, the second subset of the master policy capability set either identical to or different from the first subset of the master policy capability set.

[00197] In some embodiments, the network system for providing network access service control can be augmented wherein the first network access policy defines a set of one or more service usage limits or service cost limits.

[00198] In some embodiments, the network system for providing network access service control can be augmented wherein the first network access policy defines a set of one or more roaming network service usage limits or service cost limits.

[00199] In some embodiments, the network system for providing network access service control can be augmented wherein the first network access policy defines a set of one or more network type restrictions, wherein a network type comprises one or more of a cellular network, a 2G network, a 3G network, a 4G network, a WiFi network, a particular WiFi network APN, roaming cellular network, a particular cellular operator network.

[00200] In some embodiments, the network system for providing network access service control can be augmented wherein the first network access policy defines a set of one or more device application software network access restrictions.

[00201] In some embodiments, the network system for providing network access service control can be augmented wherein the first network access policy defines a set of one or more network destination access restrictions.

[00202] In some embodiments, the network system for providing network access service control can be augmented wherein the first network access policy defines a set of one or more enterprise network destination allowances or restrictions.

[00203] In some embodiments, the network system for providing network access service control can be augmented wherein the first network access policy defines a set of one or more enterprise network destination allowances or restrictions communicated over a secure VPN communication link.

[00204] In some embodiments, the network system for providing network access service control can be augmented wherein the first network access policy defines a set of one or more application or network destination allowances or restrictions communicated over a non-secure communication link.

[00205] In some embodiments, the network system for providing network access service control can be augmented wherein the first network access policy defines a set of one or more personal application or network destination allowances or restrictions.

[00206] In some embodiments, the network system for providing network access service control can be augmented wherein the first network access policy defines a set of one or more geographic location allowances or restrictions.

[00207] In some embodiments, the network system for providing network access service control can be augmented wherein the one or more network elements responsible for controlling network access comprises a service usage monitor located in a wireless operator network.

[00208] In some embodiments, the network system for providing network access service control can be augmented wherein the one or more network elements responsible for controlling network access comprises a service usage monitor located in an enterprise access network. In some embodiments, the one or more network elements responsible for controlling network access comprises a service usage monitor located in an enterprise access network comprise a VPN gateway wherein all device traffic is communicated from the device to the VPN gateway configured to control the device traffic. In some embodiments, the VPN gateway performs service usage classification to identify and control enterprise traffic. In some embodiments, the VPN gateway performs service usage classification to identify and control personal traffic.

[00209] In some embodiments, the network system for providing network access service control can be augmented wherein the one or more network elements responsible for controlling network access comprises a service usage monitor located on a wireless device.

INCORPORATION BY REFERENCE

[00210] The following U.S. applications are hereby incorporated by reference for all purposes: Application No. 13/248,028, filed September 28, 2011, entitled ENTERPRISE ACCESS CONTROL AND ACCOUNTING ALLOCATION FOR ACCESS NETWORKS; Application No. 12/380,780, entitled AUTOMATED DEVICE PROVISIONING AND ACTIVATION, filed March 2, 2009; Application No. 12/380,778, filed March 2, 2009, entitled VERIFIABLE DEVICE ASSISTED SERVICE USAGE BILLING WITH INTEGRATED ACCOUNTING, MEDIATION ACCOUNTING, AND MULTI-ACCOUNT; Provisional Application No. 61/206,354, entitled SERVICES POLICY COMMUNICATION SYSTEM AND METHOD, filed January 28, 2009; Provisional Application No. 61/206,944, entitled

SERVICES POLICY COMMUNICATION SYSTEM AND METHOD, filed February 4, 2009; Provisional Application No. 61/207,393, entitled SERVICES POLICY COMMUNICATION SYSTEM AND METHOD filed February 10, 2009; Provisional Application No. 61/207,739, entitled SERVICES POLICY COMMUNICATION SYSTEM AND METHOD filed February 13, 2009; and Provisional Application No. 61/387,243, entitled ENTERPRISE AND CONSUMER BILLING ALLOCATION FOR WIRELESS COMMUNICATION DEVICE SERVICE USAGE ACTIVITIES filed September 28, 2010.

CLAIMS

1. A network system for providing network access service notification messages containing information about a network access activity of an end-user device, the network system comprising:

a first service design center configured to:

obtain a first network access notification message policy comprising a first network access trigger condition and an associated first network access notification message, the first network access trigger condition comprising one or more current or requested end-user device network access activities, the first network access notification message comprising notification information to be presented to a user through a user interface,

receive a trigger condition indication from a network element,

associate the trigger condition indication with the first network access notification message, and

present the notification information to the user through the user interface;

a network provisioning instruction translator configured to:

receive, from the first service design center, the first network access trigger condition, and

determine, based on the first network access trigger condition, one or more network access trigger identification instructions; and

a network provisioning system configured to communicate the one or more network access trigger identification instructions to one or more network elements responsible for monitoring the service usage, the one or more network elements responsible for monitoring the service usage configured to:

execute the one or more network access trigger identification instructions to identify when the first network access trigger condition occurs, and

send the trigger condition indication to the first service design center.

ABSTRACT OF THE DISCLOSURE

Enterprise and consumer billing allocation for wireless communication device service usage activities is provided. In some embodiments, enterprise and consumer billing allocation for wireless communication device service usage activities includes monitoring a service usage activity of a wireless communication device, and determining an enterprise and consumer billing allocation for the monitored service usage activity. In some embodiments, enterprise and consumer billing allocation for wireless communication device service usage activities includes monitoring a service usage activity of a wireless communication device, and reporting the monitored service usage activity to a network element, in which the network element determines an enterprise and consumer billing allocation for the monitored service usage activity. In some embodiments, enterprise and consumer billing allocation for wireless communication device service usage activities includes providing a service design center for configuring an enterprise and consumer billing allocation of monitored service usage activities for a plurality of wireless communication devices associated with an enterprise account, and implementing the configured enterprise and consumer billing allocation for monitored service usage activities for the plurality of wireless communication devices associated with the enterprise account.

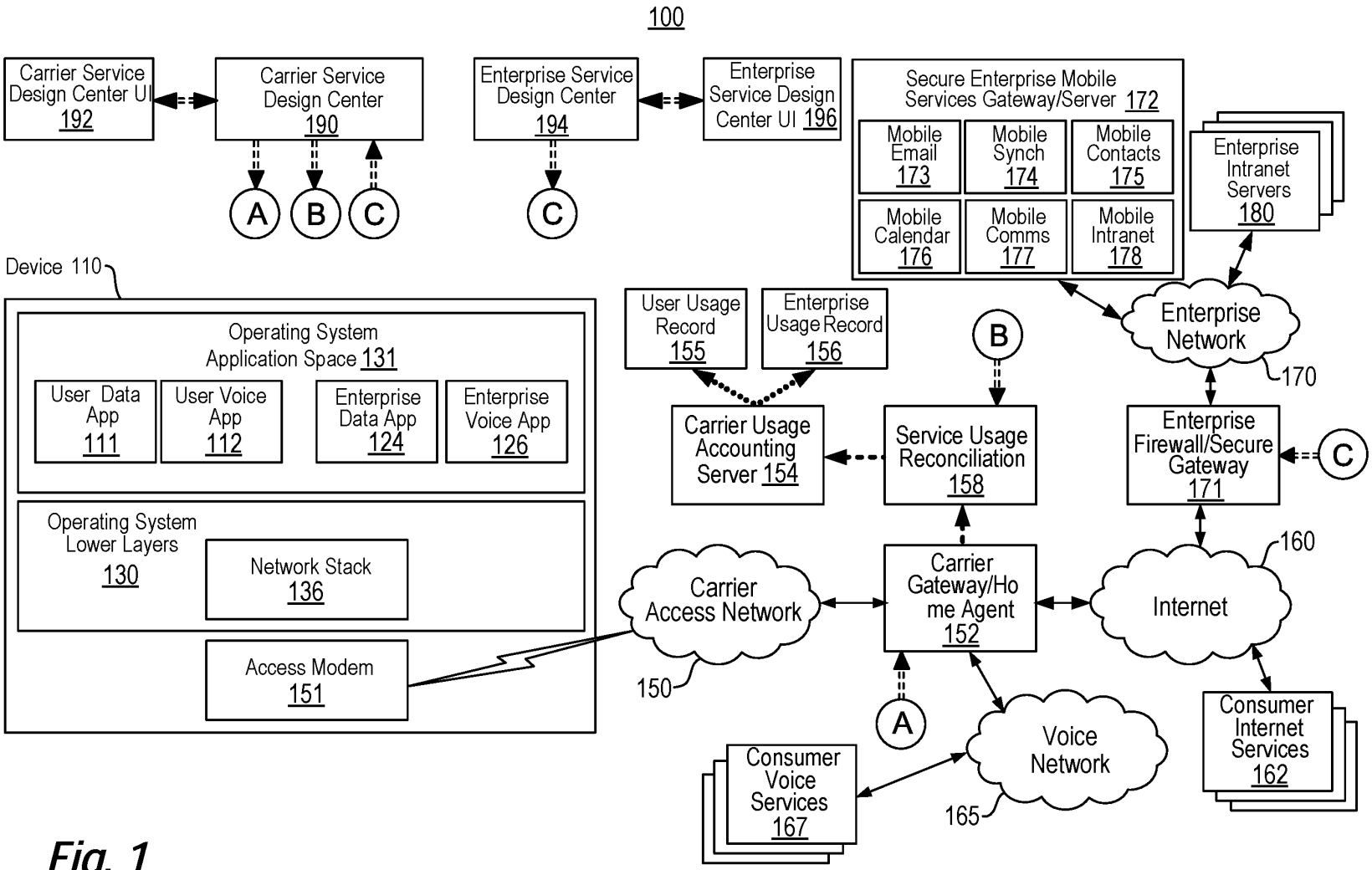

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Carrier Service Design Center 190
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Enterprise Service Design Center UI 196
Secure Enterprise Mobile Services Gateway/Server 172
Mobile Email 173
Mobile Synch 174
Mobile Contacts 175
Mobile Calendar 176
Mobile Comms 177
Mobile Intranet 178
Enterprise Intranet Servers 180
A
B
C
Device 110
Operating System Application Space 131
User Data App 111
User Voice App 112
Enterprise Data App 124
Enterprise Voice App 126
Operating System Lower Layers 130
Network Stack 136
Access Modem 151
User Usage Record 155
Enterprise Usage Record 156
Enterprise Network 170
Carrier Usage Accounting Server 154
Service Usage Reconciliation 158
Enterprise Firewall/Secure Gateway 171
Carrier Access Network
150
Carrier Gateway/Home Agent 152
Internet
160
Consumer Voice Services 167
Voice Network
165
Consumer Internet Services 162

Fig. 1

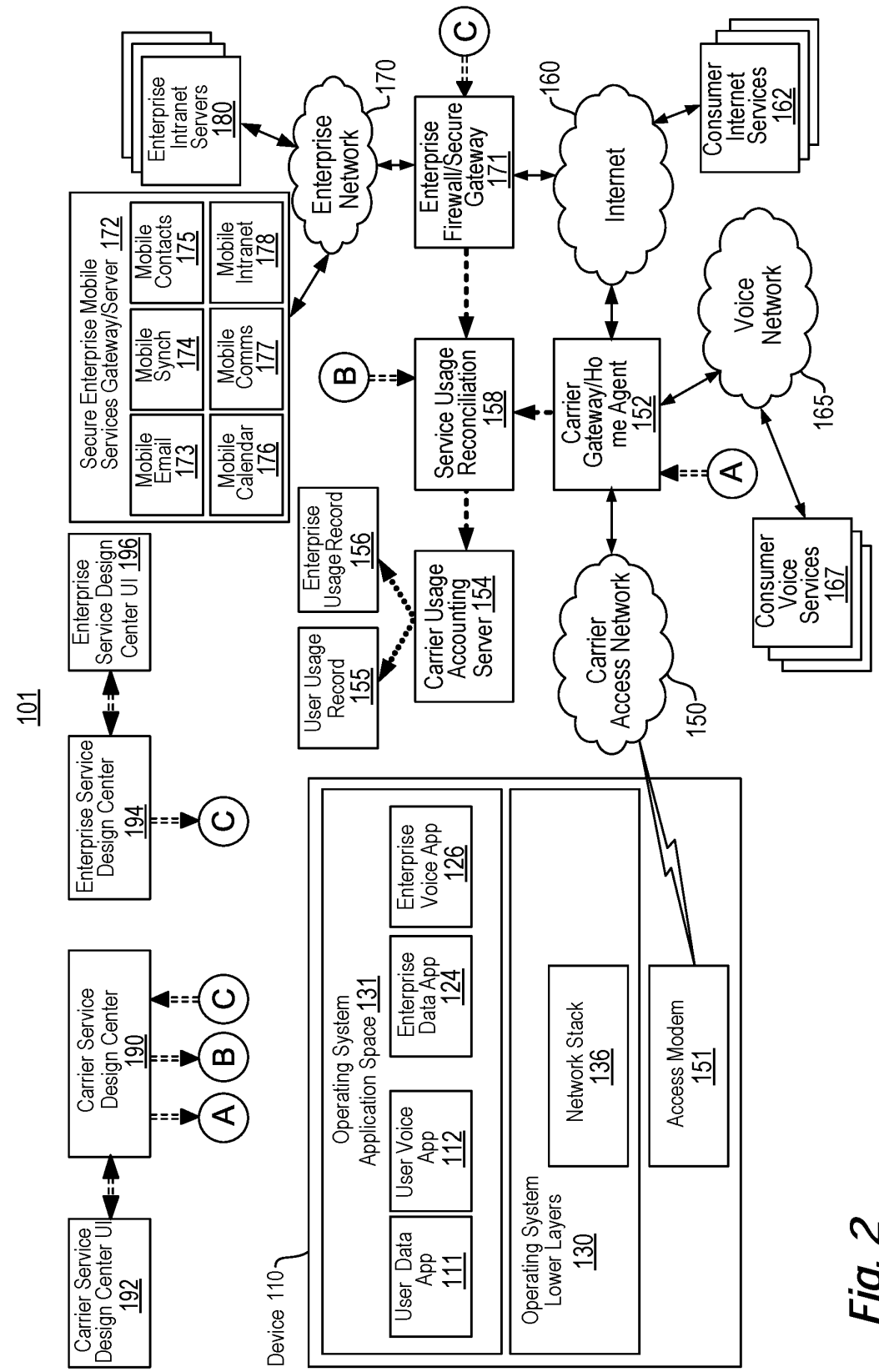

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A
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Device 110
Operating System Application Space 131
User Data App 111
User Voice App 112
Enterprise Data App 124
Enterprise Voice App 126
Operating System Lower Layers 130
Network Stack 136
Access Modem 151
Carrier Access Network 150
Carrier Usage Accounting Server 154
User Usage Record 155
Enterprise Usage Record 156
Service Usage Reconciliation 158
Carrier Gateway/Home Agent 152
Secure Enterprise Mobile Services Gateway/Server 172
Mobile Email 173
Mobile Calendar 176
Mobile Synch 174
Mobile Comms 177
Mobile Contacts 175
Mobile Intranet 178
Enterprise Intranet Servers 180
Enterprise Network 170
Enterprise Firewall/Secure Gateway 171
Internet 160
Consumer Internet Services 162
Voice Network 165
Consumer Voice Services 167

Fig. 2

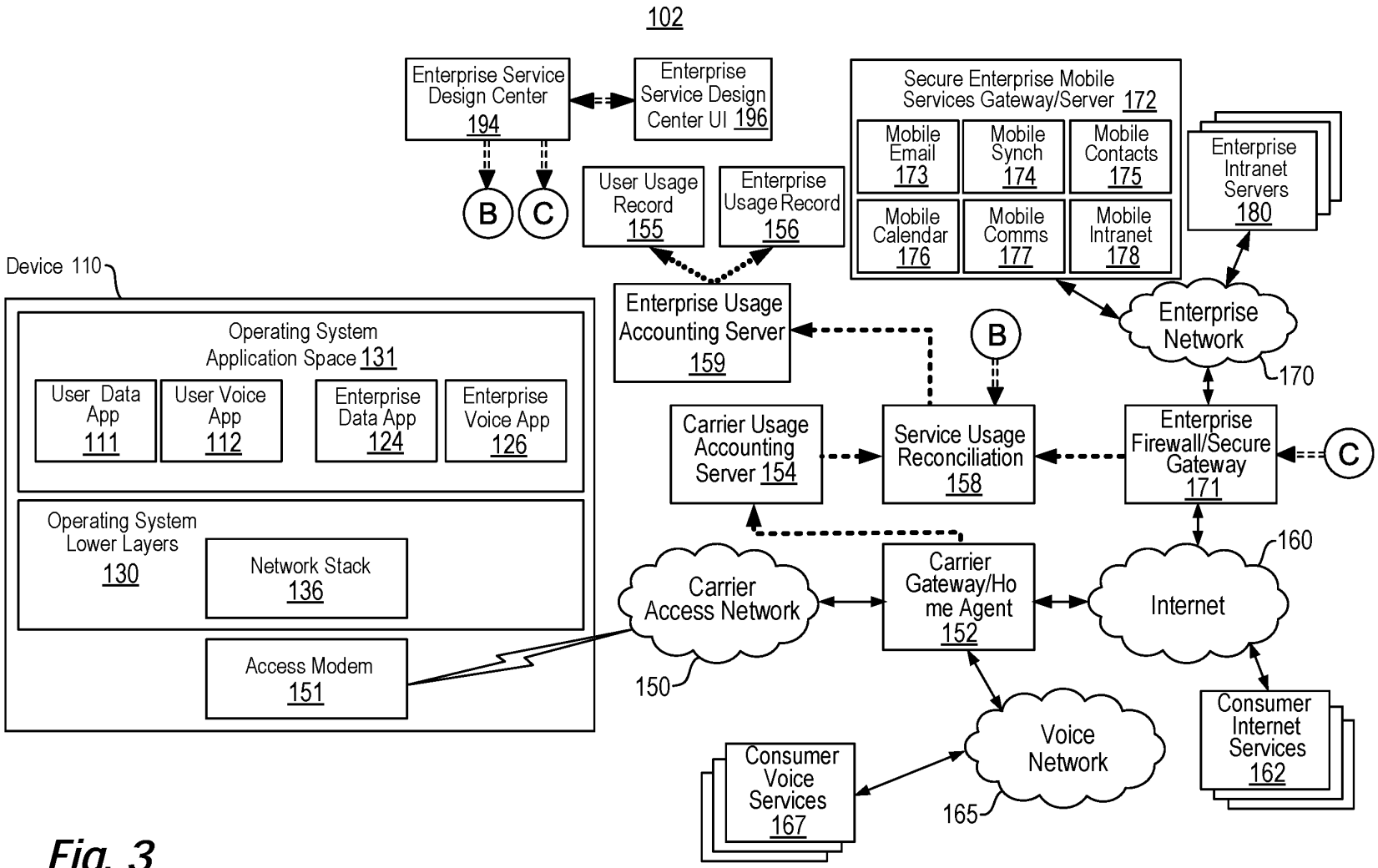

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Secure Enterprise Mobile Services Gateway/Server 172
Mobile Email 173
Mobile Synch 174
Mobile Contacts 175
Mobile Calendar 176
Mobile Comms 177
Mobile Intranet 178
Enterprise Intranet Servers 180
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User Usage Record 155
Enterprise Usage Record 156
Device 110
Enterprise Usage Accounting Server 159
Enterprise Network 170
Operating System Application Space 131
User Data App 111
User Voice App 112
Enterprise Data App 124
Enterprise Voice App 126
Carrier Usage Accounting Server 154
Service Usage Reconciliation 158
Enterprise Firewall/Secure Gateway 171
Operating System Lower Layers 130
Network Stack 136
Carrier Access Network
Carrier Gateway/Home Agent 152
Internet
160
Access Modem 151
150
Consumer Voice Services 167
Voice Network
165
Consumer Internet Services 162

Fig. 3

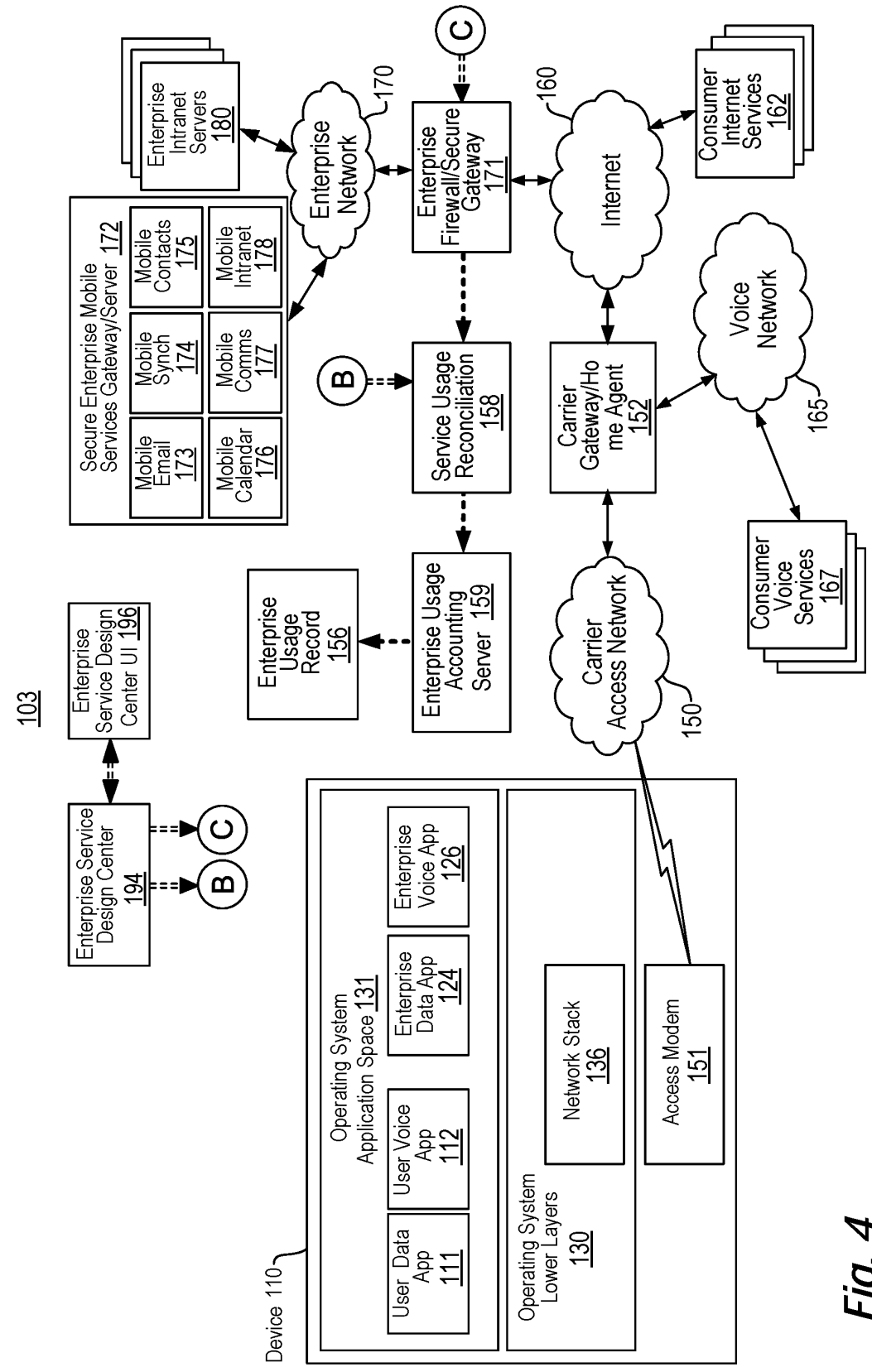

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Enterprise Service Design Center 194
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User Voice App 112
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Mobile Intranet 178
Enterprise Intranet Servers 180
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Voice Network 165
Consumer Internet Services 162
Consumer Voice Services 167

Fig. 4

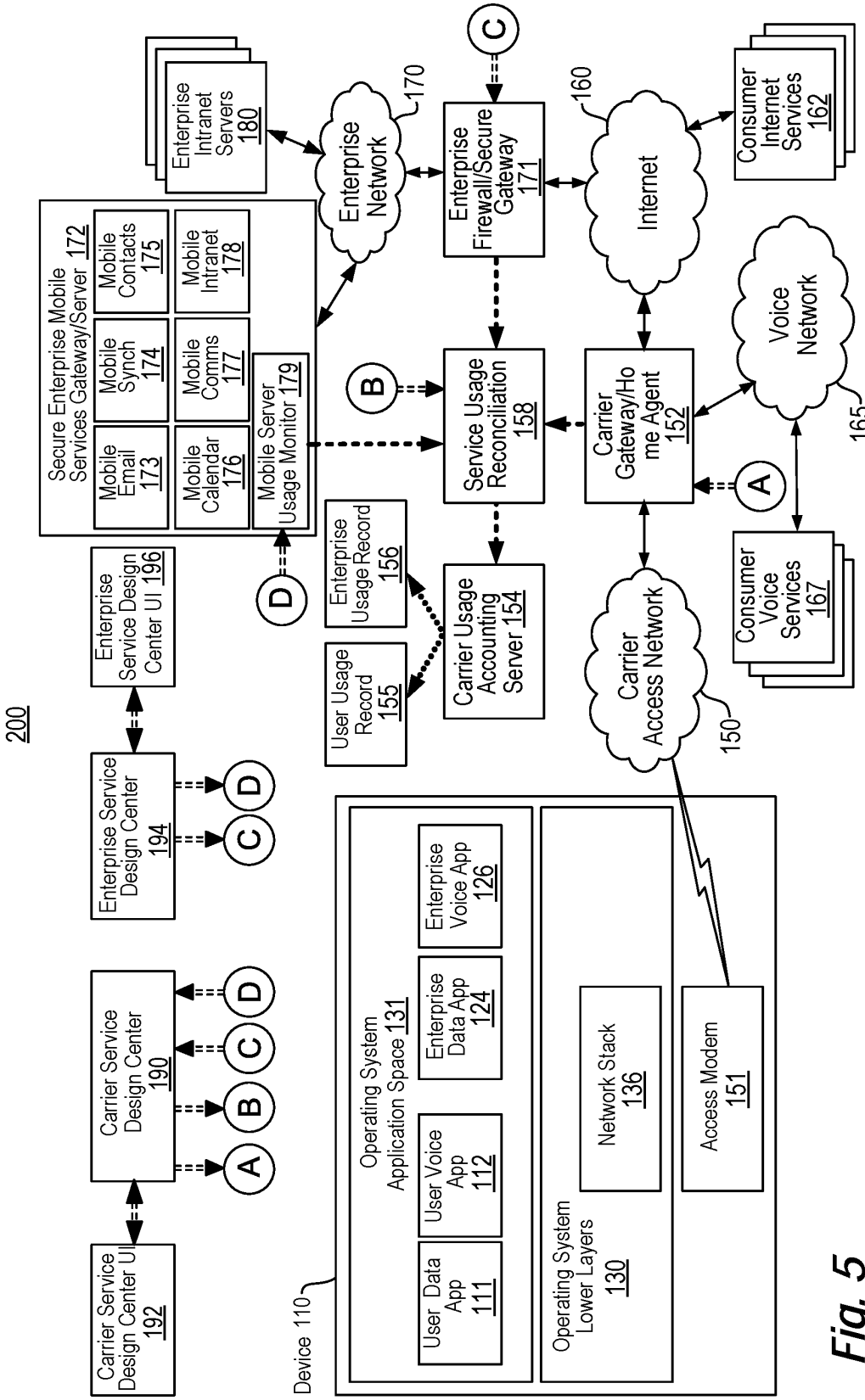

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User Data App 111
User Voice App 112
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Enterprise Voice App 126
Operating System Lower Layers 130
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Access Modem 151
Carrier Access Network
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Mobile Email 173
Mobile Synch 174
Mobile Contacts 175
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Mobile Intranet 178
Mobile Server Usage Monitor 179
Enterprise Intranet Servers 180
Enterprise Network
170
Enterprise Usage Record 156
User Usage Record 155
Carrier Usage Accounting Server 154
Service Usage Reconciliation 158
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Carrier Gateway/Home Agent 152
Internet
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Consumer Internet Services 162
Voice Network
165
Consumer Voice Services 167

Fig. 5

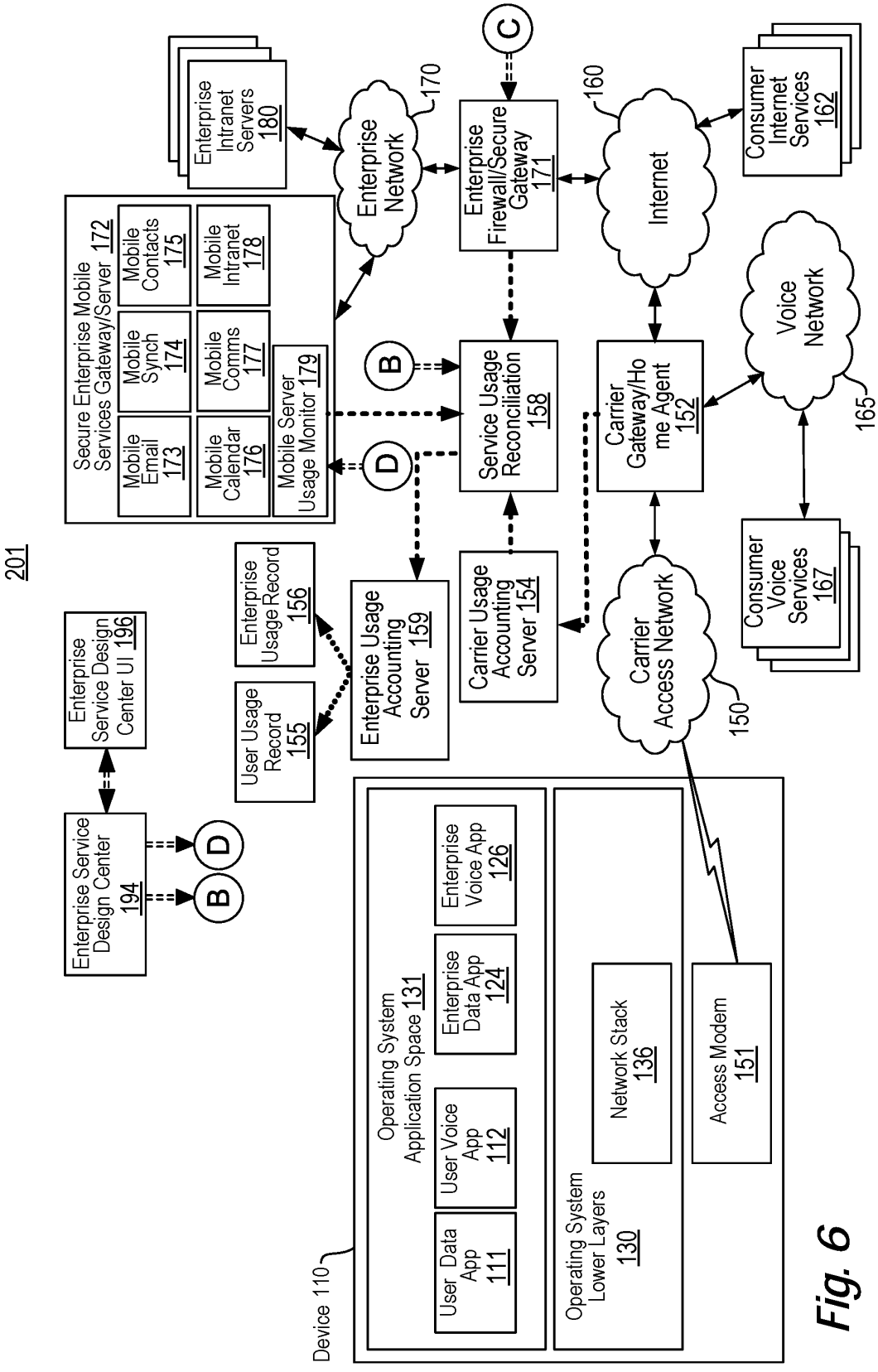

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Enterprise Service Design Center UI 196
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User Usage Record 155
Enterprise Usage Accounting Server 159
Carrier Usage Accounting Server 154
Service Usage Reconciliation 158
Secure Enterprise Mobile Services Gateway/Server 172
Mobile Email 173
Mobile Synch 174
Mobile Contacts 175
Mobile Calendar 176
Mobile Comms 177
Mobile Intranet 178
Mobile Server Usage Monitor 179
Enterprise Intranet Servers 180
Enterprise Network 170
Enterprise Firewall/Secure Gateway 171
C
Internet 160
Consumer Internet Services 162
Carrier Gateway/Home Agent 152
Voice Network 165
Carrier Access Network 150
Consumer Voice Services 167
Device 110
Operating System Application Space 131
User Data App 111
User Voice App 112
Enterprise Data App 124
Enterprise Voice App 126
Operating System Lower Layers 130
Network Stack 136
Access Modem 151

Fig. 6

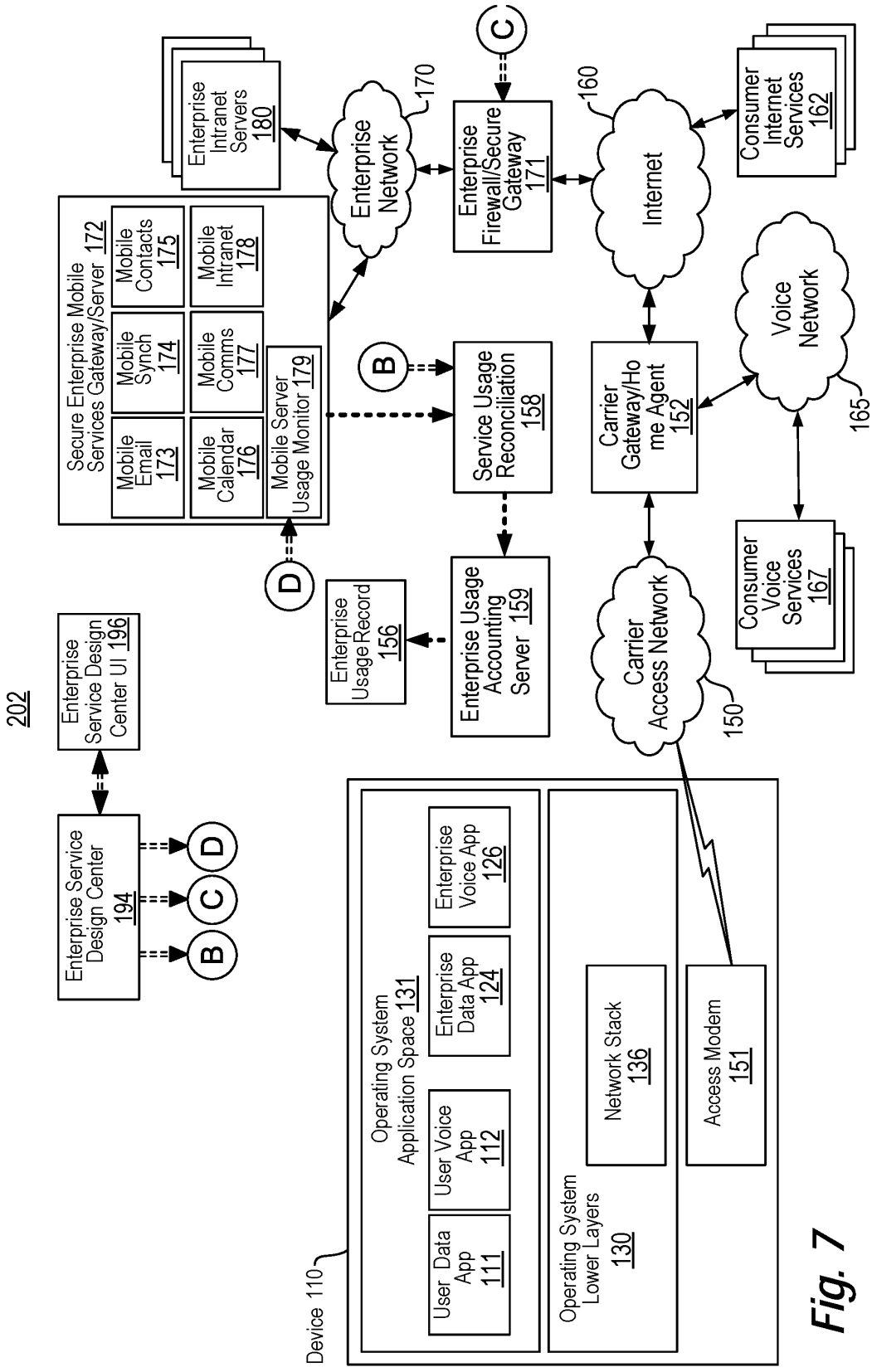

202
Enterprise Service Design Center UI 196
Enterprise Service Design Center 194
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C
D
Secure Enterprise Mobile Services Gateway/Server 172
Mobile Email 173
Mobile Calendar 176
Mobile Server Usage Monitor 179
Mobile Synch 174
Mobile Comms 177
Mobile Contacts 175
Mobile Intranet 178
Enterprise Intranet Servers 180
Enterprise Network 170
Enterprise Firewall/Secure Gateway 171
Internet 160
Consumer Internet Services 162
Service Usage Reconciliation 158
Enterprise Usage Record 156
Enterprise Usage Accounting Server 159
Carrier Gateway/Home Agent 152
Voice Network 165
Carrier Access Network 150
Consumer Voice Services 167
Device 110
Operating System Application Space 131
User Data App 111
User Voice App 112
Enterprise Data App 124
Enterprise Voice App 126
Operating System Lower Layers 130
Network Stack 136
Access Modem 151

Fig. 7

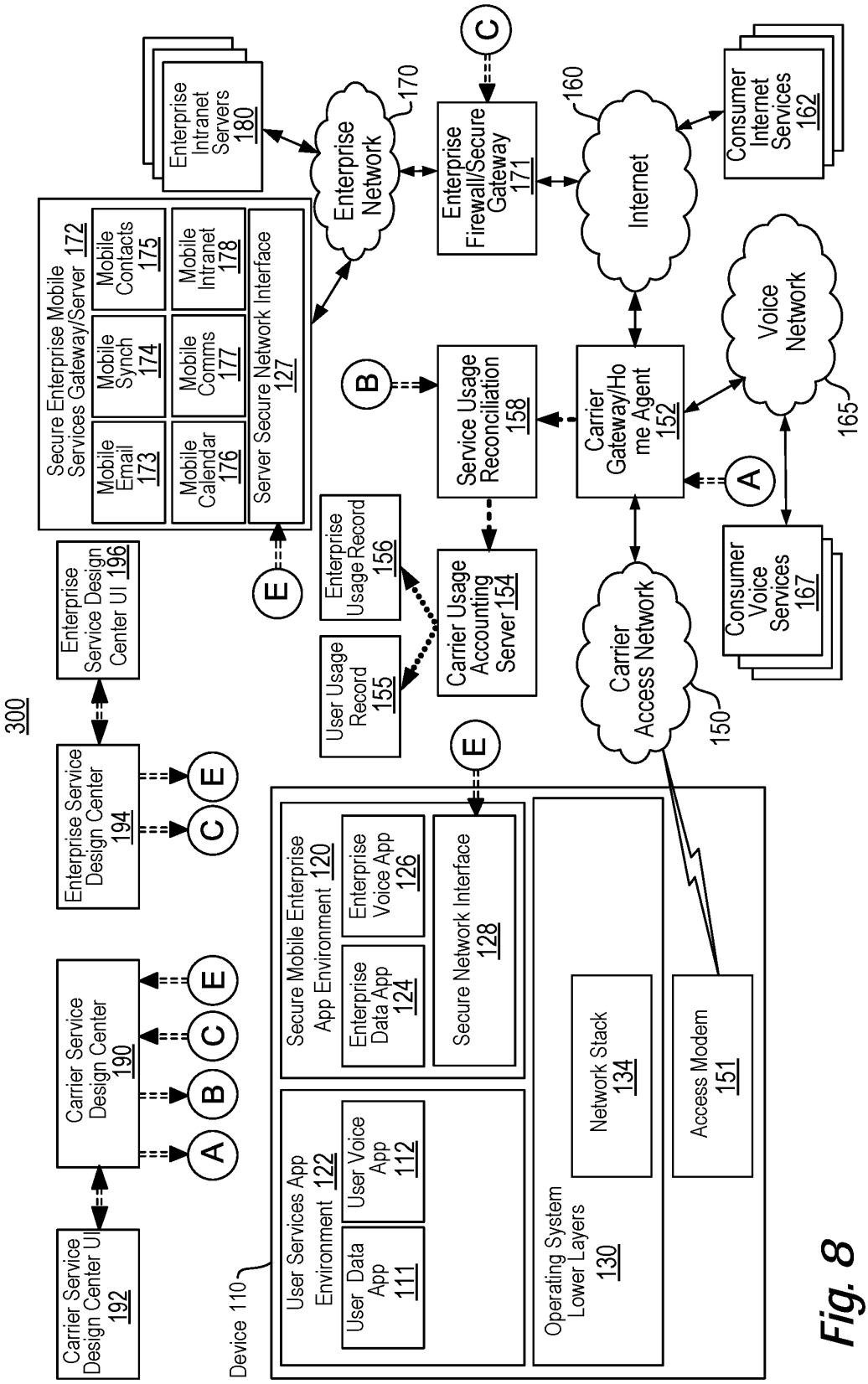

300
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Carrier Service Design Center 190
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Enterprise Service Design Center 194
A
B
C
E
Device 110
User Services App Environment 122
User Data App 111
User Voice App 112
Secure Mobile Enterprise App Environment 120
Enterprise Data App 124
Enterprise Voice App 126
Secure Network Interface 128
Operating System Lower Layers 130
Network Stack 134
Access Modem 151
Carrier Access Network 150
Secure Enterprise Mobile Services Gateway/Server 172
Mobile Email 173
Mobile Calendar 176
Mobile Synch 174
Mobile Comms 177
Mobile Contacts 175
Mobile Intranet 178
Server Secure Network Interface 127
Enterprise Intranet Servers 180
Enterprise Network 170
Enterprise Usage Record 156
User Usage Record 155
Carrier Usage Accounting Server 154
Service Usage Reconciliation 158
Enterprise Firewall/Secure Gateway 171
Carrier Gateway/Home Agent 152
Internet 160
Voice Network 165
Consumer Internet Services 162
Consumer Voice Services 167

Fig. 8

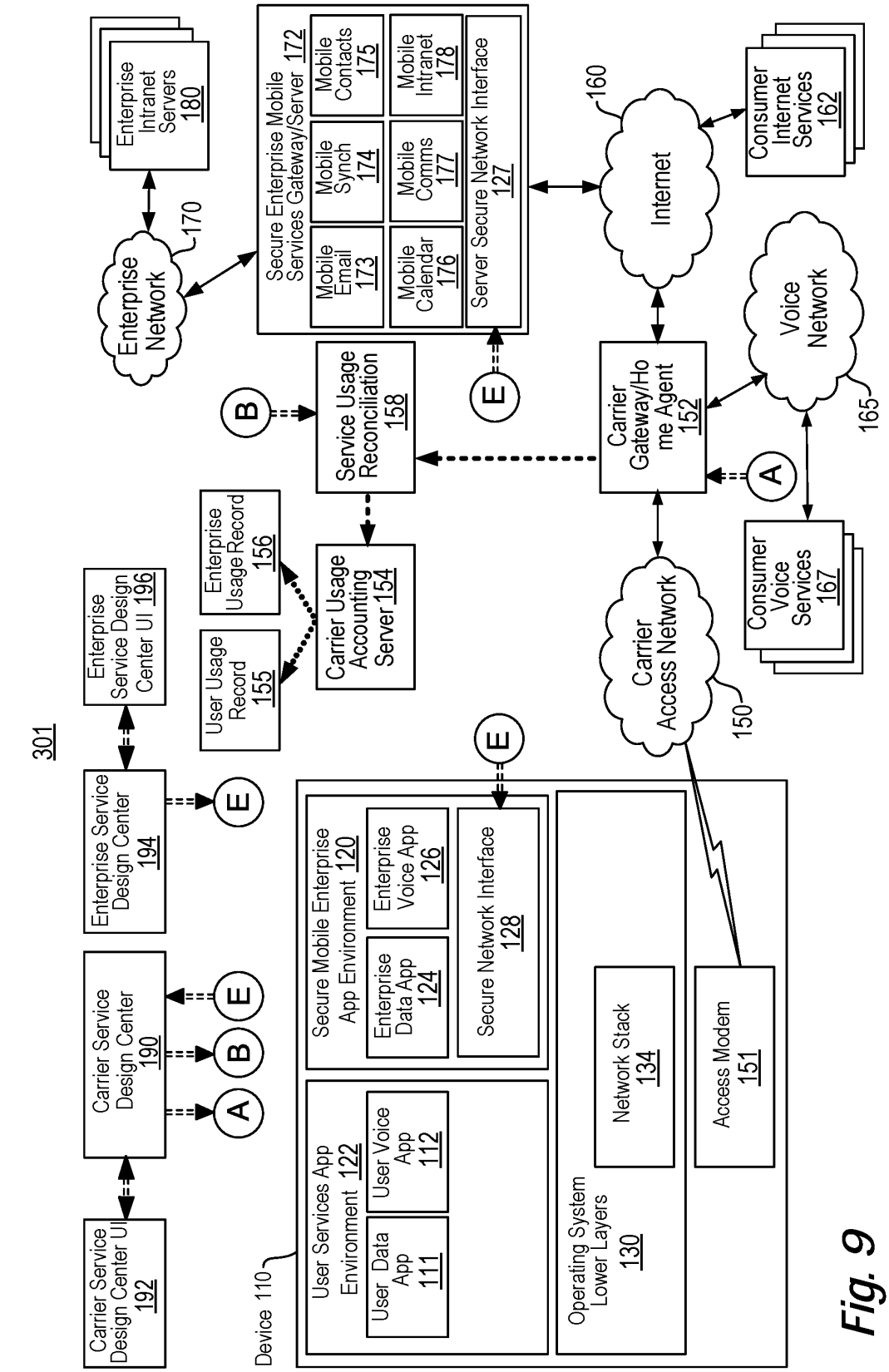

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A
B
E
E
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User Voice App 112
Secure Mobile Enterprise App Environment 120
Enterprise Data App 124
Enterprise Voice App 126
Secure Network Interface 128
Operating System Lower Layers 130
Network Stack 134
Access Modem 151
E
Carrier Access Network 150
Enterprise Usage Record 156
User Usage Record 155
Carrier Usage Accounting Server 154
B
Service Usage Reconciliation 158
Enterprise Network 170
Enterprise Intranet Servers 180
Secure Enterprise Mobile Services Gateway/Server 172
Mobile Email 173
Mobile Synch 174
Mobile Contacts 175
Mobile Calendar 176
Mobile Comms 177
Mobile Intranet 178
Server Secure Network Interface 127
E
Carrier Gateway/Home Agent 152
A
Internet 160
Voice Network 165
Consumer Internet Services 162
Consumer Voice Services 167

Fig. 9

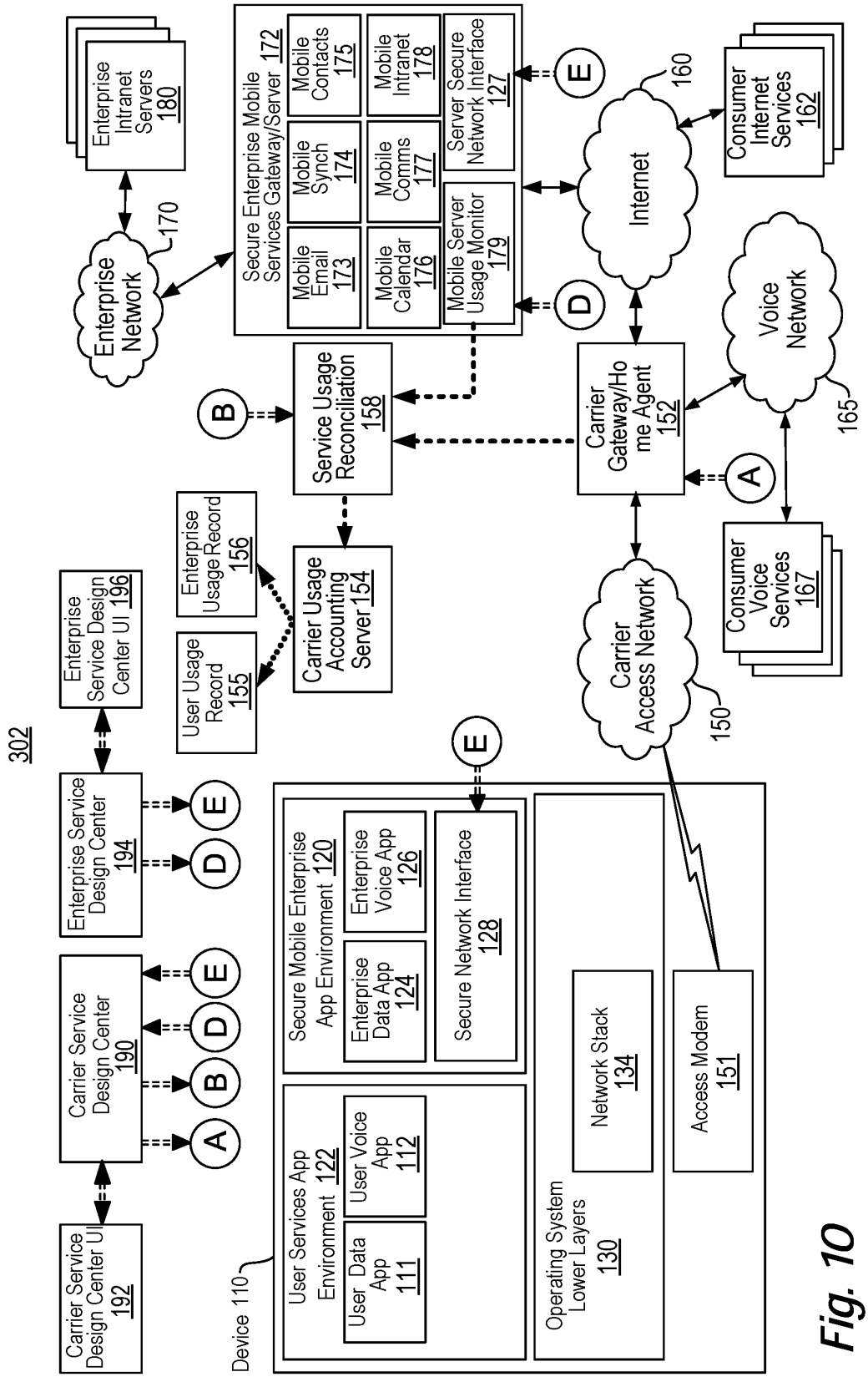

302
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Enterprise Service Design Center 194
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D
E
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User Voice App 112
Secure Mobile Enterprise App Environment 120
Enterprise Data App 124
Enterprise Voice App 126
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Network Stack 134
Access Modem 151
User Usage Record 155
Enterprise Usage Record 156
Carrier Usage Accounting Server 154
Service Usage Reconciliation 158
Enterprise Network 170
Enterprise Intranet Servers 180
Secure Enterprise Mobile Services Gateway/Server 172
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Mobile Synch 174
Mobile Contacts 175
Mobile Calendar 176
Mobile Comms 177
Mobile Intranet 178
Mobile Server Usage Monitor 179
Server Secure Network Interface 127
Carrier Gateway/Home Agent 152
Carrier Access Network 150
Internet 160
Consumer Internet Services 162
Voice Network 165
Consumer Voice Services 167

Fig. 10

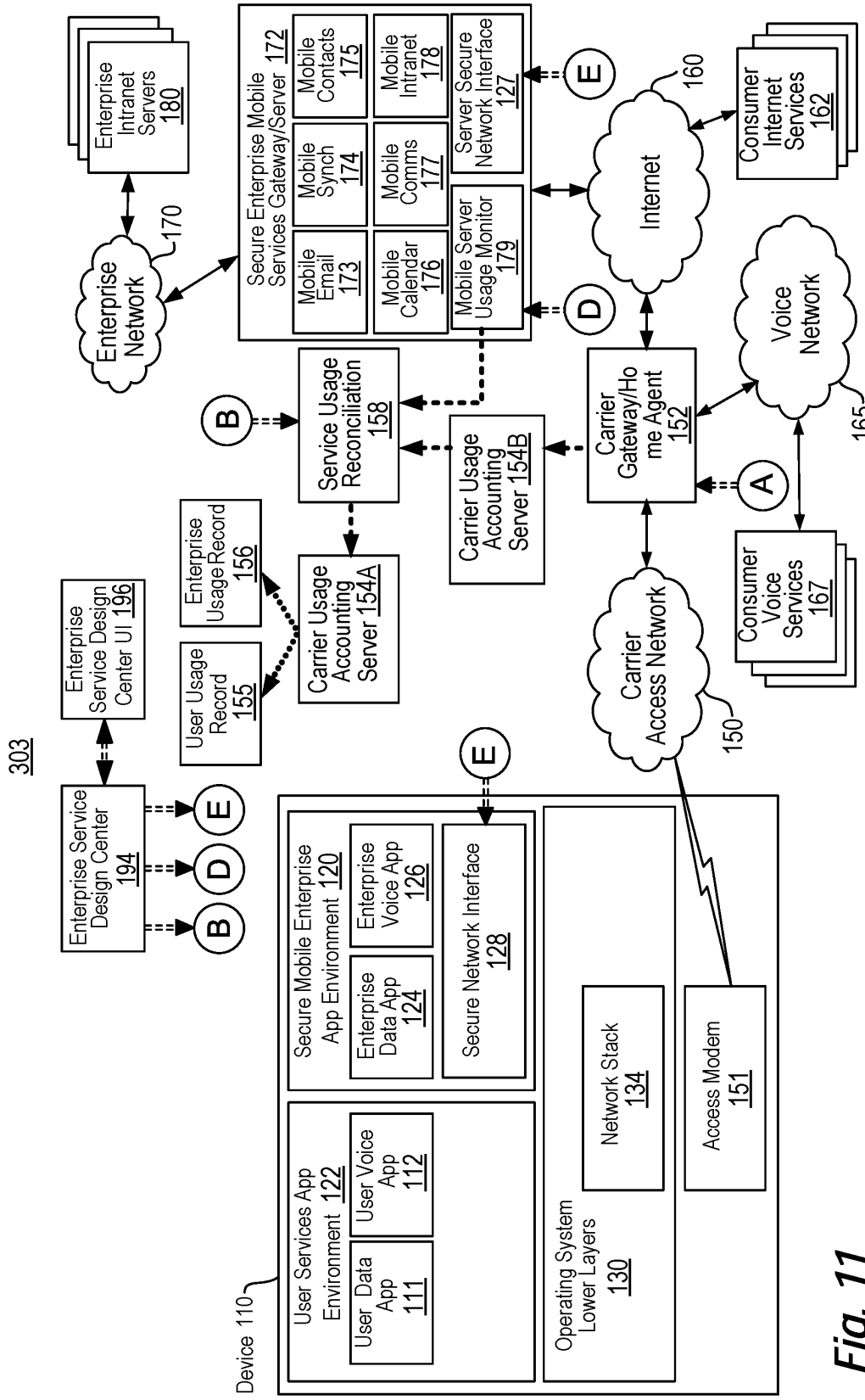

303
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Enterprise Service Design Center 194
B
D
E
User Usage Record 155
Enterprise Usage Record 156
Carrier Usage Accounting Server 154A
Service Usage Reconciliation 158
Carrier Usage Accounting Server 154B
Enterprise Network 170
Enterprise Intranet Servers 180
Secure Enterprise Mobile Services Gateway/Server 172
Mobile Email 173
Mobile Synch 174
Mobile Contacts 175
Mobile Calendar 176
Mobile Comms 177
Mobile Intranet 178
Mobile Server Usage Monitor 179
Server Secure Network Interface 127
Carrier Gateway/Home Agent 152
Internet 160
Consumer Internet Services 162
Voice Network 165
Carrier Access Network 150
Consumer Voice Services 167
A
Device 110
User Services App Environment 122
User Data App 111
User Voice App 112
Secure Mobile Enterprise App Environment 120
Enterprise Data App 124
Enterprise Voice App 126
Secure Network Interface 128
Operating System Lower Layers 130
Network Stack 134
Access Modem 151

Fig. 11

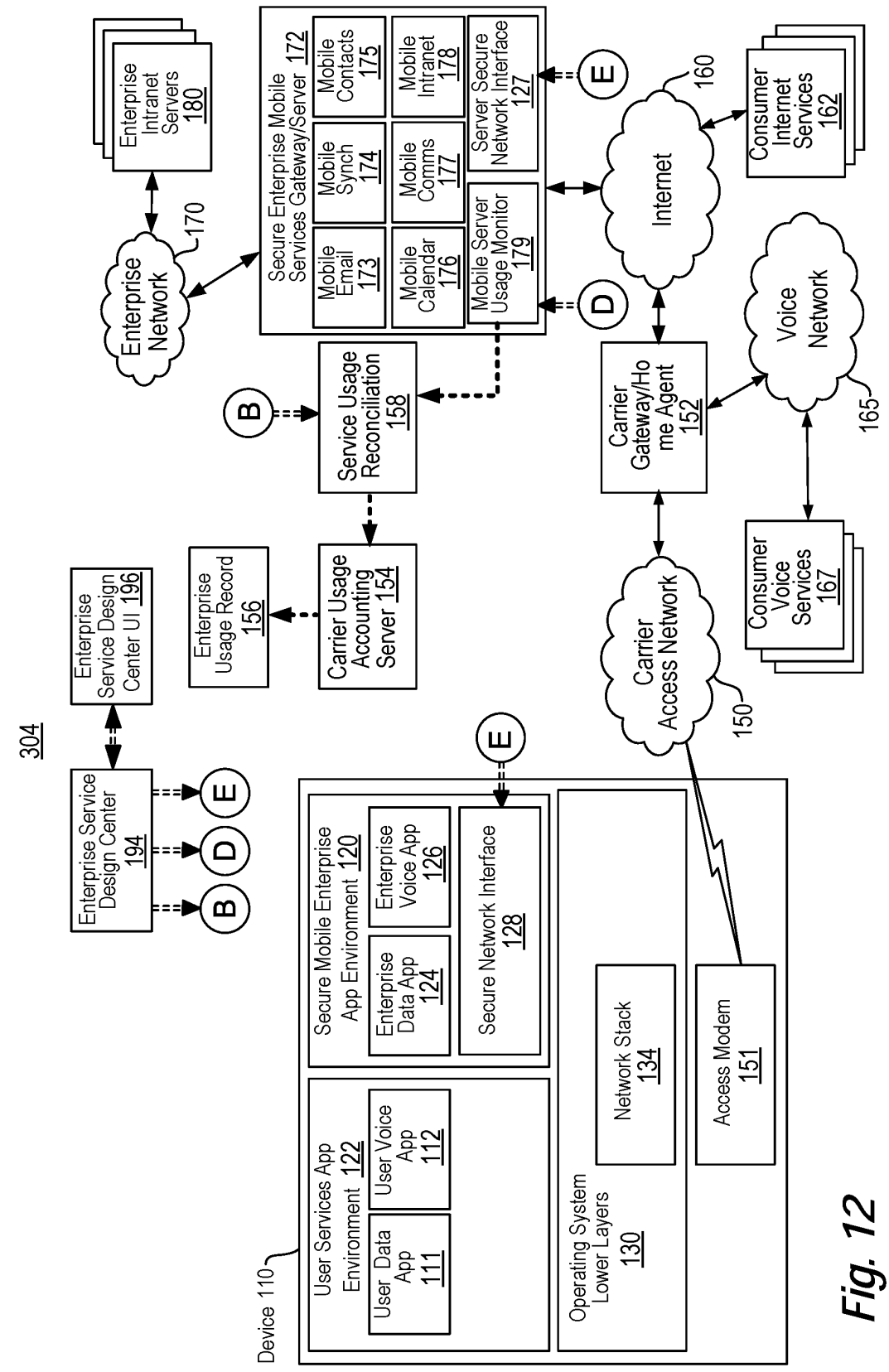

304
Enterprise Service Design Center 194
Enterprise Service Design Center UI 196
B
D
E
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User Data App 111
User Voice App 112
Secure Mobile Enterprise App Environment 120
Enterprise Data App 124
Enterprise Voice App 126
Secure Network Interface 128
Operating System Lower Layers 130
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Access Modem 151
Enterprise Usage Record 156
Carrier Usage Accounting Server 154
Service Usage Reconciliation 158
Enterprise Network 170
Enterprise Intranet Servers 180
Secure Enterprise Mobile Services Gateway/Server 172
Mobile Email 173
Mobile Synch 174
Mobile Contacts 175
Mobile Calendar 176
Mobile Comms 177
Mobile Intranet 178
Mobile Server Usage Monitor 179
Server Secure Network Interface 127
Carrier Access Network 150
Carrier Gateway/Home Agent 152
Internet 160
Voice Network 165
Consumer Internet Services 162
Consumer Voice Services 167

Fig. 12

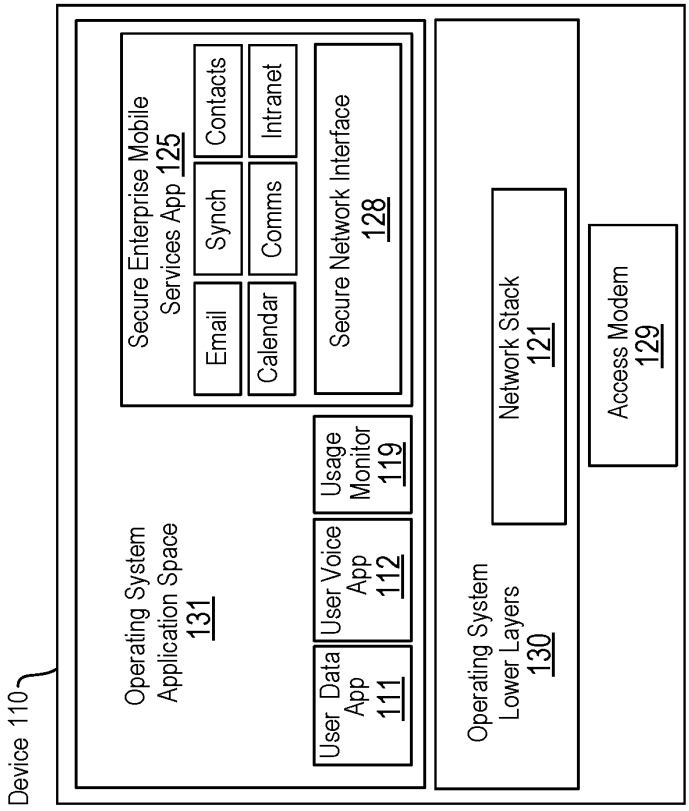

Device 110
Operating System Application Space 131
User Data App 111
User Voice App 112
Usage Monitor 119
Secure Enterprise Mobile Services App 125
Email
Calendar
Synch
Comms
Contacts
Intranet
Secure Network Interface 128
Operating System Lower Layers 130
Network Stack 121
Access Modem 129

Fig. 13

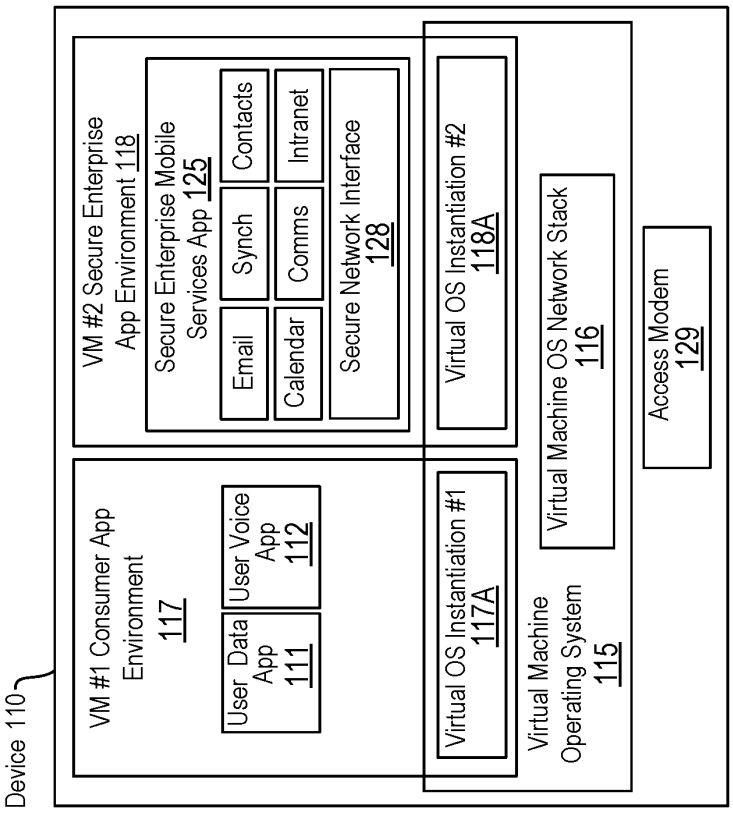

Device 110
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User Data App 111
User Voice App 112
VM #2 Secure Enterprise App Environment 118
Secure Enterprise Mobile Services App 125
Email
Synch
Contacts
Calendar
Comms
Intranet
Secure Network Interface 128
Virtual OS Instantiation #1 117A
Virtual OS Instantiation #2 118A
Virtual Machine Operating System 115
Virtual Machine OS Network Stack 116
Access Modem 129

Fig. 14

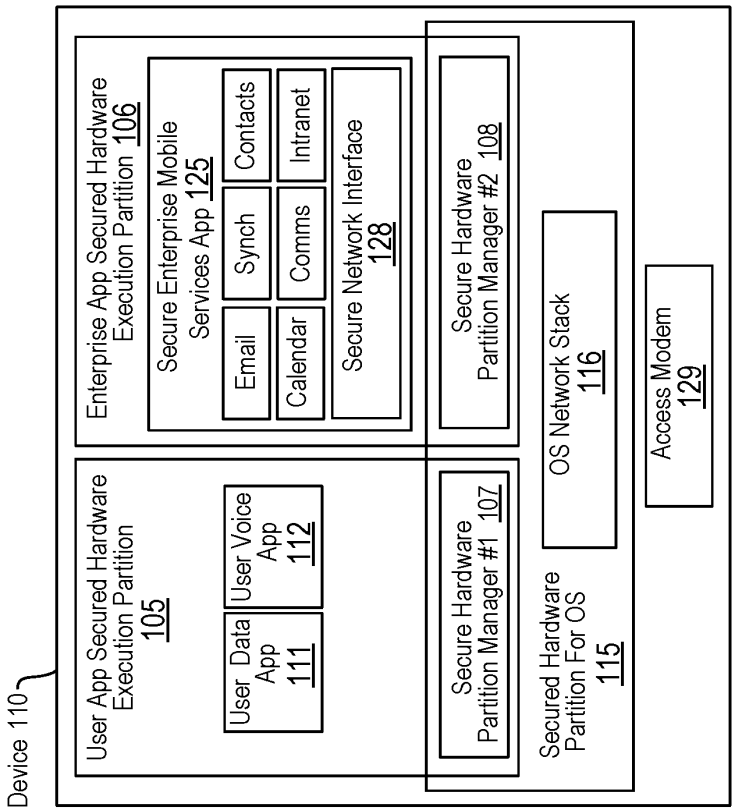

Device 110
User App Secured Hardware Execution Partition 105
User Data App 111
User Voice App 112
Enterprise App Secured Hardware Execution Partition 106
Secure Enterprise Mobile Services App 125
Email
Synch
Contacts
Calendar
Comms
Intranet
Secure Network Interface 128
Secure Hardware Partition Manager #1 107
Secure Hardware Partition Manager #2 108
Secured Hardware Partition For OS 115
OS Network Stack 116
Access Modem 129

Fig. 15

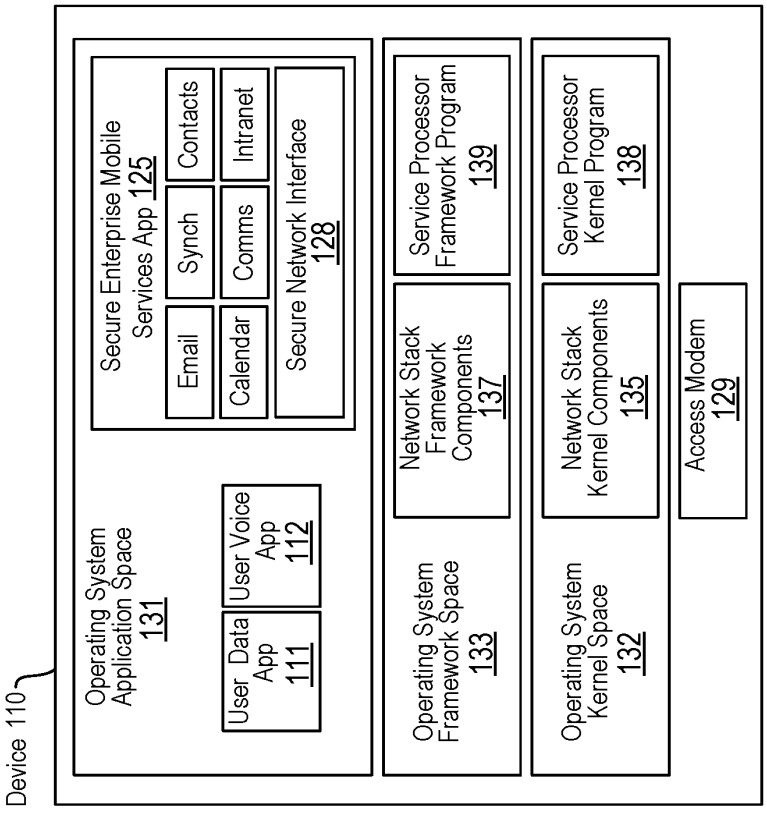

Device 110
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User Data App 111
User Voice App 112
Secure Enterprise Mobile Services App 125
Email
Synch
Contacts
Calendar
Comms
Intranet
Secure Network Interface 128
Operating System Framework Space 133
Network Stack Framework Components 137
Service Processor Framework Program 139
Operating System Kernel Space 132
Network Stack Kernel Components 135
Service Processor Kernel Program 138
Access Modem 129

Fig. 16

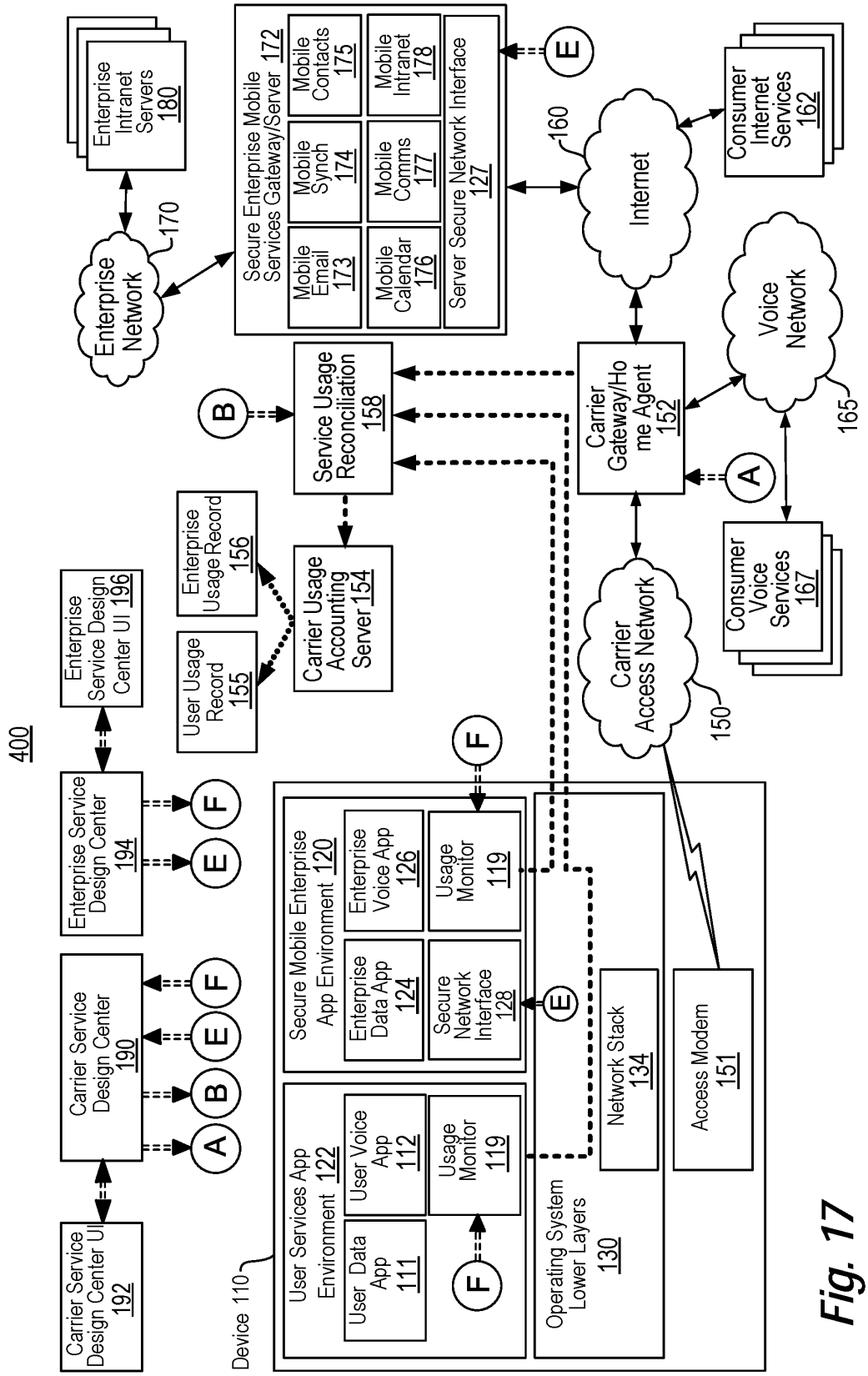

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User Data App 111
User Voice App 112
Usage Monitor 119
Secure Mobile Enterprise App Environment 120
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Enterprise Voice App 126
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Usage Monitor 119
Operating System Lower Layers 130
Network Stack 134
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Carrier Service Design Center UI 192
Carrier Service Design Center 190
Enterprise Service Design Center 194
Enterprise Service Design Center UI 196
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Enterprise Intranet Servers 180
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Mobile Contacts 175
Mobile Calendar 176
Mobile Comms 177
Mobile Intranet 178
Server Secure Network Interface 127
Service Usage Reconciliation 158
Enterprise Usage Record 156
User Usage Record 155
Carrier Usage Accounting Server 154
Carrier Gateway/Home Agent 152
Carrier Access Network 150
Internet 160
Consumer Internet Services 162
Voice Network 165
Consumer Voice Services 167
A
B
E
F

Fig. 17

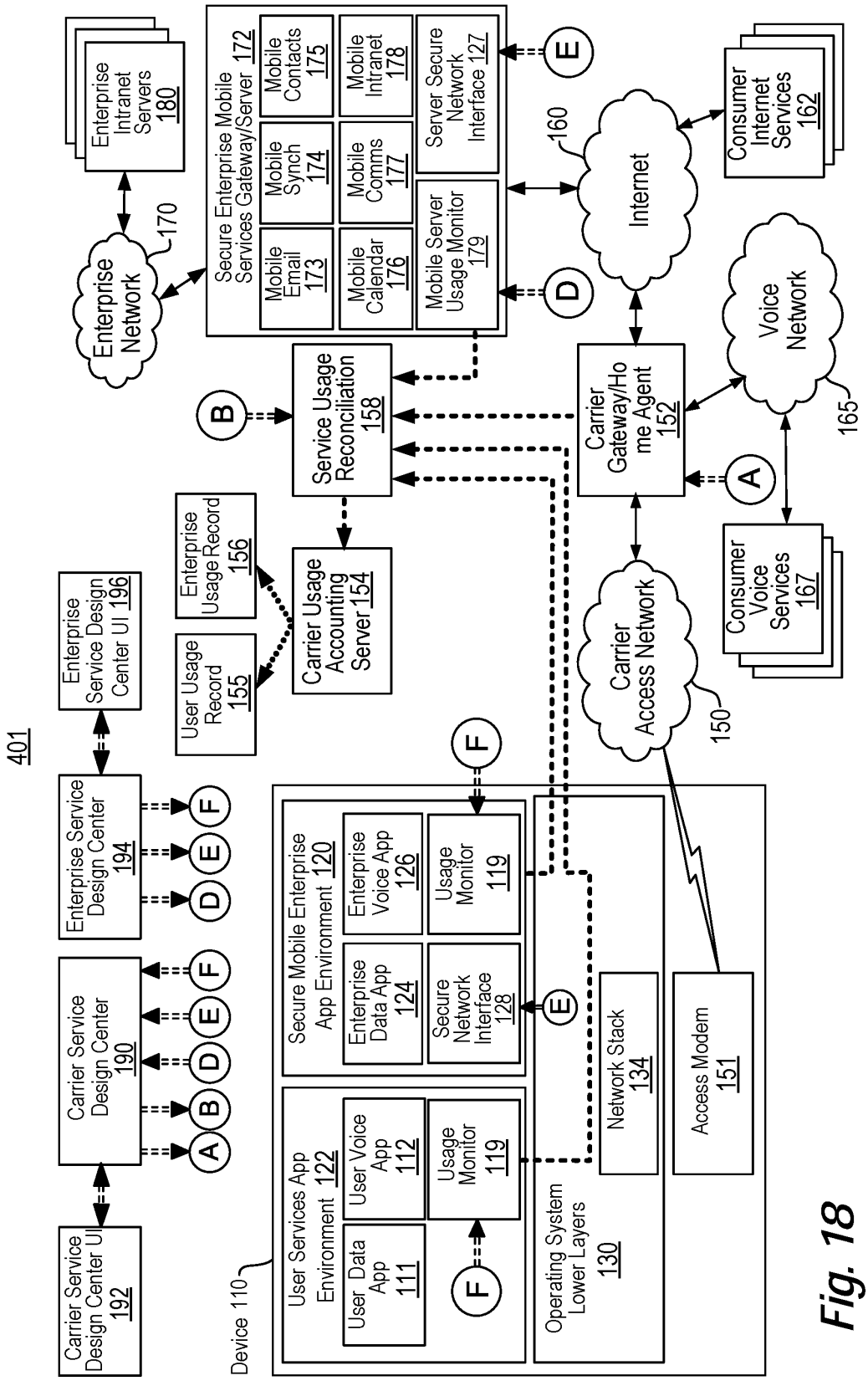

401
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Enterprise Service Design Center UI 196
A
B
D
E
F
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User Data App 111
User Voice App 112
Usage Monitor 119
Secure Mobile Enterprise App Environment 120
Enterprise Data App 124
Enterprise Voice App 126
Secure Network Interface 128
Usage Monitor 119
Operating System Lower Layers 130
Network Stack 134
Access Modem 151
Carrier Access Network
150
Carrier Gateway/Home Agent 152
Voice Network
165
Consumer Voice Services 167
Internet
160
Consumer Internet Services 162
Service Usage Reconciliation 158
Carrier Usage Accounting Server 154
Enterprise Usage Record 156
User Usage Record 155
Enterprise Network
170
Enterprise Intranet Servers 180
Secure Enterprise Mobile Services Gateway/Server 172
Mobile Email 173
Mobile Synch 174
Mobile Contacts 175
Mobile Calendar 176
Mobile Comms 177
Mobile Intranet 178
Mobile Server Usage Monitor 179
Server Secure Network Interface 127

Fig. 18

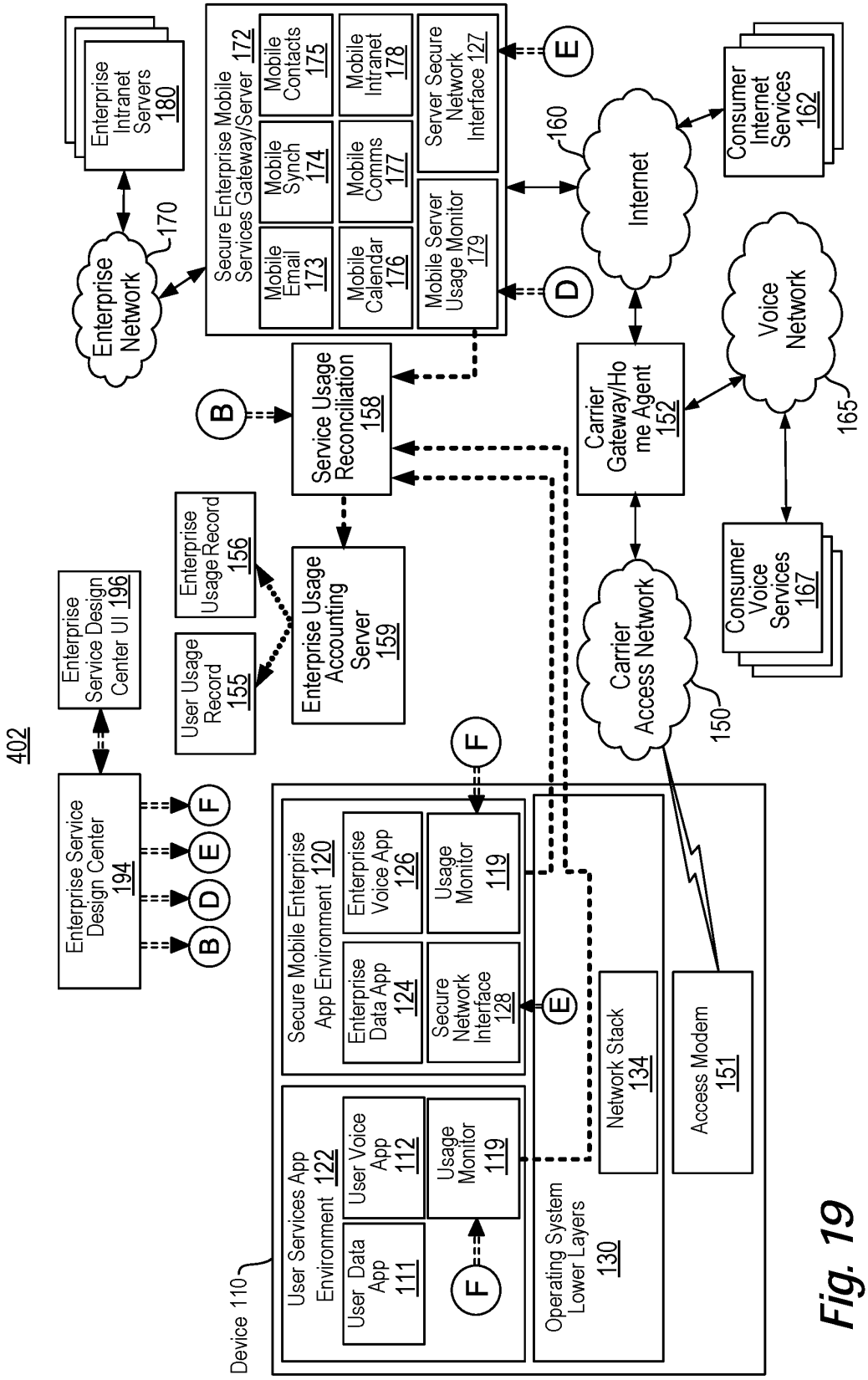

402
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Enterprise Service Design Center UI 196
Enterprise Usage Record 156
User Usage Record 155
Enterprise Usage Accounting Server 159
Service Usage Reconciliation 158
Enterprise Network 170
Enterprise Intranet Servers 180
Secure Enterprise Mobile Services Gateway/Server 172
Mobile Email 173
Mobile Synch 174
Mobile Contacts 175
Mobile Calendar 176
Mobile Comms 177
Mobile Intranet 178
Mobile Server Usage Monitor 179
Server Secure Network Interface 127
Internet 160
Consumer Internet Services 162
Carrier Gateway/Home Agent 152
Voice Network 165
Carrier Access Network 150
Consumer Voice Services 167
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User Services App Environment 122
User Data App 111
User Voice App 112
Usage Monitor 119
Secure Mobile Enterprise App Environment 120
Enterprise Data App 124
Secure Network Interface 128
Enterprise Voice App 126
Usage Monitor 119
Operating System Lower Layers 130
Network Stack 134
Access Modem 151
A
B
C
D
E
F

Fig. 19

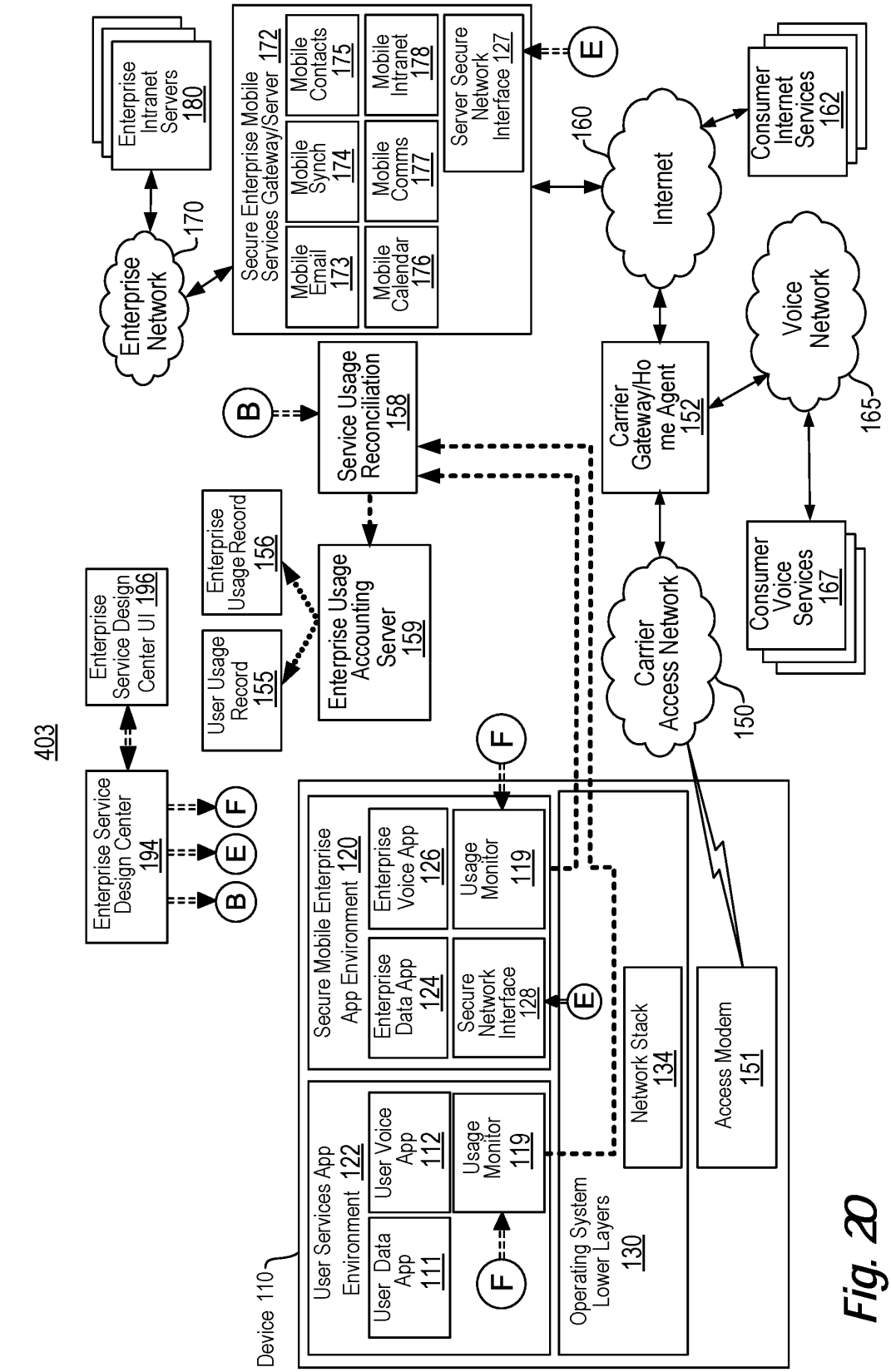

403
Enterprise Service Design Center 194
Enterprise Service Design Center UI 196
Device 110
User Services App Environment 122
User Data App 111
User Voice App 112
Usage Monitor 119
Secure Mobile Enterprise App Environment 120
Enterprise Data App 124
Secure Network Interface 128
Enterprise Voice App 126
Usage Monitor 119
Operating System Lower Layers 130
Network Stack 134
Access Modem 151
Carrier Access Network
150
Carrier Gateway/Home Agent 152
Internet
160
Voice Network
165
Consumer Voice Services 167
Consumer Internet Services 162
Enterprise Network
170
Enterprise Intranet Servers 180
Secure Enterprise Mobile Services Gateway/Server 172
Mobile Email 173
Mobile Synch 174
Mobile Contacts 175
Mobile Calendar 176
Mobile Comms 177
Mobile Intranet 178
Server Secure Network Interface 127
Service Usage Reconciliation 158
Enterprise Usage Accounting Server 159
Enterprise Usage Record 156
User Usage Record 155
A
B
E
F

Fig. 20

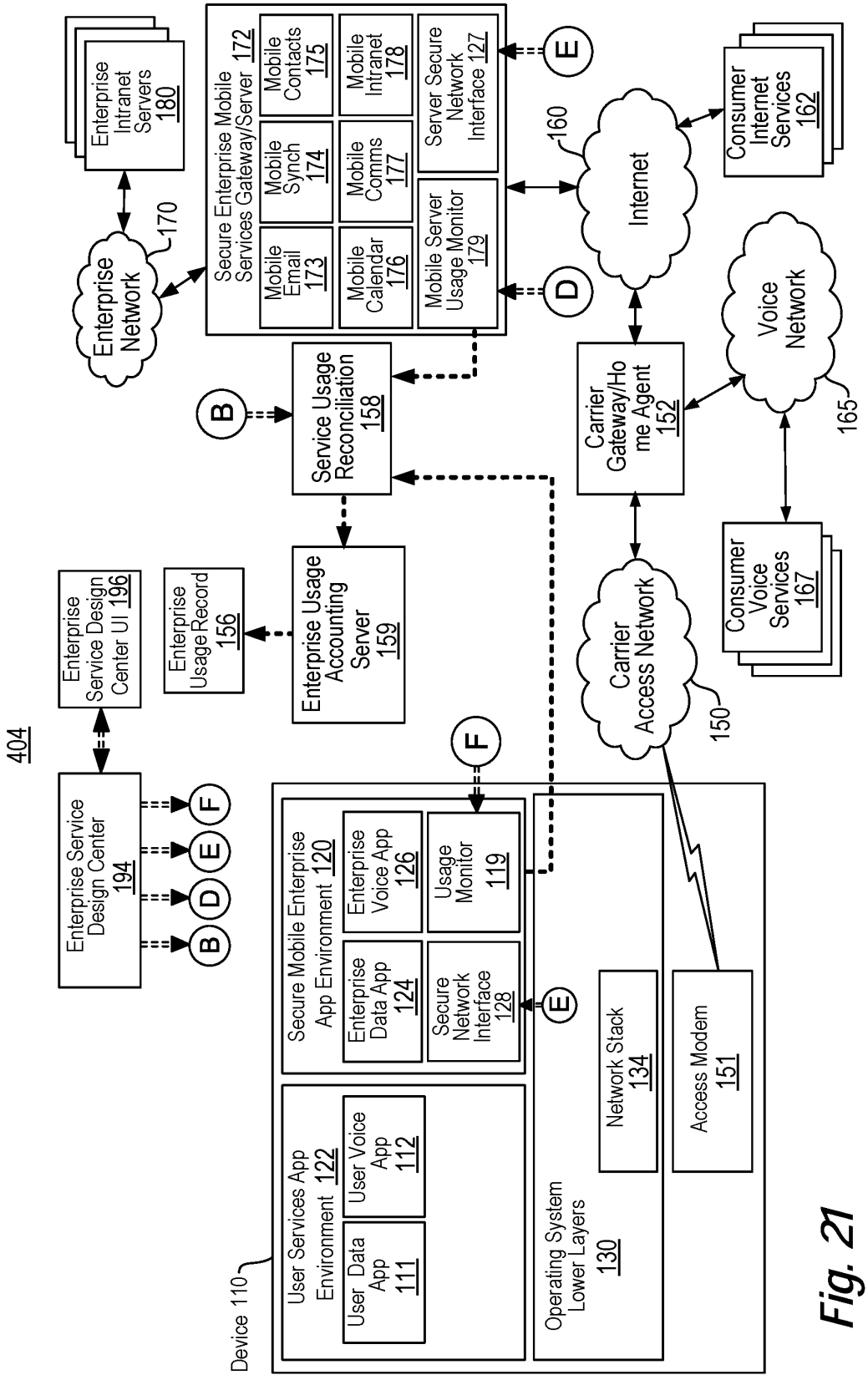

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Enterprise Service Design Center UI 196
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Enterprise Usage Accounting Server 159
Service Usage Reconciliation 158
Enterprise Network 170
Enterprise Intranet Servers 180
Secure Enterprise Mobile Services Gateway/Server 172
Mobile Email 173
Mobile Synch 174
Mobile Contacts 175
Mobile Calendar 176
Mobile Comms 177
Mobile Intranet 178
Mobile Server Usage Monitor 179
Server Secure Network Interface 127
Internet 160
Consumer Internet Services 162
Carrier Gateway/Home Agent 152
Voice Network 165
Carrier Access Network 150
Consumer Voice Services 167
Device 110
User Services App Environment 122
User Data App 111
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Secure Mobile Enterprise App Environment 120
Enterprise Data App 124
Enterprise Voice App 126
Secure Network Interface 128
Usage Monitor 119
Operating System Lower Layers 130
Network Stack 134
Access Modem 151
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C
D
E
F

Fig. 21

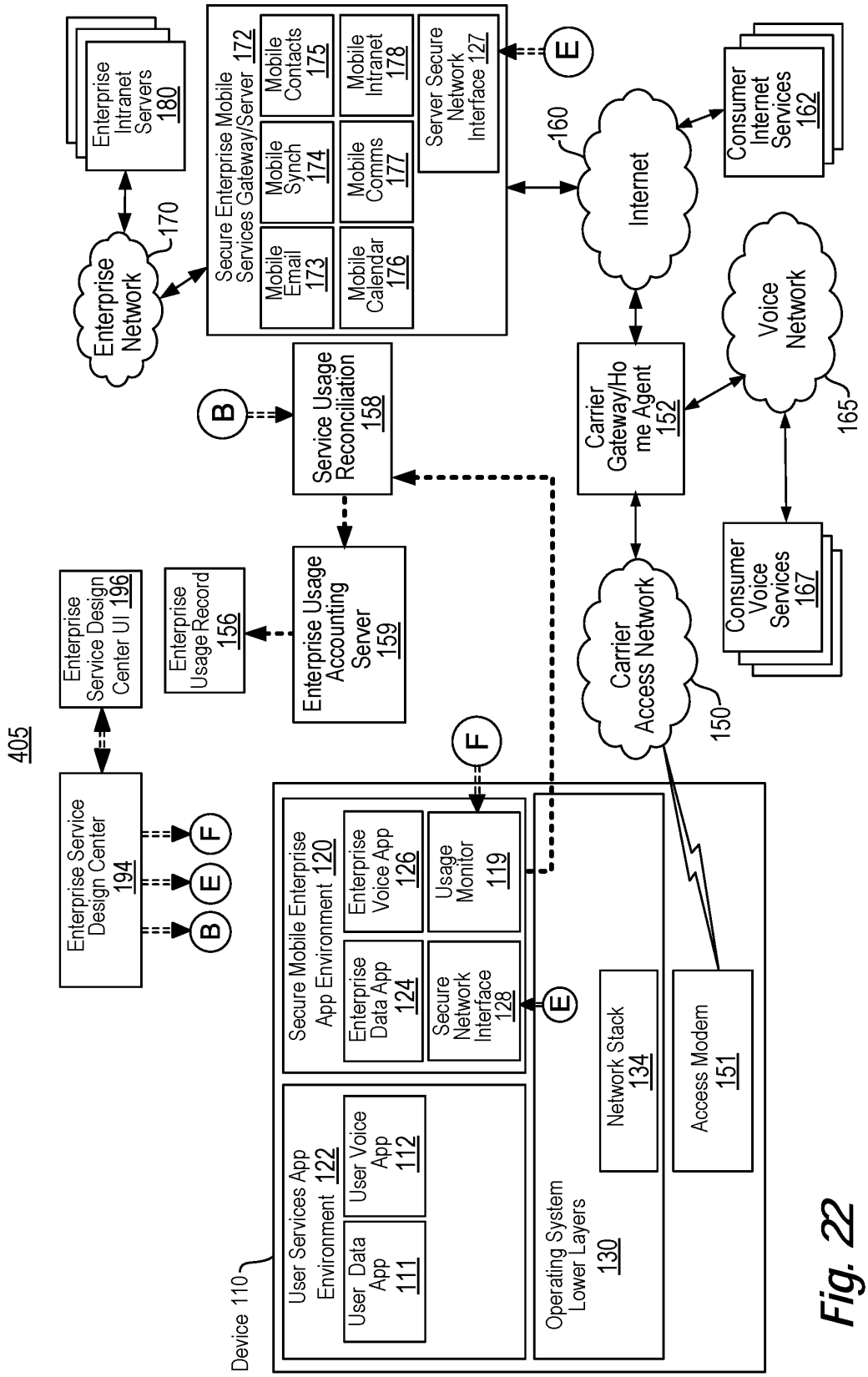

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Enterprise Service Design Center UI 196
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Service Usage Reconciliation 158
Enterprise Network 170
Enterprise Intranet Servers 180
Secure Enterprise Mobile Services Gateway/Server 172
Mobile Email 173
Mobile Synch 174
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Mobile Calendar 176
Mobile Comms 177
Mobile Intranet 178
Server Secure Network Interface 127
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Carrier Gateway/Home Agent 152
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Carrier Access Network 150
Consumer Voice Services 167
Device 110
User Services App Environment 122
User Data App 111
User Voice App 112
Secure Mobile Enterprise App Environment 120
Enterprise Data App 124
Enterprise Voice App 126
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Usage Monitor 119
Operating System Lower Layers 130
Network Stack 134
Access Modem 151
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B
C
D
E
F

Fig. 22

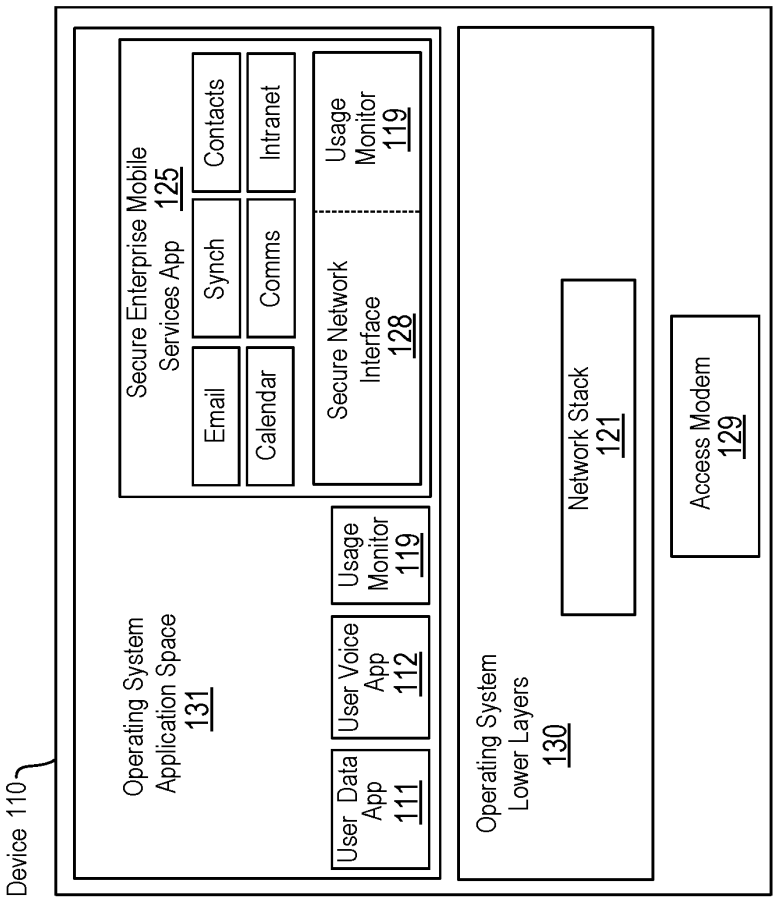

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Secure Enterprise Mobile Services App 125
Email
Calendar
Synch
Comms
Contacts
Intranet
Secure Network Interface 128
Usage Monitor 119
User Data App 111
User Voice App 112
Usage Monitor 119
Operating System Lower Layers 130
Network Stack 121
Access Modem 129

Fig. 23

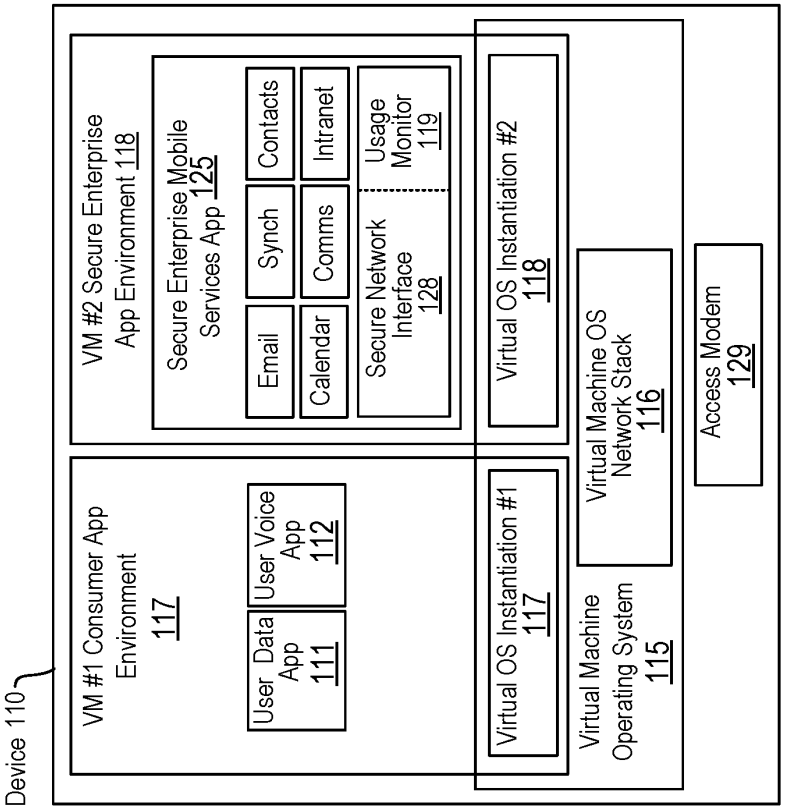

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VM #1 Consumer App Environment 117
User Data App 111
User Voice App 112
VM #2 Secure Enterprise App Environment 118
Secure Enterprise Mobile Services App 125
Email
Synch
Contacts
Calendar
Comms
Intranet
Secure Network Interface 128
Usage Monitor 119
Virtual OS Instantiation #1 117
Virtual OS Instantiation #2 118
Virtual Machine Operating System 115
Virtual Machine OS Network Stack 116
Access Modem 129

Fig. 24

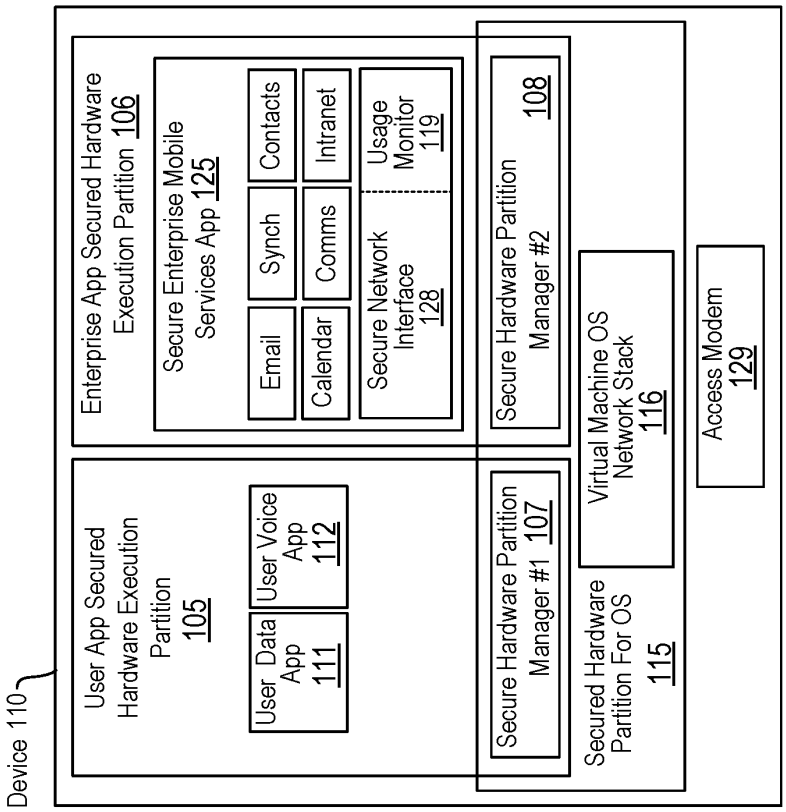

Device 110
User App Secured Hardware Execution Partition 105
User Data App 111
User Voice App 112
Enterprise App Secured Hardware Execution Partition 106
Secure Enterprise Mobile Services App 125
Email
Synch
Contacts
Calendar
Comms
Intranet
Secure Network Interface 128
Usage Monitor 119
Secured Hardware Partition For OS 115
Secure Hardware Partition Manager #1 107
Secure Hardware Partition Manager #2 108
Virtual Machine OS Network Stack 116
Access Modem 129

Fig. 25

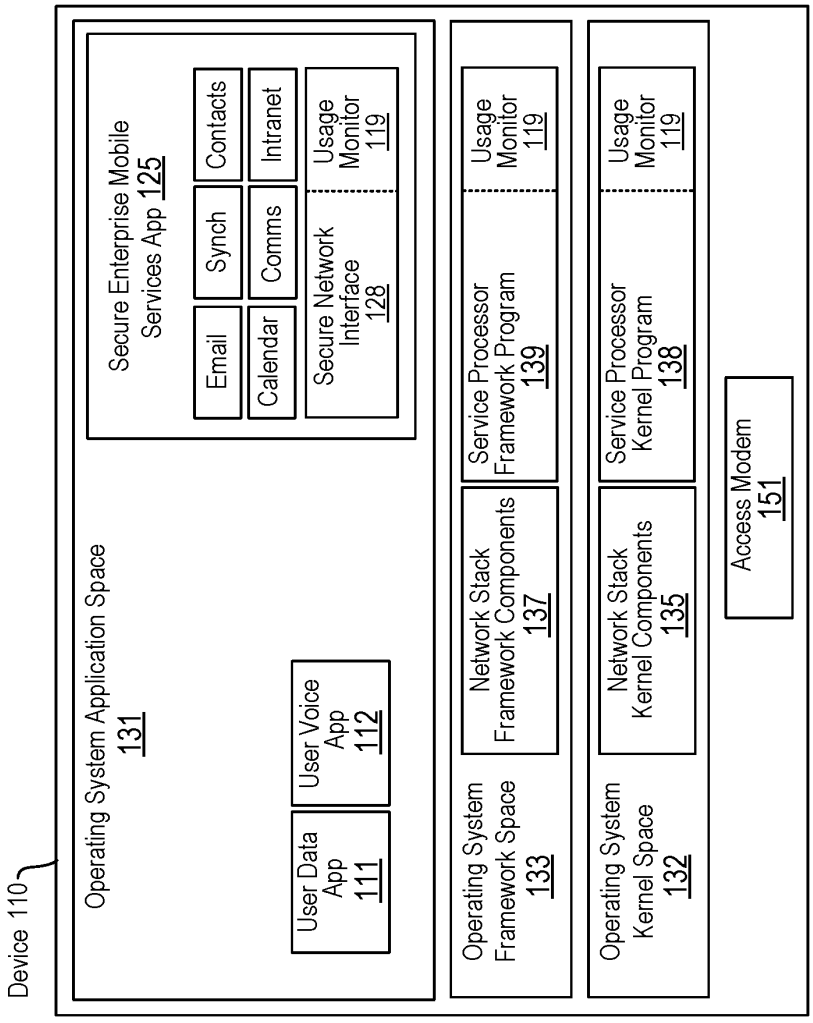

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Operating System Application Space 131
Secure Enterprise Mobile Services App 125
Email
Synch
Contacts
Calendar
Comms
Intranet
Secure Network Interface 128
Usage Monitor 119
User Data App 111
User Voice App 112
Operating System Framework Space 133
Network Stack Framework Components 137
Service Processor Framework Program 139
Usage Monitor 119
Operating System Kernel Space 132
Network Stack Kernel Components 135
Service Processor Kernel Program 138
Usage Monitor 119
Access Modem 151

Fig. 26

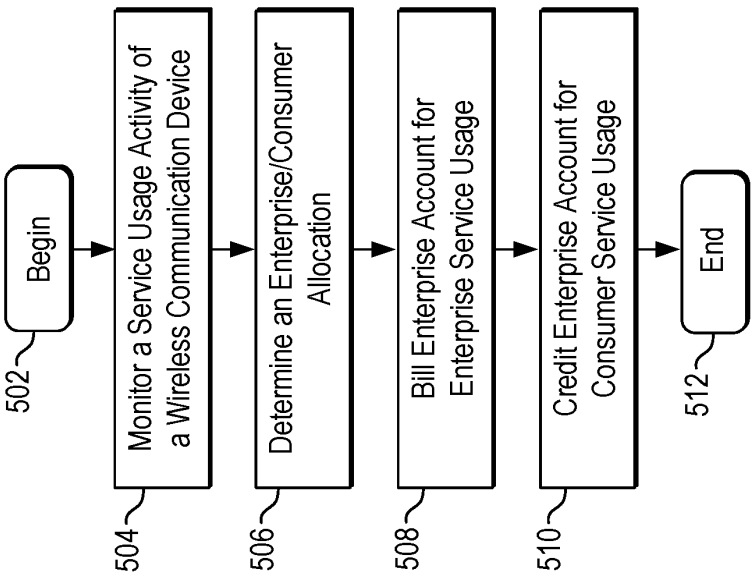

Begin
502
Monitor a Service Usage Activity of a Wireless Communication Device
504
Determine an Enterprise/Consumer Allocation
506
Bill Enterprise Account for Enterprise Service Usage
508
Credit Enterprise Account for Consumer Service Usage
510
End
512

Fig. 28

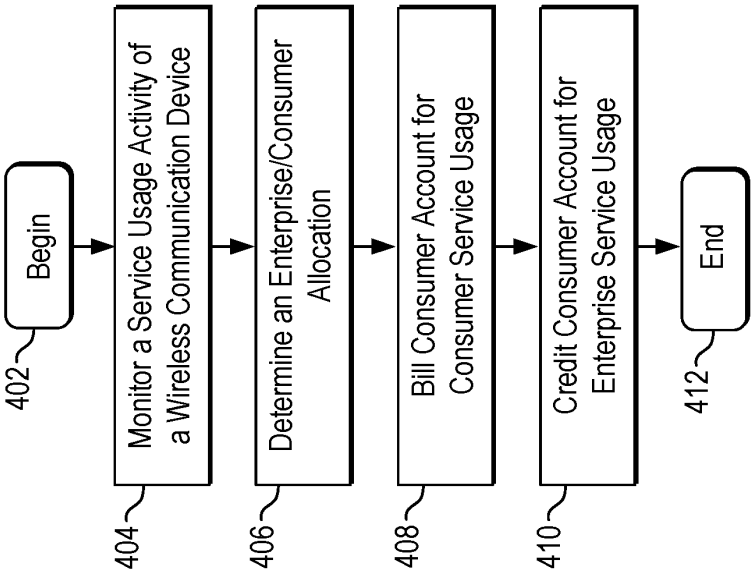

Begin
402
Monitor a Service Usage Activity of a Wireless Communication Device
404
Determine an Enterprise/Consumer Allocation
406
Bill Consumer Account for Consumer Service Usage
408
Credit Consumer Account for Enterprise Service Usage
410
End
412

Fig. 27

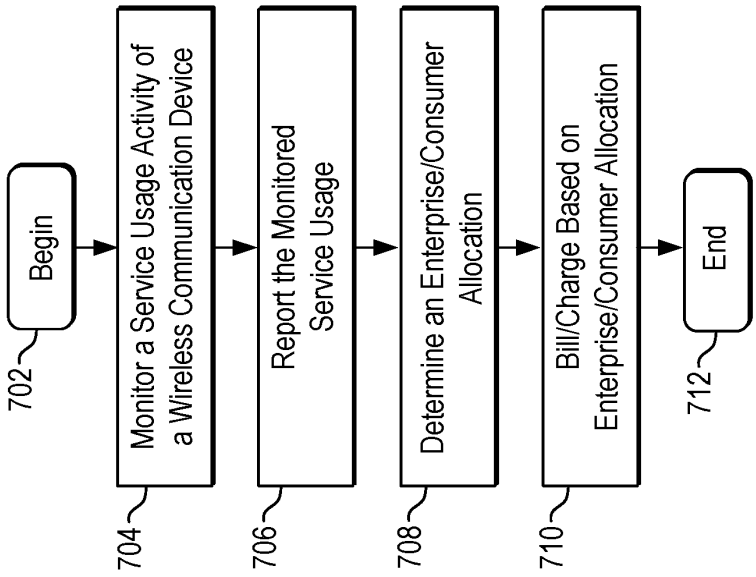

Begin
Monitor a Service Usage Activity of a Wireless Communication Device
Report the Monitored Service Usage
Determine an Enterprise/Consumer Allocation
Bill/Charge Based on Enterprise/Consumer Allocation
End
702
704
706
708
710
712

Fig. 30

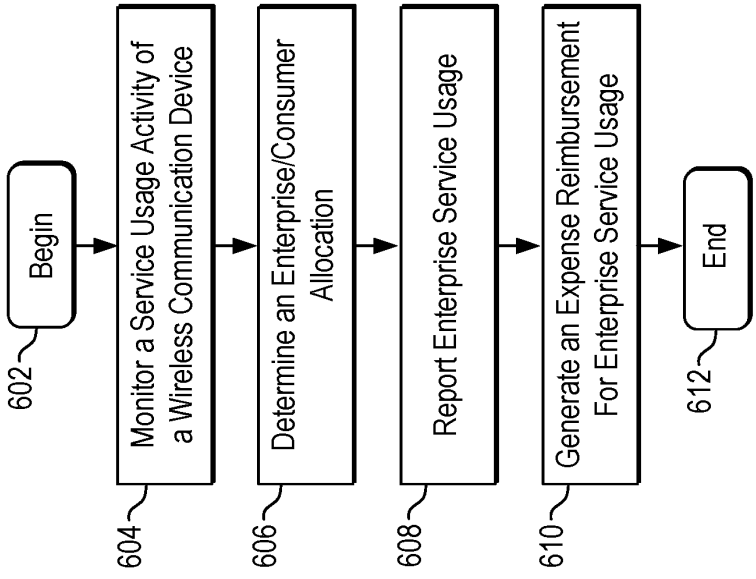

Begin
Monitor a Service Usage Activity of a Wireless Communication Device
Determine an Enterprise/Consumer Allocation
Report Enterprise Service Usage
Generate an Expense Reimbursement For Enterprise Service Usage
End
602
604
606
608
610
612

Fig. 29

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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	Enterprise Access Control and Accounting Allocation for Access Networks

As the below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application, or

☒ United States application or PCT international application number 14/578,124

filed on December 19, 2014.

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.

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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)

Title of Invention	Enterprise Access Control and Accounting Allocation for Access Networks

As the below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application, or

☒ United States application or PCT international application number 14/578,124

filed on December 19, 2014.

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.

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LEGAL NAME OF INVENTOR

Inventor: Alireza Raissinia Date (Optional): 1/10/2015

Signature:

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LEGAL NAME OF INVENTOR

Inventor: Gregory G. Raleigh 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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EFS ID:	27148070
Application Number:	15287603
International Application Number:	
Confirmation Number:	1013
Title of Invention:	Enterprise Access Control and Accounting Allocation for Access Networks
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:	RALEP037D1C1
Receipt Date:	06-OCT-2016
Filing Date:	
Time Stamp:	19:20:07
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.)
1	Application Data Sheet	P037D1C1_ADS.pdf	1823719 96b404c4ec4aaca0396798c0de2aed356e14a8d5	no	10

Warnings:

Information:					
2		P037D1C1_Spec.pdf	404722 e27cd63c8aee90c0b6e88c0b20fd6cc8e0d643c9	yes	75
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Specification		1	73	
	Claims		74	74	
	Abstract		75	75	
Warnings:					
Information:					
3	Drawings-only black and white line drawings	P037D1C1_Drawings.pdf	406870 0fed0017c774626e0f4313822c651a8399c75159	no	28
Warnings:					
Information:					
4	Oath or Declaration filed	P037D1C1_GreenD.pdf	63831 a8fe22489aa234791461f18d3f5e803407b7129a1	no	1
Warnings:					
Information:					
5	Oath or Declaration filed	P037D1C1_RaissiniaD.pdf	65339 6e385d8cba239dcef982e842c18c69a767af3d29	no	1
Warnings:					
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6	Oath or Declaration filed	P037D1C1_RaleighD.pdf	63734 cab652a179428fd64b7fc192127d649e1ea710e8	no	1
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National Stage of an International Application under 35 U.S.C. 371
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New International Application Filed with the USPTO as a Receiving Office
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