UNITED STATES PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

ACKNOWLEDGEMENT OF LOSS OF ENTITLEMENT TO ENTITY STATUS DISCOUNT

APPLICATION #	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET #	REQUEST ID
16/421,121	05/23/2019	Gregory G Raleigh	RALEP007C11C3C2C3C1C1	477709

The entity status change request below filed through Patent Center on 09/22/2025 has been accepted.

Certifications

APPLICANT CHANGING TO REGULAR UNDISCOUNTED FEE STATUS

Signature

I certify, in accordance with 37 CFR 1.4(d)(4), that I am one of the signatories making the entity status change.

Signature	Name	Registration #
/Farshad Farjami/	Farshad Farjami	41014

GOOGLE EXHIBIT 1002 (Part 1 of 3)
Google v. Headwater
IPR2026-00439

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
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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/421,121	08/17/2021	11096055	RALEP007C11C3C2C3C1C1	3747

106963 7590 07/28/2021

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 95 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;

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.

IR103 (Rev. 10/09)

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/421,121	05/23/2019	Gregory G Raleigh	RALEP007C11C3C2C3C1C1	3747

106963 7590 07/16/2021

Headwater Research LLC
1011 Pruitt Place
Tyler, TX 75703

EXAMINER	
RUDY, ANDREW J	

ART UNIT	PAPER NUMBER
3687	

NOTIFICATION DATE	DELIVERY MODE
07/16/2021	ELECTRONIC

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

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

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

patent@headwaterllc.com

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

In re Application of	:	
Raleigh, Gregory, G	:	
Application No. 16/421,121	:	DECISION ON PETITION
Filed: 23 May 2019	:	
For: AUTOMATED DEVICE PROVISIONING	:	
AND ACTIVATION	:	

This is a decision on the petition under the unintentional provisions of 37 CFR 1.137(a), filed May 19, 2021, to revive the above-identified application.

There is no indication that the petition is signed by a registered patent attorney or patent agent of record. However, in accordance with 37 CFR 1.34, the signature of James E. Harris appearing on the correspondence shall constitute a representation to the United States Patent and Trademark Office that he/she is authorized to represent the particular party in whose behalf he/she acts.

The petition is **GRANTED**.

This application became abandoned for failure to timely pay the issue fee as required by the Notice of Allowance and Fee(s) Due mailed January 22, 2021, which set a statutory period for reply of three months. Accordingly, the application became abandoned on April 23, 2021. A Notice of Abandonment was mailed on May 11, 2021.

The petition satisfies the requirements of 37 CFR 1.137(a) in that petitioner has supplied (1) the reply in the form of payment of the issue fee of $600.00, (2) the petition fee of $1,050.00 and (3) a proper statement of unintentional delay.

This application is being referred to the Office of Data Management for further processing into a patent.

Telephone inquiries concerning this decision should be directed to Jamice Brantley at (571) 272-3814. Telephone inquiries regarding the status or the processing as a patent should be directed to the Office of Data Management at (571) 272-4200.

/JAMICE T BRANTLEY/
PARASP, OPET



United States Patent and Trademark Office

Office of the Chief Financial Officer

Document Code:WFEE

User :C46472

Sale Accounting Date:05/20/2021

Sale Item Reference Number	Effective Date
16421121	05/19/2021

Document Number	Fee Code	Fee Code Description	Amount Paid	Payment Method
I20215JB15261781	2453	PET. REVIVE ABANDON APP, DELAY PYMT-RESP	$1,050.00	Deposit Account
I20215JB15261781	2501	UTILITY APPL ISSUE FEE	$600.00	Deposit Account

OPAP AKIMA
MAY 19 2021
PATENT & TRADEMARK OFFICE

Doc Code: PET.OP
Document Description: Petition for Review by the Office of Petitions

PTO/SB/64 (01-18)
Approved for use through 11/30/2020. 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 REVIVAL OF AN APPLICATION FOR PATENT ABANDONED UNINTENTIONALLY UNDER 37 CFR 1.137(a)

Docket Number (Optional): P007C11C3C2C3C1C1

First named inventor: GREGORY RALEIGH

Application No.: 16/421,121 Art Unit: 2414

Filed: MAY 23, 2019 Examiner: RUDY, ANDREW

Title: AUTOMATED DEVICE PROVISIONING AND ACTIVATION

Attention: Office of Petitions
Mail Stop Petition
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450
FAX (571) 273-8300

NOTE: If information or assistance is needed in completing this form, please contact the Office of Petitions at (571) 272-3282.

The above-identified application became abandoned for failure to file a timely and proper reply to a notice or action by the United States Patent and Trademark Office. The date of abandonment is the day after the expiration date of the period set for reply in the Office notice or action plus any extensions of time actually obtained.

APPLICANT HEREBY PETITIONS FOR REVIVAL OF THIS APPLICATION.

NOTE: A grantable petition requires the following items:

(1) Petition fee;
(2) Reply and/or issue fee;
(3) Terminal disclaimer with disclaimer fee – required for all utility and plant applications filed before June 8, 1995, and for all design applications; and
(4) Statement that the entire delay was unintentional.

1. **Petition fee**

☒ Small entity fee $ 1000.00 (37 CFR 1.17(m)). Applicant asserts small entity status. See 37 CFR 1.27.

☐ Micro entity fee $ _____ (37 CFR 1.17(m)). 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.

☐ Undiscounted fee $ _____ (37 CFR 1.17(m)).

2. **Reply and/or fee**

A The reply and/or fee to the above-noted Office notice or action in the form of

Issue Fee Transmittal (identify the type of reply):

☐ has been filed previously on _____.

☒ is enclosed herewith.

B The issue fee and publication fee (if applicable) of $ 600

☐ has been paid previously on _____.

☒ is enclosed herewith.

This collection of information is required by 37 CFR 1.137(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, 1.14 and 41.6. 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: Mail Stop Petition, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

Doc Code: PET.OP
Document Description: Petition for Review by the Office of Petitions

PTO/SB/64 (01-18)
Approved for use through 11/30/2020. 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 REVIVAL OF AN APPLICATION FOR PATENT ABANDONED UNINTENTIONALLY UNDER 37 CFR 1.137(a)

3. **Terminal disclaimer with disclaimer fee**

☒ Since this utility/plant application was filed on or after June 8, 1995, no terminal disclaimer is required.

☐ A terminal disclaimer (and disclaimer fee (37 CFR 1.20(d)) of $ _____) disclaiming the required period of time is enclosed herewith (see PTO/SB/63).

4. **STATEMENT:** The entire delay in filing the required reply from the due date for the required reply until the filing of a grantable petition under 37 CFR 1.137(a) was unintentional. [NOTE: The United States Patent and Trademark Office may require additional information if there is a question as to whether either the abandonment or the delay in filing a petition under 37 CFR 1.137(a) was unintentional (MPEP 711.03(c), subsections (III)(C) and (D)).]

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

/James E. Harris/	May 13, 2021
Signature	Date
JAMES E. HARRIS	40013
Typed or Printed Name	Registration Number, if applicable
1011 PRUITT PLACE	903-201-6212
Address	Telephone Number
TYLER, TX 75703	
Address	

Enclosures:

☒ Fee Payment

☒ Reply

☐ Terminal Disclaimer Form

☒ Additional sheet(s) containing statements establishing unintentional delay

☐ Other: Issue Fee Transmittal, Response to Notice of Abandonment

CERTIFICATE OF MAILING OR TRANSMISSION [37 CFR 1.8(a)]

I hereby certify that this correspondence is being:

☒ Deposited with the United States Postal Service on the date shown below with sufficient postage as first class mail in an envelope addressed to: Mail Stop Petition, Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450.

☐ Transmitted by facsimile on the date shown below to the United States Patent and Trademark Office at (571) 273-8300.

5-13-21
Date

Signature

Jennifer Smith
Typed or printed name of person signing certificate

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.

OPAP AKIMA-8 MAY 19 2021 PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	Raleigh, Gregory G.	Examiner:	Rudy, Andrew
Serial No.:	16/421,121	Art Unit:	3687
Filed:	May 23, 2019	Conf. No.:	3747
Title:	Automated Device Provisioning and Activation		

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

RESPONSE TO NOTICE OF ABANDONMENT

In response to the Notice of Abandonment dated May 11, 2021, (the "Notice"), regarding Applicant's failure to timely pay the issue fee, Applicant files this Response to Notice of Abandonment in support of a co-filed Petition for Revival for unintentional Abandonment and Petition Fee, and states the following:

Applicant filed the instant application ("the '121 application) on May 23, 2019.

On May 11, 2021, Applicant received a "Notice of Abandonment" stating, in part, that, "Applicant failed to timely pay the required issue fee . . . within the statutory period of three months from the mailing date of the Notice of Allowance (PTOL-85)."

Applicant received a "Notice of Allowance and Fees Due" dated January 22, 2021 (*see* document attached hereto). Approximately a month later, on February 23, 2021, Applicant received a second, reissued and corrected notice also captioned as a "Notice of Allowance and Fees Due" (*see* document attached hereto). Applicant's legal assistant updated the deadline to pay the issue fee to May 23, 2021, based on the receipt date of the second "Notice of Allowance and Fees Due."

According to 37 CFR § 1.311, an "issue fee and any required publication fee must both be paid within three months from the date of mailing of the notice of allowance to avoid abandonment of the application." Both the January 22 and February 23 documents contained a Notice of Allowability Form PTOL-37 (page 5 and page 2, respectively), while the January 22 document also contained a Notice of Allowance and Fee(s) Due form PTOL-85. Under these circumstances, there is confusion as to which mailing date controls, and it was reasonable for Applicant's legal assistant to reset the due date based on receipt of a corrected Notice of Allowability.

For further reference, Applicant also has attached hereto a printout of the "Available Documents" for this application as shown on PAIR.

The entire delay in paying the issue fee was unintentional.

CONCLUSION

Applicant respectfully requests entry of this Reply, the attached Petition, and accompanying fee, revival of the Application, and that the Application be allowed to proceed to issuance.

Applicant is also submitting the required fees and surcharges. Applicant further requests that the petition fee be refunded, as the Office's mistake and correction by issuing a second Notice of Allowability caused confusion resulting in the missed payment deadline.

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

Respectfully submitted,

Date: May 13, 2021

By: /James E. Harris/

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

CERTIFICATE OF ELECTRONIC TRANSMISSION

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

Date: 5-13-21

By: /Jennifer Smith/
Jennifer Smith

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
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/421,121	05/23/2019	Gregory G Raleigh	RALEP007C11C3C2C3C1C1	3747

106963 7590 01/22/2021

Headwater Research LLC
1011 Pruitt Place
Tyler, TX 75703



EXAMINER	
RUDY, ANDREW J	

ART UNIT	PAPER NUMBER
3687	

DATE MAILED: 01/22/2021

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 30 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.

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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. 16/421,121	Applicant(s) Raleigh, Gregory G	
	Examiner ANDREW JOSEPH RUDY	Art Unit 3687	AIA (FITF) 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 September 18, 2019 submissioin.
   ☐ 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 2-14 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

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

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

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

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

/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 May 23, 2019 are acceptable.

Priority

3. No foreign priority has been claimed by Applicant.

Claims

4. Applicant cancelled claim 1, while adding claims 2-14. Thus, claims 2-14 are pending.

5. Pertinent references are noted on the attached PTO-892.

6. Applicant's six (6) Information Disclosure Statements (IDS's) submitted have been reviewed. Note the attached IDS's.

Allowable Subject Matter

7. Pursuant to Applicant's September 17, 2020 Amendment, claims 2-14 are allowed.

8. The following is an examiner's statement of reasons for allowance: Claims 2-14 are allowed as all the cited prior art, either alone or in combination, does not disclose Applicant's inventive claim language.

Claims 2-14 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.

Claims 2-14 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."

9. 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, Eastern Standard Time.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan Uber, can be reached on 571-270-3923. 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
571-272-6789

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/421,121	05/23/2019	Gregory G Raleigh	RALEP007C11C3C2C3C1C1	3747

106963 7590 02/23/2021

Headwater Research LLC
1011 Pruitt Place
Tyler, TX 75703

EXAMINER	
RUDY, ANDREW J	

ART UNIT	PAPER NUMBER
3687	

NOTIFICATION DATE	DELIVERY MODE
02/23/2021	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

PTOL-90A (Rev. 04/07)

Notice of Allowability	Application No. 16/421,121	Applicant(s) Raleigh, Gregory G	
	Examiner ANDREW JOSEPH RUDY	Art Unit 3687	AIA (FITF) 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 September 18, 2019 submission.
   ☐ 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 2-14 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

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

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

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

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

/ANDREW JOSEPH RUDY/
Primary Examiner, Art Unit 3687

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2. Applicant's Drawings submitted May 23, 2019 are acceptable.

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3. No foreign priority has been claimed by Applicant.

Claims

4. Applicant cancelled claim 1, while adding claims 2-14. Thus, claims 2-14 are pending.

5. Pertinent references were noted from the previously attached PTO-892.

6. Applicant's six (6) Information Disclosure Statements (IDS's) submitted have been previously reviewed. However, one IDS was inadvertently not included from the previous Office Action. This one IDS is attached along with this Office Action.

Allowable Subject Matter

7. Pursuant to Applicant's September 18, 2019 Amendment, claims 2-14 are allowed. Examiner Rudy apologizes for the typo regarding the date issue noted from the previous Office Action.

8. The following is an examiner's statement of reasons for allowance: Claims 2-14 are allowed as all the cited prior art, either alone or in combination, does not disclose Applicant's inventive claim language.

Claims 2-14 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.

Claims 2-14 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."

9. 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, Eastern Standard Time.

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/ANDREW JOSEPH RUDY/
Primary Examiner
Art Unit 3687
571-272-6789

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16/421,121	AUTOMATED DEVICE PROVISIONING AND ACTIVATION	RALEP007C11C3C2C3C1C1

This application is officially maintained in electronic form. To View: Click the desired Document Description. To Download and Print: Check the desired document(s) and click either PDF, XML or DOCX.

Available Documents

Mail Room Date	Document Code	Document Description	Document Category	Page Count	PDF	XML	DOCX
05-11-2021	ABN	Abandonment	PROSECUTION	1	PDF		
02-23-2021	NOA	Notice of Allowance and Fees Due (PTOL-85)	PROSECUTION	5	PDF	XML	DOCX
02-23-2021	IIFW	Issue Information including classification, examiner, name, claim, renumbering, etc.	PROSECUTION	5	PDF		
02-23-2021	SRFW	Search information including classification, databases and other search related notes	PROSECUTION	3	PDF		
02-23-2021	1449	List of References cited by applicant and considered by examiner	PROSECUTION	20	PDF		
02-23-2021	OA.EMAIL	Email Notification	PROSECUTION	1	PDF		
01-22-2021	NOA	Notice of Allowance and Fees Due (PTOL-85)	PROSECUTION	8	PDF	XML	DOCX
01-22-2021	892	List of references cited by examiner	PROSECUTION	1	PDF		
01-22-2021	IIFW	Issue Information including classification, examiner, name, claim, renumbering, etc.	PROSECUTION	5	PDF		
01-22-2021	SRFW	Search information including classification, databases and other search related notes	PROSECUTION	3	PDF		
01-22-2021	SRNT	Examiner's search strategy and results	PROSECUTION	3	PDF		
01-22-2021	1449	List of References cited by applicant and considered by examiner	PROSECUTION	2	PDF		
01-22-2021	SRNT	Examiner's search strategy and results	PROSECUTION	1	PDF		
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01-22-2021	SRNT	Examiner's search strategy and results	PROSECUTION	9	PDF		
01-22-2021	BIB	Bibliographic Data Sheet	PROSECUTION	1	PDF		
01-22-2021	1449	List of References cited by applicant and considered by examiner	PROSECUTION	38	PDF		

01-22-2021	1449	List of References cited by applicant and considered by examiner	PROSECUTION	34	PDF
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08-10-2020	IDS	Information Disclosure Statement (IDS) Form (SB08)	PROSECUTION	4	PDF / XML
08-10-2020	NPL	Non Patent Literature	PROSECUTION	32	PDF
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09-20-2019	IDS	Information Disclosure Statement (IDS) Form (SB08)	PROSECUTION	40	PDF / XML
09-20-2019	IDS	Information Disclosure Statement (IDS) Form (SB08)	PROSECUTION	36	PDF / XML
09-20-2019	IDS	Information Disclosure Statement (IDS) Form (SB08)	PROSECUTION	31	PDF / XML
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09-18-2019	A.PE	Preliminary Amendment	PROSECUTION	1	PDF
09-18-2019	CLM	Claims	PROSECUTION	2	PDF / XML
09-18-2019	REM	Applicant Arguments/Remarks Made in an Amendment	PROSECUTION	1	PDF / XML
09-18-2019	WFEE	Fee Worksheet (SB06)	PROSECUTION	1	PDF
09-13-2019	OA.EMAIL	Email Notification	PROSECUTION	1	PDF
09-12-2019	NTC.PUB	Notice of Publication	PROSECUTION	1	PDF
06-03-2019	WFEE	Fee Worksheet (SB06)	PROSECUTION	1	PDF
06-03-2019	APP.FILE.REC	Filing Receipt	PROSECUTION	4	PDF
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05-23-2019	SPEC	Specification	PROSECUTION	240	PDF / XML
05-23-2019	CLM	Claims	PROSECUTION	1	PDF / XML
05-23-2019	ABST	Abstract	PROSECUTION	1	PDF / XML
05-23-2019	OATH	Oath or Declaration filed	PROSECUTION	1	PDF
05-23-2019	DRW	Drawings-only black and white line drawings	PROSECUTION	106	PDF
05-23-2019	ADS	Application Data Sheet	PROSECUTION	9	PDF
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- *If you experience technical difficulties or problems with PAIR outside normal Patent Electronic Business Center hours (M-F, 6AM to 12AM ET), please call 1 800-786-9199.*
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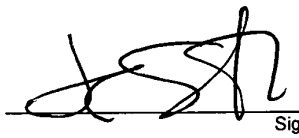
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   OR

3. ☐ EFS-Web transmitted to the USPTO.



Signature

5-13-21
Date

Jennifer Smith
Typed or printed name

903-201-6211
Telephone number

Note: Each paper must have its own certificate of mailing or transmission, or this certificate must identify each submitted paper:

Petition for Revival of an Application for Patent Abandonment Unintentionally Under 37 CFR 1.137(a)

Issue Fee Transmittal

Response to Notice of Abandonment

This collection of information is required by 37 CFR 1.8. The information is required to obtain or retain a benefit by the public, which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1.8 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

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PART B – FEE(S) TRANSMITTAL

Complete and send this form, together with the applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

By fax, send to: (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)

Headwater Research LLC
1011 Pruitt Place
Tyler, Texas 75703



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

Certificate of Mailing or Transmission

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

Jennifer Smith	(Typed or printed name)
	(Signature)
5-13-21	(Date)

APPLICATION NO	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO	CONFIRMATION NO
16/421,121	05/23/2019	Gregory G. Raleigh	RALEP007C11C3C2C3C1C1	3747

TITLE OF INVENTION: AUTOMATED DEVICE PROVISIONING AND ACTIVATION

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$600	$0	$0	$600	4/22/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
RUDY, ANDREW J.	3687	455-410000

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 03-09 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 must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE	(B) RESIDENCE: (CITY and STATE or COUNTRY)
HEADWATER RESEARCH LLC	TYLER, TEXAS

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

4a. Fees Submitted: ☑ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

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☑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 505878

5. Change of Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29. NOTE: Absent a valid Certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

☐ Applicant asserting small entity status. See 37 CFR 1.27. NOTE: If the application was previously under micro entity status, checking this box will be taken as a notification of loss of entitlement to micro entity status.

☐ Applicant changing to regular undiscounted fee status. NOTE: Checking this box will be taken as 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 May 13, 2021

Typed or printed name JAMES E. HARRIS Registration No. 40013

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Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

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106963 7590 01/22/2021
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Tyler, TX 75703



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(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/421,121	05/23/2019	Gregory G Raleigh	RALEP007C11C3C2C3C1C1	3747

TITLE OF INVENTION: AUTOMATED DEVICE PROVISIONING AND ACTIVATION

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
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EXAMINER	ART UNIT	CLASS-SUBCLASS
RUDY, ANDREW J	3687	455-410000

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 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
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2 _____
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3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

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

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

4a. Fees submitted: ❑ Issue Fee ❑ Publication Fee (if required) ❑ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

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. _____

PTOL-85 Part B (08-18) Approved for use through 01/31/2020 OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

UNITED STATES PATENT AND TRADEMARK OFFICE

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

NOTICE OF ALLOWANCE AND FEE(S) DUE

106963 7590 01/22/2021

Headwater Research LLC
1011 Pruitt Place
Tyler, TX 75703

OPAP AKIMA-B
MAY 19 2021
PATENT & TRADEMARK OFFICE

EXAMINER	
RUDY, ANDREW J	
ART UNIT	PAPER NUMBER
3687	

DATE MAILED: 01/22/2021

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/421,121	05/23/2019	Gregory G Raleigh	RALEP007C11C3C2C3C1C1	3747

TITLE OF INVENTION: AUTOMATED DEVICE PROVISIONING AND ACTIVATION

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$600	$0.00	$0.00	$600	04/22/2021

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: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/421,121	05/23/2019	Gregory G Raleigh	RALEP007C11C3C2C3C1C1	3747

7590 05/11/2021

Headwater Research LLC
1011 Pruitt Place
Tyler, TX 75703

EXAMINER	
RUDY, ANDREW J	

ART UNIT	PAPER NUMBER
3687	

NOTIFICATION DATE	DELIVERY MODE
05/11/2021	ELECTRONIC

Notice of Abandonment

This application is abandoned in view of:

1. ☐ The applicant's failure to timely file a proper reply to the Office letter mailed on _____.
   (a) ☐ A reply was received on _____ (with a Certificate of Mailing or Transmission date _____), which is after the expiration of the period for reply (including a total extension of _____ month(s)) which expired on _____.
   (b) ☑ No reply has been received.
2. ☑ Applicant's failure to timely pay the required issue fee and publication fee, if applicable, within the statutory period of three months from the mailing date of the Notice of Allowance (PTOL-85).
   (a) ☐ The issue fee and publication fee, if applicable, was received on _____ (with a Certificate of Mailing or Transmission date _____), which is after the expiration of the statutory period for payment of the issue fee (and publication fee) set in the Notice of Allowance (PTOL-85).
   (b) ☐ The submitted fee of $_____ is insufficient. A balance of $_____ is due.
   The issue fee required by 37 CFR 1.18 is $_____.
   The publication fee, if required by 37 CFR 1.18(d), is $_____.
   (c) ☑ The issue fee and publication fee, if applicable, has not been received.
3. ☐ Applicant's failure to timely file corrected drawings as required by, and within the three-month period set in, the Notice of Allowability (PTO-37).
   (a) ☐ Proposed corrected drawings were received on _____ (with a Certificate of Mailing or Transmission dated _____), which is after the expiration of the period for reply.
   (b) ☐ No corrected drawing have been received.
4. ☐ Applicant's failure to timely file the inventor's oath or declaration no later than the date on which the issue fee was paid as required by the Notice Requiring Inventor's Oath or Declaration (PTO-2306).
   (a) ☐ An inventor's oath or declaration was received on _____ (with a Certificate of Mailing or Transmission date _____), which is after the date on which the issue fee was paid.
   (b) ☐ While an oath or declaration (or substitute statement) for one or more inventors was received, an oath or declaration (or substitute statement) for at least one other inventor has not been received.
   (c) ☐ No inventor's oath or declaration has been received.
5. ☐ Drawings received on _____ were disapproved by examiner. See examiner's response dated _____.
6. ☐ Corrected drawings were received on _____ , which is after the expiration of the one-month period for reply set in examiner's response dated _____.
7. ☐ No corrected drawings have been received in reply to one-month period set in examiner's response dated _____.
8. ☐ The reason(s) below:

Petitions to revive under 37 CFR 1.137(a) or request to withdraw the holding of abandonment under 37 CFR 1.181, should be promptly filed to minimize any negative effects on patent term.

/ADL/

(571)-272-4200 or 1(888)-786-0101
Patent Publication Branch
Office of Data Management

FORM PTO-ABN0 (Rev. 03/17)

UNITED STATES PATENT AND TRADEMARK OFFICE

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United States Patent and Trademark Office
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/421,121	05/23/2019	Gregory G Raleigh	RALEP007C11C3C2C3C1C1	3747

106963 7590 02/23/2021

Headwater Research LLC
1011 Pruitt Place
Tyler, TX 75703

EXAMINER	
RUDY, ANDREW J	

ART UNIT	PAPER NUMBER
3687	

NOTIFICATION DATE	DELIVERY MODE
02/23/2021	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

Notice of Allowability	Application No. 16/421,121	Applicant(s) Raleigh, Gregory G	
	Examiner ANDREW JOSEPH RUDY	Art Unit 3687	AIA (FITF) 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 September 18, 2019 submission.
   ☐ 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 2-14 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

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

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

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

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

/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 May 23, 2019 are acceptable.

Priority

3. No foreign priority has been claimed by Applicant.

Claims

4. Applicant cancelled claim 1, while adding claims 2-14. Thus, claims 2-14 are pending.

5. Pertinent references were noted from the previously attached PTO-892.

6. Applicant's six (6) Information Disclosure Statements (IDS's) submitted have been previously reviewed. However, one IDS was inadvertently not included from the previous Office Action. This one IDS is attached along with this Office Action.

Allowable Subject Matter

7. Pursuant to Applicant's September 18, 2019 Amendment, claims 2-14 are allowed. Examiner Rudy apologizes for the typo regarding the date issue noted from the previous Office Action.

8. The following is an examiner's statement of reasons for allowance: Claims 2-14 are allowed as all the cited prior art, either alone or in combination, does not disclose Applicant's inventive claim language.

Claims 2-14 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.

Claims 2-14 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."

9. 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, Eastern Standard Time.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan Uber, can be reached on 571-270-3923. 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
571-272-6789

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/421,121	Raleigh, Gregory G
	Examiner	**Art Unit**
	ANDREW JOSEPH RUDY	3687

CPC						
Symbol					**Type**	**Version**
H04W	/	12	/	08	F	2013-01-01
G06Q	/	10	/	06375	I	2013-01-01
G06Q	/	20	/	102	I	2013-01-01
G06Q	/	20	/	20	I	2013-01-01
G06Q	/	20	/	40	I	2013-01-01
G06Q	/	30	/	0207	I	2013-01-01
G06Q	/	30	/	0283	I	2013-01-01
G06Q	/	30	/	0284	I	2013-01-01
G06Q	/	30	/	04	I	2013-01-01
G06Q	/	30	/	0601	I	2013-01-01
G06Q	/	40	/	00	I	2013-01-01
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H04L	/	41	/	0893	I	2013-01-01
H04M	/	15	/	00	I	2013-01-01
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H04L	/	67	/	26	I	2013-01-01
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H04W	/	4	/	50	I	2018-02-01
H04W	/	12	/	037	I	2021-01-01
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H04L	/	9	/	32	I	2013-01-01
H04L	/	63	/	10	I	2013-01-01
H04W	/	28	/	02	I	2013-01-01
H04L	/	47	/	2408	I	2013-01-01

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	14	
/ANDREW JOSEPH RUDY/ Primary Examiner, Art Unit 3687	17 February 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	20

U.S. Patent and Trademark Office — Part of Paper No.: 20210217

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	Examiner	**Art Unit**
	ANDREW JOSEPH RUDY	3687

CPC						
Symbol					**Type**	**Version**
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H04W	/	4	/	12	I	2013-01-01
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H04W	/	8	/	18	I	2013-01-01
H04W	/	72	/	0453	I	2013-01-01
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H04W	/	28	/	0215	I	2013-01-01
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H04L	/	41	/	0806	I	2013-01-01
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H04L	/	63	/	0892	I	2013-01-01
H04L	/	67	/	145	I	2013-01-01
H04W	/	12	/	06	I	2013-01-01
H04L	/	63	/	0853	I	2013-01-01

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	14	
/ANDREW JOSEPH RUDY/ Primary Examiner, Art Unit 3687	17 February 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	20

U.S. Patent and Trademark Office — Part of Paper No.: 20210217

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	ANDREW JOSEPH RUDY	3687

CPC						
Symbol					Type	Version
H04W	/	48	/	16	I	2013-01-01
H04L	/	41	/	5025	A	2013-01-01
H04M	/	2215	/	0188	A	2013-01-01
H04L	/	67	/	34	A	2013-01-01
H04L	/	67	/	2819	A	2013-01-01
H04W	/	8	/	02	A	2013-01-01
Y02P	/	90	/	80	A	2015-11-01
H04W	/	84	/	04	A	2013-01-01
H04W	/	84	/	12	A	2013-01-01
H04W	/	88	/	06	A	2013-01-01
H04W	/	84	/	042	A	2013-01-01
H04L	/	41	/	0876	A	2013-01-01

CPC Combination Sets							
Symbol					Type	Set	Ranking	Version
	/		/					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	14	
/ANDREW JOSEPH RUDY/ Primary Examiner, Art Unit 3687	17 February 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	20

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INTERNATIONAL CLASSIFICATION				
CLAIMED				
H04W	/	12	/	08

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**
455	410

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

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	14	
/ANDREW JOSEPH RUDY/ Primary Examiner, Art Unit 3687	17 February 2021	O.G. Print Claim(s)	O.G. Print Figure
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	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	11	11												
3	3	12	12												
4	4	2	13												
5	5	13	14												
6	6														
7	7														
8	8														
9	9														
10	10														

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	14	
/ANDREW JOSEPH RUDY/ Primary Examiner, Art Unit 3687	17 February 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	20

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Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/421,121	Raleigh, Gregory G
	Examiner	Art Unit
	ANDREW J RUDY	3687

CPC - Searched*		
Symbol	**Date**	**Examiner**
H04W12/08;28/02;;12/00;4/50;48/16;12/06;72/04;8/18;4/12;12/813;24/08;88/08;48/14;28/12;4/24;8/20;24/08;28/0268;72/0453;84/04;8/20;12/0017;84/12;8/18;48/16;88/08;28/12;8/02;84/042;12/06;12/00;88/06;4/50;4/18;4/20;28/02;4/12;12/02;28/0215;4/02;12/0027;12/08;28/02;12/00;48/14	01/13/2021	AJR
G06Q030/02;10/06;20/10;20/20;20/40;30/04;30/06;40/00;30/0283;40/12;30/0241;10/06315;30/0601;40/00;10/06375;30/0207;30/0284;20/32;20/40;30/04;20/102;30/02	01/13/2021	AJR
G06F015/177	01/13/2021	AJR
H04M015/00;2215/0188;15/58;15/88;15/80;15/00;15/61;2215/0188	01/13/2021	AJR
H04L51/046;67/306;67/2819;63/20;41/0876;67/26;63/08;67/327;63/04;41/5054;63/0428;12/14;41/5003;47/20;63/10;41/5025;63/0853;67/145;41/0806;47/2408;67/34;9/32;41/0893;9/3247;63/0236;63/0892;9/32;29/08;29/06;12/24;12/813;12/58;12/851	01/13/2021	AJR
Y02P90/80	01/13/2021	AJR
Above reviewed.	02/17/2021	AJR

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**
370	252-254	01/13/2021	AJR
455	405,406,414.1,432.1,456.1	01/13/2021	AJR
705	28, 30	01/13/2021	AJR
Above	reviewed.	02/17/2021	AJR

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

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/421,121	Raleigh, Gregory G
	Examiner	Art Unit
	ANDREW J RUDY	3687

Search Notes		
Search Notes	**Date**	**Examiner**
Continuity data reviewed.	01/04/2021	AJR
Inventor name search conducted.	01/04/2021	AJR
IP.com searched:	01/13/2021	AJR
Bibliographic data updated.	01/13/2021	AJR
IP.com searched: "(((wireless adj wide adj area adj network) or wwan) same ((first or initial) near5 service near5 profile) same ((second or plural) near5 service near5 profile) same modem same (first near5 wireless near5 network) same (second near5 wireless near5 network) same policy)" "(((first or initial) near5 service) near5 profile) same (((second or plural) near5 service) near5 profile) same ((first near5 wireless) near5 network) same ((second near5 wireless) near5 network)" "(((first or initial) near5 service) near5 profile) same (((second or plural) near5 service) near5 profile) same ((first near5 wireless) near5 network) same ((second near5 wireless) near5 network) same policy same modem"	01/13/2021	AJR
East search attached.	01/14/2021	AJR
Above reviewed.	02/17/2021	AJR

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/421,121	Raleigh, Gregory G
	Examiner	Art Unit
	ANDREW J RUDY	3687

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**
H04W	12/08;28/02;;12/00;4/50;48/16;12/06;72/04;8/18;4/12;12/813;24/08;88/08;48/14;28/12;4/24;8/20;24/08;28/0268;72/0453;84/04;8/20;12/0017;84/12;8/18;48/16;88/08;28/12;8/02;84/042;12/06;12/00;88/06;4/50;4/18;4/20;28/02;4/12;12/02;28/0215;4/02;12/0027;12/08;28/02;12/00;48/14	01/13/2021	AJR
G06Q	030/02;10/06;20/10;20/20;20/40;30/04;30/06;40/00;30/0283;40/12;30/0241;10/06315;30/0601;40/00;10/06375;30/0207;30/0284;20/32;20/40;30/04;20/102;30/02	01/13/2021	AJR
G06F	015/177	01/13/2021	AJR
H04M	015/00;2215/0188;15/58;15/88;15/80;15/00;15/61;2215/0188	01/13/2021	AJR
H04L	51/046;67/306;67/2819;63/20;41/0876;67/26;63/08;67/327;63/04;41/5054;63/0428;12/14;41/5003;47/20;63/10;41/5025;63/0853;67/145;41/0806;47/2408;67/34;9/32;41/0893;9/3247;63/0236;63/0892;9/32;29/08;29/06;12/24;12/813;12/58;12/851	01/13/2021	AJR
Y02P	90/80	01/13/2021	AJR
370	252-254	01/13/2021	AJR
455	405,406,414.1,432.1,456.1	01/13/2021	AJR
705	28,30	01/13/2021	AJR
Above	reviewed.	02/17/2021	AJR

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
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Examiner Name	ANDREW J. RUDY
Attorney Docket Number	RALEP007C11C3C2C1C1

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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	3	8352980		2013-01-08	Howcroft, Jerald Robert	
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	Art Unit	3687
	Examiner Name	ANDREW J. RUDY
	Attorney Docket Number	RALEP007C11C3C2C1C1

	185	9111088	B2	2015-08-18	Ghai et al.	
	186	9137286	B1	2015-09-15	Yuan	
	187	9172553	B2	2015-10-27	Dawes et al.	
	188	9262370	B2	2016-02-16	Hofstaedter et al.	
	189	9286469	B2	2016-03-15	Kraemer et al.	
	190	9286604	B2	2016-03-15	Aabye et al.	
	191	9313708	B2	2016-04-12	Nam et al.	
	192	9325737	B2	2016-04-26	Gutowski et al.	
	193	9326173	B2	2016-04-26	Luft, Achim	
	194	9344557	B2	2016-05-17	Gruchala et al.	
	195	9363285	B2	2016-06-07	Kitamura	

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	16421121
	Filing Date	2019-05-23
	First Named Inventor	GREGORY G. RALEIGH
	Art Unit	3687
	Examiner Name	ANDREW J. RUDY
	Attorney Docket Number	RALEP007C11C3C2C1C1

	196	9367680	B2	2016-06-14	Mahaffey et al.	
	197	9413546	B2	2016-08-09	Meier et al.	
	198	9418381	B2	2016-08-16	Ahuja et al.	
	199	9501803	B2	2016-11-22	Bilac et al.	
	200	9589117	B2	2017-03-07	Ali et al.	
	201	9615192	B2	2017-04-04	Raleigh	
	202	RE44412		2013-08-06	Naqvi et al.	

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

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

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16421121
	Filing Date	2019-05-23
	First Named Inventor	GREGORY G. RALEIGH
	Art Unit	3687
	Examiner Name	ANDREW J. RUDY
	Attorney Docket Number	RALEP007C11C3C2C1C1

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							

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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.	T[5]
	1		

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EXAMINER SIGNATURE

Examiner Signature	/ANDREW JOSEPH RUDY/	Date Considered	01/12/2021

*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.

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

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 01/22/2021

Headwater Research LLC
1011 Pruitt Place
Tyler, TX 75703

EXAMINER
RUDY, ANDREW J

ART UNIT	PAPER NUMBER
3687	

DATE MAILED: 01/22/2021

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/421,121	05/23/2019	Gregory G Raleigh	RALEP007C11C3C2C3C1C1	3747

TITLE OF INVENTION: AUTOMATED DEVICE PROVISIONING AND ACTIVATION

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$600	$0.00	$0.00	$600	04/22/2021

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: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (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 01/22/2021
Headwater Research LLC
1011 Pruitt Place
Tyler, TX 75703

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

Certificate of Mailing or Transmission

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

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/421,121	05/23/2019	Gregory G Raleigh	RALEP007C11C3C2C3C1C1	3747

TITLE OF INVENTION: AUTOMATED DEVICE PROVISIONING AND ACTIVATION

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$600	$0.00	$0.00	$600	04/22/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
RUDY, ANDREW J	3687	455-410000

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 03-09 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 must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). 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. Fees submitted: ❑ Issue Fee ❑ Publication Fee (if required) ❑ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

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. _____

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UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/421,121	05/23/2019	Gregory G Raleigh	RALEP007C11C3C2C3C1C1	3747

106963 7590 01/22/2021

Headwater Research LLC
1011 Pruitt Place
Tyler, TX 75703

EXAMINER	
RUDY, ANDREW J	

ART UNIT	PAPER NUMBER
3687	

DATE MAILED: 01/22/2021

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 30 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. 16/421,121	Applicant(s) Raleigh, Gregory G	
	Examiner ANDREW JOSEPH RUDY	Art Unit 3687	AIA (FITF) 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 September 18, 2019 submissioin.
   ☐ 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 2-14 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

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

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

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

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

/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 May 23, 2019 are acceptable.

Priority

3. No foreign priority has been claimed by Applicant.

Claims

4. Applicant cancelled claim 1, while adding claims 2-14. Thus, claims 2-14 are pending.

5. Pertinent references are noted on the attached PTO-892.

6. Applicant's six (6) Information Disclosure Statements (IDS's) submitted have been reviewed. Note the attached IDS's.

Allowable Subject Matter

7. Pursuant to Applicant's September 17, 2020 Amendment, claims 2-14 are allowed.

8. The following is an examiner's statement of reasons for allowance: Claims 2-14 are allowed as all the cited prior art, either alone or in combination, does not disclose Applicant's inventive claim language.

Claims 2-14 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.

Claims 2-14 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."

9. 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, Eastern Standard Time.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan Uber, can be reached on 571-270-3923. 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
571-272-6789

Notice of References Cited	Application/Control No. 16/421,121	Applicant(s)/Patent Under Reexamination Raleigh, Gregory G	
	Examiner ANDREW JOSEPH RUDY	Art Unit 3687	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-7171199-B1	01-2007	Rahman; Mohamed Anisur	H04W8/02	455/411
*	B	US-8185127-B1	05-2012	Cai; Zheng	H04W28/18	455/452.2
*	C	US-9516456-B2	12-2016	Stephens; Spencer	H04L29/08846	1/1
*	D	US-10027819-B2	07-2018	Lu; Tingting	G06Q10/1091	1/1
	E					
	F					
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	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/421,121	Raleigh, Gregory G
	Examiner	**Art Unit**
	ANDREW JOSEPH RUDY	3687

CPC						
Symbol					**Type**	**Version**
H04W	/	12	/	08	F	2013-01-01
G06Q	/	10	/	06375	I	2013-01-01
G06Q	/	20	/	102	I	2013-01-01
G06Q	/	20	/	20	I	2013-01-01
G06Q	/	20	/	40	I	2013-01-01
G06Q	/	30	/	0207	I	2013-01-01
G06Q	/	30	/	0283	I	2013-01-01
G06Q	/	30	/	0284	I	2013-01-01
G06Q	/	30	/	04	I	2013-01-01
G06Q	/	30	/	0601	I	2013-01-01
G06Q	/	40	/	00	I	2013-01-01
H04L	/	12	/	14	I	2013-01-01
H04L	/	41	/	0893	I	2013-01-01
H04M	/	15	/	00	I	2013-01-01
H04M	/	15	/	58	I	2013-01-01
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H04W	/	28	/	02	I	2013-01-01
H04L	/	47	/	2408	I	2013-01-01

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	14	
/ANDREW JOSEPH RUDY/ Primary Examiner, Art Unit 3687	14 January 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	20

U.S. Patent and Trademark Office — Part of Paper No.: 20210114

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/421,121	Raleigh, Gregory G
	Examiner	**Art Unit**
	ANDREW JOSEPH RUDY	3687

CPC						
Symbol					**Type**	**Version**
H04L	/	63	/	08	I	2013-01-01
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H04W	/	48	/	14	I	2013-01-01
H04W	/	4	/	20	I	2013-01-01
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H04L	/	9	/	3247	I	2013-01-01
H04L	/	63	/	0892	I	2013-01-01
H04L	/	67	/	145	I	2013-01-01
H04W	/	12	/	06	I	2013-01-01
H04L	/	63	/	0853	I	2013-01-01

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	14	
/ANDREW JOSEPH RUDY/ Primary Examiner, Art Unit 3687	14 January 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	20

U.S. Patent and Trademark Office — Part of Paper No.: 20210114

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	16/421,121	Raleigh, Gregory G
	Examiner	**Art Unit**
	ANDREW JOSEPH RUDY	3687

CPC						
Symbol					**Type**	**Version**
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Y02P	/	90	/	80	A	2015-11-01
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H04W	/	88	/	06	A	2013-01-01
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CPC Combination Sets								
Symbol					**Type**	**Set**	**Ranking**	**Version**
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NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	14	
/ANDREW JOSEPH RUDY/ Primary Examiner, Art Unit 3687	14 January 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	20

U.S. Patent and Trademark Office — Part of Paper No.: 20210114

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/421,121	Raleigh, Gregory G
	Examiner	**Art Unit**
	ANDREW JOSEPH RUDY	3687

INTERNATIONAL CLASSIFICATION				
CLAIMED				
H04W	/	12	/	08

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**
455	410

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

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	14	
/ANDREW JOSEPH RUDY/ Primary Examiner, Art Unit 3687	14 January 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	20

U.S. Patent and Trademark Office — Part of Paper No.: 20210114

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/421,121	Raleigh, Gregory G
	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	11	11												
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NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	14	
/ANDREW JOSEPH RUDY/ Primary Examiner, Art Unit 3687	14 January 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	20

U.S. Patent and Trademark Office Part of Paper No.: 20210114

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/421,121	Raleigh, Gregory G
	Examiner	Art Unit
	ANDREW JOSEPH RUDY	3687

CPC - Searched*		
Symbol	**Date**	**Examiner**
H04W12/08;28/02;;12/00;4/50;48/16;12/06;72/04;8/18;4/12;12/813;24/08;88/08;48/14;28/12;4/24;8/20;24/08;28/0268;72/0453;84/04;8/20;12/0017;84/12;8/18;48/16;88/08;28/12;8/02;84/042;12/06;12/00;88/06;4/50;4/18;4/20;28/02;4/12;12/02;28/0215;4/02;12/0027;12/08;28/02;12/00;48/14	01/13/2021	AJR
G06Q030/02;10/06;20/10;20/20;20/40;30/04;30/06;40/00;30/0283;40/12;30/0241;10/06315;30/0601;40/00;10/06375;30/0207;30/0284;20/32;20/40;30/04;20/102;30/02	01/13/2021	AJR
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H04L51/046;67/306;67/2819;63/20;41/0876;67/26;63/08;67/327;63/04;41/5054;63/0428;12/14;41/5003;47/20;63/10;41/5025;63/0853;67/145;41/0806;47/2408;67/34;9/32;41/0893;9/3247;63/0236;63/0892;9/32;29/08;29/06;12/24;12/813;12/58;12/851	01/13/2021	AJR
Y02P90/80	01/13/2021	AJR

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**
370	252-254	01/13/2021	AJR
455	405,406,414.1,432.1,456.1	01/13/2021	AJR
705	28, 30	01/13/2021	AJR

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

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/421,121	Raleigh, Gregory G
	Examiner	Art Unit
	ANDREW JOSEPH RUDY	3687

Search Notes		
Search Notes	**Date**	**Examiner**
Continuity data reviewed.	01/04/2021	AJR
Inventor name search conducted.	01/04/2021	AJR
IP.com searched:	01/13/2021	AJR
Bibliographic data updated.	01/13/2021	AJR
IP.com searched: "(((wireless adj wide adj area adj network) or wwan) same ((first or initial) near5 service near5 profile) same ((second or plural) near5 service near5 profile) same modem same (first near5 wireless near5 network) same (second near5 wireless near5 network) same policy)" "(((first or initial) near5 service) near5 profile) same (((second or plural) near5 service) near5 profile) same ((first near5 wireless) near5 network) same ((second near5 wireless) near5 network)" "(((first or initial) near5 service) near5 profile) same (((second or plural) near5 service) near5 profile) same ((first near5 wireless) near5 network) same ((second near5 wireless) near5 network) same policy same modem"	01/13/2021	AJR
East search attached.	01/14/2021	AJR

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/421,121	Raleigh, Gregory G
	Examiner	Art Unit
	ANDREW JOSEPH RUDY	3687

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**
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455	405,406,414.1,432.1,456.1	01/13/2021	AJR
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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
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PTO/SB/08a (02-18)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16421121
Filing Date	2019-05-23
First Named Inventor	RALEIGH, GREGORY
Art Unit	3687
Examiner Name	UBER, NATHAN
Attorney Docket Number	RALEP007C11C3C2C3C1C1

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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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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	16421121
	Filing Date	2019-05-23
	First Named Inventor	RALEIGH, GREGORY
	Art Unit	3687
	Examiner Name	UBER, NATHAN
	Attorney Docket Number	RALEP007C11C3C2C3C1C1

/A.J.R./	1	BYRD, "Open Secure Wireless," May 5, 2010	
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/A.J.R./	3	SHARKEY, "Coding for Life--Battery Life, That Is," May 27, 2009	

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EXAMINER SIGNATURE

Examiner Signature	/ANDREW. /JOSEPH RUDY/	Date Considered	01/12/2021

*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.

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

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
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L22	0	(((wireless adj wide adj area adj network) or wwan) same ((first or initial) near5 service near5 profile) same ((second or plural) near5 service near5 profile) same modem same (first near5 wireless near5 network) same (second near5 wireless near5 network) same policy)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/01/12 17:08
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16421121
Filing Date	2019-05-23
First Named Inventor	GREGORY G. RALEIGH
Art Unit	3687
Examiner Name	ANDREW J. RUDY
Attorney Docket Number	RALEP007C11C3C2C3C1C1

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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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	2	6967958		2005-11-22	ONO, Yoshiyuki et al.	
	3	6970692	B2	2005-11-29	Tysor, Arthur James	
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	9	6996393		2006-02-07	Pyhalammi, Seppo et al.	
	10	6998985		2006-02-14	REISMAN et al.	
	11	7002920		2006-02-21	Ayyagari, Deepak et al.	
	12	7007295	B1	2006-02-28	Rose et al.	
	13	7013469	B2	2006-03-14	Smith et al.	
	14	7017189	B1	2006-03-21	DeMello et al.	
	15	7024200		2006-04-04	McKENNA et al.	
	16	7024460	B2	2006-04-04	Koopmas et al.	
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	20	7032072	B1	2006-04-18	Quinn et al.	
	21	7039027	B2	2006-05-02	Bridgelall, Raj	
	22	7039037		2006-05-02	Wang, Jiwei R. et al.	
	23	7039403		2006-05-02	Wong, Gregory A.	
	24	7039713	B1	2006-05-02	Van Gunter, David et al.	
	25	7042988		2006-05-09	JUITT et al.	
	26	7043225	B1	2006-05-09	Patel et al.	
	27	7043226		2006-05-09	Yamauchi, Toshiaki	
	28	7043268	B2	2006-05-09	Yukie et al.	
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	31	7058968		2006-06-06	ROWLAND et al.	
	32	7068600		2006-06-27	CAIN, Joseph Bibb	
	33	7069248		2006-06-27	HUBER, Adriano	
	34	7082422	B1	2006-07-25	Zirngibl et al.	
	35	7084775	B1	2006-08-01	Smith, Michael R.	
	36	7092696		2006-08-15	HOSAIN et al.	
	37	7095754	B2	2006-08-22	Benveniste, Mathilde	
	38	7102620	B2	2006-09-05	Harries, Andrew Stanely Guy et al.	
	39	7110753	B2	2006-09-19	Campen, Kenneth Brian	
	40	7113780	B2	2006-09-26	Mckenna Daniel et al.	
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	42	7120133	B1	2006-10-10	Joo et al.	
	43	7133386	B2	2006-11-07	Holur et al.	
	44	7133695	B2	2006-11-07	Beyda, William J.	
	45	7136361	B2	2006-11-14	Benveniste, Mathilde	
	46	7139569	B2	2006-11-21	Kato, Akira	
	47	7142876		2006-11-28	TROSSEN et al.	
	48	7149229	B1	2006-12-12	Leung, Kent K.	
	49	7149521	B2	2006-12-12	Sundar et al.	
	50	7151764	B1	2006-12-19	Heinonen et al.	
	51	7158792		2007-01-02	COOK et al.	
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	53	7165040	B2	2007-01-16	Ehrman et al.	
	54	7167078		2007-01-23	POURCHOT, Shawn C.	
	55	7174156	B1	2007-02-06	Mangal, Manish	
	56	7174174		2007-02-06	BORIS et al.	
	57	7177919	B1	2007-02-13	Truong et al.	
	58	7180855		2007-02-20	LIN , Wei	
	59	7181017		2007-02-20	Nagel, Robert H. et al.	
	60	7191248	B2	2007-03-13	Chattopadhyay et al.	
	61	7197321		2007-03-27	ERSKINE et al.	
	62	7200112	B2	2007-04-03	Sundar et al.	
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	64	7203169	B1	2007-04-10	Okholm, Jon et al.	
	65	7203721	B1	2007-04-10	Ben-Efraim et al.	
	66	7203752	B2	2007-04-10	Rice et al.	
	67	7212491		2007-05-01	Koga, Takahiro	
	68	7219123	B1	2007-05-15	Fiechter et al.	
	69	7222190	B2	2007-05-22	Klinker et al.	
	70	7222304	B2	2007-05-22	Beaton et al.	
	71	7224968	B2	2007-05-29	Dobson et al.	
	72	7228354		2007-06-05	CHAMBLISS, David Darden et al.	
	73	7236780		2007-06-26	Benco, David S.	
	74	7242668	B2	2007-07-10	Kan et al.	

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	76	7245901		2007-07-17	McGREGOR et al.	
	77	7248570	B2	2007-07-24	Bahl et al.	
	78	7251218		2007-07-31	Jorgensen, Jacob W.	
	79	7260382	B1	2007-08-21	Lamb et al.	
	80	7266371	B1	2007-09-04	Amin et al.	
	81	7269157	B2	2007-09-11	Klinker et al.	
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	83	7272660	B1	2007-09-18	Powers et al.	
	84	7280816		2007-10-09	FRATTI et al.	
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	86	7283561		2007-10-16	Picher-Dempsey, Heidi	
	87	7283963		2007-10-16	FITZPATRICK, John E. et al.	
	88	7286834	B2	2007-10-23	Walter	
	89	7286848	B2	2007-10-23	Vireday, Richard P. et al.	
	90	7289489		2007-10-30	KUNG et al.	
	91	7290283		2007-10-30	COPELAND III, John A.	
	92	7310424		2007-12-18	Gehring, Stephan Walter et al.	
	93	7313237	B2	2007-12-25	Bahl, Paramvir et al.	
	94	7315892	B2	2008-01-01	Freimuth et al.	
	95	7317699		2008-01-08	GODFREY et al.	
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	97	7320029	B2	2008-01-15	Rinne et al.	
	98	7322044		2008-01-22	HRASTAR, Scott E.	
	99	7324447		2008-01-29	MORFORD, Michael Robert	
	100	7325037		2008-01-29	LAWSON, Karen L.	
	101	7336960		2008-02-26	ZAVALKOVSKY et al.	
	102	7340772	B2	2008-03-04	Panasyuk et al.	
	103	7346410		2008-03-18	UCHIYAMA, Kenji	
	104	7349695		2008-03-25	OOMMEN et al.	
	105	7353533		2008-04-01	WRIGHT et al.	
	106	7356011		2008-04-08	Waters, Christopher J.F. et al.	
	107	7356337		2008-04-08	FLORENCE, Shahar	

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	108	7366497		2008-04-29	NAGATA, Hideaki	
	109	7366654	B2	2008-04-29	Moore, Robert C.	
	110	7369848	B2	2008-05-06	Jiang, Yue Jun	
	111	7369856	B2	2008-05-06	Ovadia, Shlomo	
	112	7373136		2008-05-13	WATLER et al.	
	113	7373179		2008-05-13	Stine, Ted et al.	
	114	7379731	B2	2008-05-27	Natsuno et al.	
	115	7388950		2008-06-17	ELSEY et al.	
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	119	7401338		2008-07-15	BOWEN et al.	
	120	7403763		2008-07-22	MAES, Stephane H.	
	121	7409447	B	2008-08-05	Assadzadeh, Alireza	
	122	7409569	B2	2008-08-05	Illowsky et al.	
	123	7411930	B2	2008-08-12	Montojo et al.	
	124	7418253		2008-08-26	KAVANAH, Alan	
	125	7418257		2008-08-26	Kim, Myong-Ju	
	126	7421004		2008-09-02	FEHER, Kamilo	
	127	7423971	B1	2008-09-09	Mohaban et al.	
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	129	7433362	B2	2008-10-07	Mallya et al.	

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	130	7436816	B2	2008-10-14	Mehta et al.	
	131	7440433	B2	2008-10-21	Rink et al.	
	132	7444669	B1	2008-10-28	Bahl, Paramvir et al.	
	133	7450591		2008-11-11	KORLING et al.	
	134	7450927		2008-11-11	CRESWELL et al.	
	135	7454191	B2	2008-11-18	Dawson et al.	
	136	7457265		2008-11-25	Julka, Vibhor et al.	
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	138	7460837	B2	2008-12-02	Diener, Neil R.	
	139	7466652	B2	2008-12-16	Lau et al.	
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	141	7472189		2008-12-30	Mallya, Arvind R. et al.	
	142	7478420	B2	2009-01-13	Wright, Michael et al.	
	143	7486185		2009-02-03	CULPEPPER et al.	
	144	7486658	B2	2009-02-03	Kumar, Rajneesh	
	145	7493659	B1	2009-02-17	Wu, Handong et al.	
	146	7496652		2009-02-24	Pezzutti, David	
	147	7499438		2009-03-03	Hinman, Brian L. et al.	
	148	7499537		2009-03-03	ELSEY et al.	
	149	7502672	B1	2009-03-10	Kolls, H. Brock	
	150	7505756	B2	2009-03-17	Bahl	
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	152	7508799	B2	2009-03-24	Sumner et al.	
	153	7512128	B2	2009-03-31	DiMambro et al.	
	154	7512131	B2	2009-03-31	Svensson et al.	
	155	7515608		2009-04-07	Yuan, Yuan et al.	
	156	7515926	B2	2009-04-07	Bu et al.	
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	158	7522549	B2	2009-04-21	Karaoguz et al.	
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	160	7526541	B2	2009-04-28	Roese et al.	
	161	7529204	B2	2009-05-05	Bourlas, Yair et al.	
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	163	7536695	B2	2009-05-19	Alam et al.	
	164	7539132	B2	2009-05-26	Werner et al.	
	165	7539862	B2	2009-05-26	Edgett et al.	
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	169	7546629		2009-06-09	ALBERT, Anthony et al.	
	170	7548875	B2	2009-06-16	Mikkelsen et al.	
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	174	7554983	B1	2009-06-30	Muppala, Suresh	
	175	7555757	B2	2009-06-30	Smith et al.	
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	178	7564799	B2	2009-07-21	Holland et al.	
	179	7565141		2009-07-21	Macaluso, Anthony G.	
	180	7574509	B2	2009-08-11	Nixon et al.	
	181	7574731		2009-08-11	FASCENDA, Anthony C.	
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	187	7586871	B2	2009-09-08	Hamilton et al.	
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	189	7593730	B2	2009-09-22	Khandelwal, Deepak et al.	
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	191	7599288		2009-10-06	COLE, Raymond E. et al.	
	192	7599714	B2	2009-10-06	Kuzminskiy, Alexandr	
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	198	7610047	B2	2009-10-27	Hicks III et al.	
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	202	7614051	B	2009-11-03	Glaum et al.	
	203	7616962	B2	2009-11-10	Oswal, Anand K. et al.	
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	208	7620383	B2	2009-11-17	Taglienti et al.	
	209	7627314		2009-12-01	Carlson, Steven I. et al.	
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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	16421121
	Filing Date	2019-05-23
	First Named Inventor	GREGORY G. RALEIGH
	Art Unit	3687
	Examiner Name	ANDREW J. RUDY
	Attorney Docket Number	RALEP007C11C3C2C3C1C1

	229	7668176		2010-02-23	Chuah, Mooi Choo	
	230	7668612	B	2010-02-23	Okkonen, Harri	
	231	7668903		2010-02-23	EDWARDS et al.	
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	236	7684370	B2	2010-03-23	Kezys, Vytautas Robertas	
	237	7685131		2010-03-23	Batra, Vishal Singh et al.	
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	240	7688792	B2	2010-03-30	Babbar et al.	
	241	7693107	B2	2010-04-06	De Froment, Eric	
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	251	7720960	B2	2010-05-18	Pruss, Richard Manfred et al.	
	252	7721296	B2	2010-05-18	Ricagni, Giuseppe	
	253	7724716	B2	2010-05-25	Fadell, Anthony M.	
	254	7725570		2010-05-25	Lewis, Lundy	
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	Attorney Docket Number	RALEP007C11C3C2C3C1C1

	262	7747730		2010-06-29	HARLOW, James D.	
	263	7752330	B2	2010-07-06	Olsen et al.	
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	279	7792538		2010-09-07	Kozisek, Steven E.	
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	281	7797019	B2	2010-09-14	Friedmann	
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	Examiner Name	ANDREW J. RUDY
	Attorney Docket Number	RALEP007C11C3C2C3C1C1

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	Attorney Docket Number	RALEP007C11C3C2C3C1C1

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	166,082	H04W12/08;28/02;;12/00;4/50;48/16;12/06;72/04;8/18;4/12;12/813;24/08;88/08;48/14;28/12;4/24;8/20.cpc. or G06Q030/02;10/06;20/10;20/20;20/40;30/04;30/06;40/00.cpc. or G06F015/177.cpc. or H04L9/32;29/08;29/06;12/24;12/813;12/58;12/851.cpc. or H04M015/00.cpc. and 709/217-223.ccls. or 705/28,30.ccls. or 455/405,406,414.1,432.1,456.1.ccls. or 370/252-254.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/01/12 16:46
L2	259,108	H04W12/08;28/02;;12/00;4/50;48/16;12/06;72/04;8/18;4/12;12/813;24/08;88/08;48/14;28/12;4/24;8/20.cpc. or G06Q030/02;10/06;20/10;20/20;20/40;30/04;30/06;40/00.cpc. or G06F015/177.cpc. or H04L9/32;29/08;29/06;12/24;12/813;12/58;12/851.cpc. or H04M015/00.cpc. or 709/217-223.ccls. or 705/28,30.ccls. or 455/405,406,414.1,432.1,456.1.ccls. or 370/252-254.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DE	OR	OFF	2021/01/12 16:46

			RWENT; IBM_TDB			
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L4	349,150	1 or 2 or 3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/01/12 16:47

L5	0	4 and ((wireless adj wide adj area adj network) or wwan) same ((first or initial) near5 service near5 profile) same ((second or plural) near5 service near5 profile) same modem same (first near5 wireless near5 network) same (second near5 wireless near5 network) same policy	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/01/12 16:52
L6	0	4 and (((wireless adj wide adj area adj network) or wwan) same ((first or initial) near5 service near5 profile) same ((second or plural) near5 service near5 profile) same modem same (first near5 wireless near5 network) same (second near5 wireless near5 network) same policy)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/01/12 16:53
L7	0	4 and (((wireless adj wide adj area adj network) or wwan) same ((first or initial) near5 service near5 profile) same ((second or plural) near5 service near5 profile) same (first near5 wireless near5 network) same (second near5 wireless near5 network) same policy)	US-PGPUB; USPAT	OR	ON	2021/01/12 16:53

			; US OCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
L8	0	4 and (((wireless adj wide adj area adj network) or wwan) same (service near5 profile) same ((second or plural) near5 service near5 profile) same (first near5 wireless near5 network) same (second near5 wireless near5 network) same policy)	US-PGPUB; USPAT; US OCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/01/12 16:54
L9	0	4 and (((wireless adj wide adj area adj network) or wwan) same (service near5 profile) same ((second or plural) near5 service near5 profile) same (wireless near5 network) same policy)	US-PGPUB; USPAT; US OCR; FPRS;	OR	ON	2021/01/12 16:55

			EPO; JPO; DERWENT; IBM_TDB			
L10	0	4 and ((first or initial) near5 service near5 profile) same ((second or plural) near5 service near5 profile) same modem same (first near5 wireless near5 network) same (second near5 wireless near5 network) same policy	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/01/12 16:55
L11	0	4 and (((first or initial) near5 service) near5 profile) same (((second or plural) near5 service) near5 profile) same modem same ((first near5 wireless) near5 network) same ((second near5 wireless) near5 network) same policy	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERW	OR	ON	2021/01/12 16:57

			EN T; IBM _T DB			
L12	0	4 and (((first or initial) near5 service) near5 profile) same (((second or plural) near5 service) near5 profile) same ((first near5 wireless) near5 network) same ((second near5 wireless) near5 network) same policy	US-PG PU B; US PAT ; US OC R; FPR S; EP O; JPO ; DE RW EN T; IBM _T DB	OR	ON	2021/01/12 16:57
L14	120,002	H04W12/08;28/02;;12/00;4/50;48/16;12/06;72/04;8/18;4/12;12/813;24/08;88/08;48/14;28/12;4/24;8/20.cpc. or G06Q030/02;10/06;20/10;20/20;20/40;30/04;30/06;40/00.cpc. or G06F015/177.cpc. or H04L9/32;29/08;29/06;12/24;12/813;12/58;12/851.cpc. or H04M015/00.cpc. and 709/217-223.ccls. or 705/28,30.ccls. or 455/405,406,414.1,432.1,456.1.ccls. or 370/252-254.ccls. and (((wireless adj wide adj area adj network) or wwan) same ((first or initial) near5 service near5 profile) same ((second or plural) near5 service near5 profile) same modem same (first near5 wireless near5 network) same (second near5 wireless near5 network) same policy)	US-PG PU B; US PAT ; US OC R; FPR S; EP O; JPO ; DE RW EN T; IBM _T DB	OR	OFF	2021/01/12 16:59

L15	215,477	H04W12/08;28/02;;12/00;4/50;48/16;12/06;72/04;8/18;4/12;12/813;24/08;88/08;48/14;28/12;4/24;8/20.cpc. or G06Q030/02;10/06;20/10;20/20;20/40;30/04;30/06;40/00.cpc. or G06F015/177.cpc. or H04L9/32;29/08;29/06;12/24;12/813;12/58;12/851.cpc. or H04M015/00.cpc. or 709/217-223.ccls. or 705/28,30.ccls. or 455/405,406,414.1,432.1,456.1.ccls. or 370/252-254.ccls. and (((wireless adj wide adj area adj network) or wwan) same ((first or initial) near5 service near5 profile) same ((second or plural) near5 service near5 profile) same modem same (first near5 wireless near5 network) same (second near5 wireless near5 network) same policy)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/01/12 17:00
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		/0215;4/02;12/0027;12/08;28/02;12/00;48/14.cpc. or G06Q30/0283;20/20;40/12;30/0241;10/06315;30/0601;40/00;10/06375;30/0207;30/0284;20/32;20/40;30/04;20/102;30/02.cpc. or G06F15/177.cpc. or Y02P90/80.cpc. or H04M2215/0188.cpc.) and (((wireless adj wide adj area adj network) or wwan) same ((first or initial) near5 service near5 profile) same ((second or plural) near5 service near5 profile) same modem same (first near5 wireless near5 network) same (second near5 wireless near5 network) same policy)	; US OCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
L18	0	(H04W12/08;28/02;;12/00;4/50;48/16;12/06;72/04;8/18;4/12;12/813;24/08;88/08;48/14;28/12;4/24;8/20.cpc. or G06Q030/02;10/06;20/10;20/20;20/40;30/04;30/06;40/00.cpc. or G06F015/177.cpc. or H04L9/32;29/08;29/06;12/24;12/813;12/58;12/851.cpc. or H04M015/00.cpc. or 709/217-223.ccls. or 705/28,30.ccls. or 455/405,406,414.1,432.1,456.1.ccls. or 370/252-254.ccls.) and (((wireless adj wide adj area adj network) or wwan) same ((first or initial) near5 service near5 profile) same ((second or plural) near5 service near5 profile) same modem same (first near5 wireless near5 network) same (second near5 wireless near5 network) same policy)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/01/12 17:01
L19	0	(H04L51/046;67/306;67/2819;63/20;41/0876;67/26;63/08;67/327;63/04;41/5054;63/0428;12/14;41/5003;47/20;63/10;41/5025;63/0853;67/145;41/0806;47/2408;67/34;9/32;41/0893;9/3247;63/0236;63/0892.cpc. or H04M15/58;15/88;15/80;15/00;15/61.cpc. or H04W24/08;28/0268;72/0453;84/04;8/20;12/0017;84/12;8/18;48/16;88/08;28/12;8/02;84/042;12/06;12/00;88/06;4/50;4/18;4/20;28/02;4/12;12/02;28/0215;4/02;12/0027;12/08;28/02;12/00;48/14.cpc. or G06Q30/0283;20/20;40/12;30/0241;10/06315;30/0601;40/00;10/06375;30/0207;30/0284;20/32;20/40;30/04;20/102;30/02.cpc. or G06F15/177.cpc. or Y02P90/80.cpc. or H04M2215/0188.cpc.) and (((wireless adj wide adj area adj network) or wwan) same ((first or initial) near5 service near5 profile) same ((second or plural) near5 service near5 profile) same modem same	US-PGPUB; USPAT; USOCR; FPRS;	OR	OFF	2021/01/12 17:01

		(first near5 wireless near5 network) same (second near5 wireless near5 network) same policy)	EPO; JPO; DERWENT; IBM_TDB			
L20	3	4 and (((first or initial) near5 service) near5 profile) same (((second or plural) near5 service) near5 profile) same ((first near5 wireless) near5 network) same ((second near5 wireless) near5 network)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/01/12 17:02

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SERIAL NUMBER	FILING or 371(c) DATE RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
16/421,121	05/23/2019	455	3687	RALEP007C11C3C2C3C1C1

APPLICANTS
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INVENTORS
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**** CONTINUING DATA ***************************
This application is a CON of 15/427,837 02/08/2017 PAT 10321318
which is a CON of 15/239,398 08/17/2016 PAT 9641957
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**** FOREIGN APPLICATIONS ***************************

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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	106	1	1

ADDRESS
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Tyler, TX 75703
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TITLE
Automated Device Provisioning and Activation

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	Attorney Docket Number	RALEP007C11C3C2C3C1C1

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	Examiner Name	UBER, NATHAN
	Attorney Docket Number	RALEP007C11C3C2C3C1C1

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

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Signature	/James E. Harris/	Date (YYYY-MM-DD)	2020-08-10
Name/Print	James E. Harris	Registration Number	40013

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Application Number:	16421121
International Application Number:	
Confirmation Number:	3747
Title of Invention:	Automated Device Provisioning and Activation
First Named Inventor/Applicant Name:	Gregory G Raleigh
Customer Number:	106963
Filer:	James E. Harris/Jennifer Smith
Filer Authorized By:	James E. Harris
Attorney Docket Number:	RALEP007C11C3C2C3C1C1
Receipt Date:	10-AUG-2020
Filing Date:	23-MAY-2019
Time Stamp:	15:52:36
Application Type:	Utility under 35 USC 111(a)

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

Application Number	16421121
Filing Date	2019-05-23
First Named Inventor	GREGORY G. RALEIGH
Art Unit	3687
Examiner Name	ANDREW J. RUDY
Attorney Docket Number	RALEP007C11C3C2C1C1

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16421121
	Filing Date	2019-05-23
	First Named Inventor	GREGORY G. RALEIGH
	Art Unit	3687
	Examiner Name	ANDREW J. RUDY
	Attorney Docket Number	RALEP007C11C3C2C1C1

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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[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	16421121
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	Art Unit	3687
	Examiner Name	ANDREW J. RUDY
	Attorney Docket Number	RALEP007C11C3C2C1C1

CERTIFICATION STATEMENT

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

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

OR

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

See attached certification statement.

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

☒ A certification statement is not submitted herewith.

SIGNATURE

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

Signature	/James E. Harris/	Date (YYYY-MM-DD)	2019-09-20
Name/Print	James E. Harris	Registration Number	40013

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

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

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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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Electronic Patent Application Fee Transmittal	
Application Number:	16421121
Filing Date:	23-May-2019
Title of Invention:	Automated Device Provisioning and Activation
First Named Inventor/Applicant Name:	Gregory G Raleigh
Filer:	James E. Harris/Jennifer Smith
Attorney Docket Number:	RALEP007C11C3C2C3C1C1
Filed as Small Entity	
Filing Fees for Utility under 35 USC 111(a)	

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	2806	1	120	120
		Total in USD ($)		**120**

Electronic Acknowledgement Receipt	
EFS ID:	37231114
Application Number:	16421121
International Application Number:	
Confirmation Number:	3747
Title of Invention:	Automated Device Provisioning and Activation
First Named Inventor/Applicant Name:	Gregory G Raleigh
Customer Number:	106963
Filer:	James E. Harris/Jennifer Smith
Filer Authorized By:	James E. Harris
Attorney Docket Number:	RALEP007C11C3C2C3C1C1
Receipt Date:	20-SEP-2019
Filing Date:	23-MAY-2019
Time Stamp:	16:31:56
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$120
RAM confirmation Number	E20199JG32558305
Deposit Account	505876
Authorized User	Jennifer Smith
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 1.21 (Miscellaneous fees and charges)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	P007C11C3C2C3C1C1_Transmittal_Letter.pdf	63310 cf1cb41847d3eef82cc88231f10d42d46b473189	no	2
Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	P007C11C3C2C3C1C1_IDS1.pdf	1065529 08d7f019c73abde7f159d4d59e92dd6c95bca4f6	no	40
Warnings:					
Information:					
3	Information Disclosure Statement (IDS) Form (SB08)	P007C11C3C2C3C1C1_IDS2.pdf	1062503 16a688c61cbbde36d25d962187f3549b23258d55	no	36
Warnings:					
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4	Information Disclosure Statement (IDS) Form (SB08)	P007C11C3C2C3C1C1_IDS3.pdf	1060254 2b9ab9c22c068ddfdb606c07c496de510c2b433f	no	31
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Warnings:					
Information:					
6	Information Disclosure Statement (IDS) Form (SB08)	P007C11C3C2C3C1C1_IDS5.pdf	1057696 232a02b015911575ab6f6c316540bbb881b3b55c	no	22
Warnings:					
Information:					

7	Fee Worksheet (SB06)	fee-info.pdf	30489 a9e7cd4af7b6483da360096d725e8671ff54552a	no	2
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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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	Raleigh, Gregory G.	Examiner:	Rudy, Andrew J.
Serial No.:	16/421,121	Art Unit:	3687
Filed:	May 23, 2019	Conf. No.:	3747
Title:	Automated Device Provisioning and Activation		

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. 15/427,837 filed February 8, 2017, of which the instant application is a continuation, or in related U.S. Patent Application No. 15/239,398 filed on August 17, 2016, of which 15/427,837 is a continuation.

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: September 20, 2019

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

CERTIFICATE OF ELECTRONIC TRANSMISSION

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

Date: September 20, 2019 By: /Jennifer Smith/
Jennifer Smith

PTO/SB/08a (02-18)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16421121
Filing Date	2019-05-23
First Named Inventor	GREGORY G. RALEIGH
Art Unit	3687
Examiner Name	ANDREW J. RUDY
Attorney Docket Number	RALEP007C11C3C2C3C1C1

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	7835275	B1	2010-11-16	Swan et al.	
	2	7843831	B2	2010-11-30	Morrill et al.	
	3	7843843	B1	2010-11-30	Papp III et al.	
	4	7844034	B1	2010-11-30	Oh et al.	
	5	7844728	B2	2010-11-30	Anderson et al.	
	6	7848768		2010-12-07	OMORI et al.	
	7	7849161	B2	2010-12-07	Koch et al.	
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	9	7849477	B2	2010-12-07	Cristofalo et al.	
	10	7853255	B2	2010-12-14	Karaoguz et al.	
	11	7853656	B2	2010-12-14	Yach et al.	
	12	7856226		2010-12-21	WONG, Ellis L. et al.	
	13	7860088	B2	2010-12-28	Lioy, Marcello	
	14	7865182		2011-01-04	Macaluso, Anthony G.	
	15	7865187	B2	2011-01-04	Ramer et al.	
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	17	7873001	B2	2011-01-18	Silver, Andrew	
	18	7873344		2011-01-18	BOWSER, Robert et al.	
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	Attorney Docket Number	RALEP007C11C3C2C3C1C1

	20	7873540	B2	2011-01-18	Arumugam, Avin	
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	25	7882029		2011-02-01	WHITE, Craig R.	
	26	7882247	B2	2011-02-01	Sturniolo et al.	
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	31	7890084		2011-02-15	Dudziak, Thaddeus Jude et al.	
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	36	7903553		2011-03-08	Liu, Enhui	
	37	7907970		2011-03-15	Park, Vincent D. et al.	
	38	7911975		2011-03-22	DROZ, Patrick et al.	
	39	7912025		2011-03-22	Pattenden, Christopher E. S. et al.	
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	Attorney Docket Number	RALEP007C11C3C2C3C1C1

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	48	7929973		2011-04-19	Zavalkovsky, Arthur et al.	
	49	7930327	B2	2011-04-19	Craft David et al.	
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	Art Unit	3687
	Examiner Name	ANDREW J. RUDY
	Attorney Docket Number	RALEP007C11C3C2C3C1C1

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	57	7940751		2011-05-10	Hansen, Christopher J.	
	58	7941184		2011-05-10	PRENDERGAST et al.	
	59	7944948		2011-05-17	Chow, Albert T. et al.	
	60	7945238	B2	2011-05-17	Baker, Matthew Donald et al.	
	61	7945240		2011-05-17	KLOCK, Jacqueline et al.	
	62	7945945		2011-05-17	Graham, Richard et al.	
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	64	7948953	B2	2011-05-24	Melkote, Keerti G. et al.	
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	Attorney Docket Number	RALEP007C11C3C2C3C1C1

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	76	7969950	B2	2011-06-28	Iyer, Pradeep J. et al.	
	77	7970350		2011-06-28	SHEYNMAN, Arnold	
	78	7970426		2011-06-28	Poe, Brian R. et al.	
	79	7974624		2011-07-05	Gallagher, Michael D. et al.	
	80	7975184		2011-07-05	GOFF et al.	
	81	7978627		2011-07-12	TAYLOR, William Scott et al.	
	82	7978686	B2	2011-07-12	Goyal et al.	
	83	7979069	B2	2011-07-12	Hupp et al.	
	84	7979889	B2	2011-07-12	Gladstone et al.	
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	86	7984130		2011-07-19	BOGINENI et al.	
	87	7984511	B2	2011-07-19	Kocher Paul et al.	
	88	7986935		2011-07-26	D'SOUZA et al.	
	89	7987496	B2	2011-07-26	Bryce et al.	
	90	7987510	B2	2011-07-26	Kocher et al.	
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	92	8000276	B2	2011-08-16	Scherzer, Shimon et al.	
	93	8000318		2011-08-16	Wiley, William L. et al.	
	94	8005009		2011-08-23	McKee, Neil et al.	
	95	8005459		2011-08-23	BALSILLIE, Jim	
	96	8005726	B1	2011-08-23	Bao, Yulin	

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	97	8005913	B1	2011-08-23	Carlander, Carrie	
	98	8005988		2011-08-23	MAES, Stephane H.	
	99	8010080		2011-08-30	THENTHIRUPERAI et al.	
	100	8010081		2011-08-30	ROSKOWSKI, Steve	
	101	8010082	B2	2011-08-30	Sutaria et al.	
	102	8010990	B2	2011-08-30	Ferguson et al.	
	103	8015133		2011-09-06	WU et al.	
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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).

OR

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

See attached certification statement.

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

☒ A certification statement is not submitted herewith.

SIGNATURE

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

Signature	/James E. Harris/	Date (YYYY-MM-DD)	2019-09-20
Name/Print	James E. Harris	Registration Number	40013

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First Named Inventor	GREGORY G. RALEIGH
Art Unit	3687
Examiner Name	ANDREW J. RUDY
Attorney Docket Number	RALEP007C11C3C2C3C1C1

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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	GREGORY G. RALEIGH
	Art Unit	3687
	Examiner Name	ANDREW J. RUDY
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Name/Print	James E. Harris	Registration Number	40013

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	First Named Inventor	GREGORY G. RALEIGH
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	Examiner Name	ANDREW J. RUDY
	Attorney Docket Number	RALEP007C11C3C2C3C1C1

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	Examiner Name	ANDREW J. RUDY
	Attorney Docket Number	RALEP007C11C3C2C3C1C1

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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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See attached certification statement.

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

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Signature	/James E. Harris/	Date (YYYY-MM-DD)	2019-09-20
Name/Print	James E. Harris	Registration Number	40013

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EFS ID:	37207717
Application Number:	16421121
International Application Number:	
Confirmation Number:	3747
Title of Invention:	Automated Device Provisioning and Activation
First Named Inventor/Applicant Name:	Gregory G Raleigh
Customer Number:	106963
Filer:	James E. Harris/Jennifer Smith
Filer Authorized By:	James E. Harris
Attorney Docket Number:	RALEP007C11C3C2C3C1C1
Receipt Date:	18-SEP-2019
Filing Date:	23-MAY-2019
Time Stamp:	22:00:59
Application Type:	Utility under 35 USC 111(a)

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	Raleigh, Gregory G.	Examiner:	Andrew, Rudy J.
Serial No.:	16/421,121	Art Unit:	3687
Filed:	May 23, 2019	Conf. No.:	3747
Title:	Automated Device Provisioning and Activation		

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

PRELIMINARY AMENDMENT

Before examination in this case, please enter the following amendments and remarks:

Amendments to the Claims begin on page 2.

Remarks begin on page 4.

AMENDMENTS TO THE CLAIMS

1. (Canceled).

2. (New) A wireless end-user device comprising:
a Wireless Wide-Area Network (WWAN) modem;
a secure memory to store
a first service profile associated with a first service plan and a first wireless network accessible through the WWAN modem, the first service profile comprising a first set of network service policies, and
a second service profile associated with a second service plan and a second wireless network accessible through the WWAN modem, the second service profile comprising a second set of network service policies;
a connection manager to select an access network connection for the WWAN modem, based on a selected one of the first and second service profiles;
at least one adaptive service policy control agent to enforce network service policies associated with the selected one of the first and second service profiles, the enforced network service policies including policies enforced at an application service interface on network data connections for selected applications resident on the device.

3. (New) The wireless end-user device of claim 2, further comprising a service monitor agent to record network service usage categorized by sub-account for different wireless networks, including separate service usage counts associated with each of the first service plan and the second service plan.

4. (New) The wireless end-user device of claim 3, wherein for at least one of the first and second service plans, the wireless end-user device synchronizes a local service usage count with a network-based service count.

5. (New) The wireless end-user device of claim 2, wherein the first service plan is associated with a central provider that operates a WWAN access network, and the second service plan is associated with a virtual network operator.

6. (New) The wireless end-user device of claim 2, further comprising a user service interface to allow a user to make a user selection between the first and second service profiles, the connection manager to, responsive to the user selection, select an access network connection for the WWAN modem.

7. (New) The wireless end-user device of claim 2, further comprising a service notification and billing interface to display service usage options for each of the first and second service profiles.

8. (New) The wireless end-user device of claim 2, wherein the at least one adaptive service policy control agent applies network service policies from a superset profile that provides capabilities from each of the first and second service profiles.

9. (New) The wireless end-user device of claim 2, wherein the at least one adaptive service policy control agent detects network connection changes from the first wireless network to the second wireless network, and in response enforces the second set of network service policies.

10. (New) The wireless end-user device of claim 2, wherein the connection manager further comprises a modem selection and control layer that routes certain types of data traffic to the first wireless network and other types of data traffic to the second wireless network.

11. (New) The wireless end-user device of claim 2, further comprising a Subscriber Identity Module (SIM), the adaptive service policy control agent located at least in part on the SIM.

12. (New) The wireless end-user device of claim 2, the connection manager configured to prompt the WWAN modem to connect to a selected access network and send credentials associated with the selected one of the first and second service profiles to the selected access network.

13. (New) The wireless end-user device of claim 2, the first service profile further comprising first device credentials and the second service profile further comprising second device credentials, the wireless end-user device further comprising a device master agent credential that is independent of the first and second device credentials.

14. (New) The wireless end-user device of claim 13, configured to, when the second service plan is inactive, suspend the second device credentials, and when the second service plan is reactivated, reactivate the second device credentials.

REMARKS

Claim 1 has been canceled, and new claims 2-14 been added. No new matter has been added. Applicant respectfully requests the entry of the amendments herein.

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

Respectfully submitted,

Date: September 18, 2019

By: /James E. Harris/

James E. Harris
Reg. No. 40,013
Patent Counsel
Headwater Research LLC
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(903) 201-6212

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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 $50 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $230 =	
☐ 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

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	09/18/2019	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 13	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

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	LDRC
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/EVA V GILLIS/
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The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/421,121	05/23/2019	Gregory G Raleigh	RALEP007C11C3C2C3C1C1

CONFIRMATION NO. 3747

106963
Headwater Research LLC
1011 Pruitt Place
Tyler, TX 75703

PUBLICATION NOTICE

OC000000111079200

Title: Automated Device Provisioning and Activation

Publication No.US-2019-0281463-A1
Publication Date:09/12/2019

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.

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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
16/421,121	05/23/2019		1585	RALEP007C11C3C2C3C1C1	1	1

CONFIRMATION NO. 3747

106963
Headwater Research LLC
1011 Pruitt Place
Tyler, TX 75703

FILING RECEIPT

OC000000108593274

Date Mailed: 06/03/2019

Receipt is acknowledged of this non-provisional utility 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 FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

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Inventor(s)

Gregory G Raleigh, Woodside, CA;

Applicant(s)

Headwater Research LLC, Tyler, TX;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 15/427,837 02/08/2017 PAT 10321318
which is a CON of 15/239,398 08/17/2016 PAT 9641957
which is a CON of 14/979,233 12/22/2015 PAT 9532161
which is a CON of 14/667,353 03/24/2015 PAT 9232403
which is a CON of 14/263,604 04/28/2014 PAT 9037127
which is a CON of 12/380,780 03/02/2009 PAT 8839388
which 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

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The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/421,121**

Projected Publication Date: 09/12/2019

Non-Publication Request: No

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

Automated Device Provisioning and Activation

Preliminary Class

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

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Title 37, Code of Federal Regulations, 5.11 & 5.15

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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 16/421,121

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	75		N/A	
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	330		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	380		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	1 minus 20 =	*	x 50 =	0.00	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	1 minus 3 =	*	x 230 =	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).			800			
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	1585		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	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
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".
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The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

AUTOMATED DEVICE PROVISIONING AND ACTIVATION

BACKGROUND OF THE INVENTION

[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] FIG. 1 illustrates a simplified (e.g., "flattened") network architecture in accordance with some embodiments.

[0005] FIG. 2 illustrates another simplified (e.g., "flattened") network architecture including an MVNO (Mobile Virtual Network Operator) relationship in accordance with some embodiments.

[0006] FIG. 3 illustrates another simplified (e.g., "flattened") network architecture including two central providers in accordance with some embodiments.

[0007] FIG. 4 illustrates a network architecture including a Universal Mobile Telecommunications System (UMTS) overlay configuration in accordance with some embodiments.

[0008] FIG. 5 illustrates a network architecture including an Evolution Data Optimized (EVDO) overlay configuration in accordance with some embodiments.

[0009] FIG. 6 illustrates a network architecture including a 4G LTE and Wi-Fi overlay configuration in accordance with some embodiments.

[0010] FIG. 7 illustrates a network architecture including a WiMax and Wi-Fi overlay configuration in accordance with some embodiments.

[0011] FIG. 8 illustrates another simplified (e.g., "flattened") network architecture including multiple wireless access networks (e.g., 3G and 4G Wireless Wide Area Networks (WWANs)) and multiple wire line networks (e.g., Data Over Cable Service Interface Specification (DOCSIS) and Digital Subscriber Line Access Multiplexer (DSLAM) wire line networks) in accordance with some embodiments.

[0012] FIG. 9 illustrates a hardware diagram of a device that includes a service processor in accordance with some embodiments.

[0013] FIG. 10 illustrates another hardware diagram of a device that includes a service processor in accordance with some embodiments.

[0014] FIG. 11 illustrates another hardware diagram of a device that includes a service processor in accordance with some embodiments.

[0015] FIG. 12 illustrates another hardware diagram of a device that includes a service processor in accordance with some embodiments.

[0016] FIG. 13 illustrates another hardware diagram of a device that includes a service processor implemented in external memory of a System On Chip (SOC) in accordance with some embodiments.

[0017] FIG. 14 illustrates another hardware diagram of a device that includes a service processor implemented in external memory of a System On Chip (SOC) in accordance with some embodiments.

[0018] FIGS. 15A through 15F illustrate hardware diagrams of a device that include a service processor and a bus structure extension using intermediate modem or networking device combinations in accordance with various embodiments.

[0019] FIG. 16 is a functional diagram illustrating a device based service processor and a service controller in accordance with some embodiments.

[0020] FIG. 17 is another functional diagram illustrating the device based service processor and the service controller in accordance with some embodiments.

[0021] FIG. 18 is another functional diagram illustrating the device based service processor and the service controller in which the service processor controls the policy implementation for multiple access network modems and technologies in accordance with some embodiments.

[0022] FIG. 19 is another functional diagram illustrating the service processor and the service controller in accordance with some embodiments.

[0023] FIG. 20 is another functional diagram illustrating the service processor and the service controller in accordance with some embodiments.

[0024] FIG. 21 is another functional diagram illustrating the service processor and the service controller in accordance with some embodiments.

[0025] FIGS. 22A and 22B provide tables summarizing various service processor agents (and/or components/functions implemented in software and/or hardware) in accordance with some embodiments.

[0026] FIG. 23 provides a table summarizing various service controller server elements (and/or components/functions implemented in software and/or hardware) in accordance with some embodiments.

[0027] FIG. 24 is a functional diagram illustrating the service control device link of the service processor and the service control service link of the service controller in accordance with some embodiments.

[0028] FIG. 25 is a functional diagram illustrating framing structure of a service processor communication frame and a service controller communication frame in accordance with some embodiments.

[0029] FIGS. 26A through 26H provide tables summarizing various service processor heartbeat functions and parameters in accordance with some embodiments.

[0030] FIGS. 27A through 27P provide tables summarizing various device based service policy implementation verification techniques in accordance with some embodiments.

[0031] FIGS. 28A through 28E provide tables summarizing various techniques for protecting the device based service policy from compromise in accordance with some embodiments.

[0032] FIG. 29 is a functional diagram illustrating a device communications stack that allows for implementing verifiable traffic shaping policy, access control policy and/or service monitoring policy in accordance with some embodiments.

[0033] FIG. 30 is another functional diagram illustrating the device communications stack that allows for implementing traffic shaping policy, access control policy and/or service monitoring policy in accordance with some embodiments.

[0034] FIG. 31 is another functional diagram illustrating the device communications stack that allows for implementing traffic shaping policy, access control policy and/or service monitoring policy in accordance with some embodiments.

[0035] FIG. 32 is another functional diagram illustrating the device communications stack that allows for implementing traffic shaping policy, access control policy and/or service monitoring policy in accordance with some embodiments.

[0036] FIG. 33 is another functional diagram illustrating the device communications stack that allows for implementing traffic shaping policy, access control policy and/or service monitoring policy in accordance with some embodiments.

[0037] FIG. 34 is another functional diagram illustrating the device communications stack that allows for implementing traffic shaping policy, access control policy and/or service monitoring policy in accordance with some embodiments.

[0038] FIG. 35 is another functional diagram illustrating the device communications stack that allows for implementing traffic shaping policy, access control policy and/or service monitoring policy in accordance with some embodiments.

[0039] FIG. 36 is another functional diagram illustrating the device communications stack that allows for implementing traffic shaping policy, access control policy and/or service monitoring policy in accordance with some embodiments.

[0040] FIG. 37 is another functional diagram illustrating the device communications stack that allows for implementing traffic shaping policy, access control policy and/or service monitoring policy in accordance with some embodiments.

[0041] FIG. 38 is a functional diagram illustrating a device service processor packet processing flow in accordance with some embodiments.

[0042] FIG. 39 is another functional diagram illustrating the device service processor packet processing flow in accordance with some embodiments.

[0043] FIG. 40 is another functional diagram illustrating the device service processor packet processing flow in accordance with some embodiments.

[0044] FIG. 41 provides a table summarizing various privacy levels for service history reporting in accordance with some embodiments.

[0045] FIGS. 42A through 42J provide tables summarizing various service policy control commands in accordance with some embodiments.

[0046] FIGS. 43A through 43B are flow diagrams illustrating a flow diagram for a service processor authorization sequence as shown in FIG. 43A and a flow diagram for a service controller authorization sequence as shown in FIG. 43B in accordance with some embodiments.

[0047] FIGS. 44A through 44B are flow diagrams illustrating a flow diagram for a service processor activation sequence as shown in FIG. 44A and a flow diagram for a service controller activation sequence as shown in FIG. 44B in accordance with some embodiments.

[0048] FIGS. 45A through 45B are flow diagrams illustrating a flow diagram for a service processor access control sequence as shown in FIG. 45A and a flow diagram for a service controller access control sequence as shown in FIG. 45B in accordance with some embodiments.

[0049] FIG. 46 is a functional diagram illustrating open, decentralized, device based mobile commerce transactions in accordance with some embodiments.

[0050] FIGS. 47A through 47B are transactional diagrams illustrating open, decentralized, device based mobile commerce transactions in accordance with some embodiments.

[0051] FIG. 48 illustrates a network architecture including a service controller device control system and a service controller analysis and management system in accordance with some embodiments.

[0052] FIG. 49 illustrates a network architecture for an open developer platform for virtual service provider (VSP) partitioning in accordance with some embodiments.

[0053] FIG. 50 illustrates a network architecture including a billing to service controller interface for accommodating minimum changes in existing central billing, AAA and/or other network components in accordance with some embodiments.

[0054] FIG. 51 illustrates a network architecture for locating service controller device control functions with AAA and network service usage functions in accordance with some embodiments.

[0055] FIG. 52 illustrates a network architecture for locating service controller device control functions in the access transport network in accordance with some embodiments.

[0056] FIG. 53 illustrates a network architecture for locating service controller device control functions in the radio access network in accordance with some embodiments.

[0057] FIG. 54 illustrates a network architecture for locating service controller device control functions with AAA and network service usage including deep packet inspection functions in accordance with some embodiments.

[0058] FIG. 55 illustrates another network architecture for locating service controller device control functions with AAA and network service usage including deep packet inspection functions in accordance with some embodiments.

[0059] FIG. 56 illustrates a 4G/3G/2G DPI/DPC enabled gateway in accordance with some embodiments.

[0060] FIG. 57 illustrates a network architecture including the VSP workstation server in communication with the 4G/3G/2G DPI/DPC gateways in accordance with some embodiments.

[0061] FIG. 58 illustrates another 4G/3G/2G DPI/DPC enabled gateway in accordance with some embodiments.

[0062] FIG. 59 illustrates another network architecture including the VSP workstation server in communication with the 4G/3G/2G DPI/DPC gateways in accordance with some embodiments.

[0063] FIG. 60 illustrates a 4G/3G/2G DPI/DPC enabled gateway and service controller device control system in accordance with some embodiments.

[0064] FIG. 61 illustrates another network architecture including the VSP workstation server in communication with the 4G/3G/2G DPI/DPC gateways in accordance with some embodiments.

[0065] FIG. 62 illustrates another 4G/3G/2G DPI/DPC enabled gateway and service controller device control system in accordance with some embodiments.

[0066] FIG. 63 illustrates another network architecture including the VSP workstation server in communication with the 4G/3G/2G DPI/DPC gateways in accordance with some embodiments.

[0067] FIG. 64 illustrates another network architecture including a system located in the manufacturing or distribution chain for the device that provides the device provisioning or partial provisioning, and any pre-activation required for the device to later activate on the network in accordance with some embodiments.

DETAILED DESCRIPTION

[0068] 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.

[0069] 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.

[0070] With the development and increasing proliferation of mass market digital communications and content distribution, communication network capacity gains are being outpaced by growing digital networking demand. For example, some industry experts project average wireless device usage of four devices per subscriber, with a mixture of general purpose devices like smart phones and computers along with special purpose devices like music players, electronic readers, connected (e.g., networked) cameras and connected gaming devices. In

addition, 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 if not efficiently managed. Because some components of service provider costs go up with increasing bandwidth, this trend will also negatively impact service provider profits.

[0071] There is a need for a communication system and method that provides for flexible service plans and management of user network services to provide consumer choice of more refined service plan offerings and efficient management of network capacity.

[0072] Also, it is becoming increasingly important to more deeply manage the level of services delivered to networked devices to provide cost effective services that match growing digital networking usage patterns. For example, access providers can move away from only billing for basic access and move toward billing for higher level service delivery with example services including rich Internet access and email, application based billing, content distribution, entertainment activities, information or content subscription or gaming. In addition, a growing number of new special purpose and general purpose networked devices are fueling demand for new service plans, for example, tailored to the new device usage models (e.g., a special service plan for an e-book reader device).

[0073] As network capabilities grow and new networked device offerings grow, access network service providers will realize increasing value in opening up their networks to allow innovation and expanded offerings for network service consumers. However, opening up the networks to provide efficient third party definition of alternative service and billing models requires more flexible service and billing policy management solutions. For example, machine to machine applications such as telemetry, surveillance, shipment tracking and two way power control systems are example new applications that would require new offerings to make such available to network service customers. The need to customize service offerings for these new applications requires more efficient methods for defining, testing and launching new services with more refined control of service functions and service costs. In some embodiments, this means billing for different types of service elements, such as total traffic, content downloads, application usage, information or content subscription services, people or asset tracking services, real time machine to machine information or electronic commerce transactions.

[0074] In some embodiments, network user capacity is increased and user service costs are reduced by managing and billing for service consumption in a more refined manner (e.g., to satisfy network neutrality requirements). By managing service consumption in a user friendly manner, the overall service capacity required to satisfy the user device needs can be tailored more closely to the needs of a given user thereby reducing user service costs and increasing service provider profits. For example, managing service usage while maintaining user satisfaction includes service usage policy implementation and policy management to identify, manage and bill for service usage categories, such as total traffic consumption, content downloads, application usage, information or content subscription services, electronic commerce transactions, people or asset tracking services or machine to machine networking services. As described herein, service activity is used to refer to any service usage or traffic usage that can be associated with, for example, an application; a network communication end point, such as an address, uniform resource locator (URL) or other identifier with which the device is communicating; a traffic content type; a transaction where content or other material, information or goods are transacted, purchased, reserved, ordered or exchanged; a download, upload or file transfer; email, text, SMS, IMS or other messaging activity or usage; VOIP services; video services; a device usage event that generates a billing event; service usage associated with a bill by account activity (also referred to as billing by account) as described herein; device location; device service usage patterns, device user interface (UI) discovery patterns, content usage patterns or other characterizations of device usage; or other categories of user or device activity that can be identified, monitored, recorded, reported, controlled or processed in accordance with a set of verifiable service control policies. As will be apparent to one of ordinary skill in the art in view of the embodiments described herein, some embodiments identify various service activities for the purpose of decomposing overall service usage into finer sub-categories of activities that can be verifiably monitored, categorized, cataloged, reported, controlled, monetized and used for end user notification in a manner that results in superior optimization of the service capabilities for various levels of service cost or for various types of devices or groups. In some embodiments, it will be apparent to one of ordinary skill in the art that the terms service activity or service usage are associated with categorizing and possibly monitoring or controlling data traffic, application usage, communication with certain network end points, or transactions, and it will also be apparent that in some embodiments the term service activity is

intended to include one or more of the broader aspects listed above. The shortened term service usage can be used interchangeably with service activity, but neither term is intended in general to exclude any aspect of the other. In some cases, where the terms service usage or service activity are used, more specific descriptors such as traffic usage, application usage, website usage, and other service usage examples are also used to provide more specific examples or focus in on a particular element of the more encompassing terms.

[0075] In some embodiments, employing this level of service categorization and control is accomplished in a manner that satisfies user preferences. In some embodiments, employing this level of service categorization and control is accomplished in a manner that also satisfies government rules or regulations regarding open access, for example, network neutrality requirements. In some embodiments, service management solutions that also collect and/or report user or device service usage or service activity behavior to determine how best to meet the user's simultaneous desires for service quality and lower service costs are disclosed. For example, such monitoring and reporting are accomplished in a manner that includes approval by the user and in a manner that also protects the privacy of user information and service usage behavior or service activity history.

[0076] In some embodiments, a system and method is disclosed for increasing network user capacity for wireless networks in the face of increasing service demand per user by providing for a greater number of base stations, also sometimes referred to as access points, base terminals, terminal nodes or other well known acronyms, to be more easily and/or more cost effectively deployed. For example, to simplify the process of deploying base stations, the installation complexity and the network infrastructure required for the base station to obtain backhaul service to the various networks that users desire to connect with are reduced.

[0077] In some embodiments, dense base station deployments are simplified by reducing the requirement to aggregate or concentrate the base station traffic through a specific dedicated core network infrastructure, so that the base stations connect to the desired user networks through a more diverse set of local loop, back bone and core routing options. This approach also reduces network infrastructure equipment, installation and maintenance costs. In some embodiments, this is accomplished by distributing the network traffic policy implementation and

control away from the core network by providing for more control for service policy implementation and management on the end user device and, in some embodiments, in the end user device with respect to certain service policies and the network (e.g., control plane servers) with respect to other service policies. For example, this approach facilitates connecting the base stations directly to the local loop Internet with a minimum of specific dedicated networking infrastructure.

[0078] In some embodiments, service and transaction billing event capture and logging are distributed to the device. For example, providing service and transaction billing event capture and logging at the device provides a greater capability to monitor, classify and control deeper aspects of service usage or service activity at the device as compared to the relatively less capability for the same in the network infrastructure (e.g., for certain traffic flows, such as encrypted traffic flows). Furthermore, billing at the device provides for very specialized with many different billing and service plans for different device and service usage or service activity scenario combinations without the problem of attempting to propagate and manage many different deep packet inspection (DPI) and traffic shaping profiles in the networking equipment infrastructure. For example, service billing at the device can provide for more sophisticated, more specialized and more scalable billing and service plans.

[0079] Another form of billing that needs improvement is electronic commerce transaction billing with device assisted central billing. Today, most central billing and content distribution models require either centralized content distribution maintained by the central service provider or central billing authority, or a centralized ecommerce website or portal traffic aggregation system controlled by the central service provider or central billing provider, or both. In such systems, content and transaction providers such as media providers, application developers, entertainment providers, transaction website providers and others must adapt their mainstream electronic offering and commerce systems, such as shopping experience websites, to fit within the various proprietary customized infrastructure and content storage solutions for ecommerce markets, such as BREW® (Binary Runtime Environment for Wireless from Qualcomm® Inc.), Symbian OS (from Symbian Software Ltd) and Apple iPhone 3G App Store (from Apple Inc.). This approach requires a large amount of unnecessary custom interface development and stifles open market creativity for HTTP, WAP or portal/widget based shopping

destinations and experiences. As disclosed below, a superior approach includes device based transaction billing for an open ecosystem in which a central billing provider provides users and ecommerce transaction providers with a central billing solution and experience that does not require extensive custom development or ecommerce infrastructure interfacing.

[0080] In some embodiments, products that incorporate device assisted service policy implementation, network services and service profiles (e.g., a service profile includes a set of one or more service policy settings for the device for a service on the network) are disclosed, as described below. For example, aspects of the service policy (e.g., a set of policies/policy settings for the device for network services, typically referring to lower level settings, such as access control settings, traffic control settings, billing system settings, user notification settings, user privacy settings, user preference settings, authentication settings and admission control settings) that are moved out of the core network and into the end user device include, for example, certain lower level service policy implementations, service usage or service activity monitoring and reporting including, for example, privacy filtering, customer resource management monitoring and reporting including, for example, privacy filtering, adaptive service policy control, service network access control services, service network authentication services, service network admission control services, service billing, transaction billing, simplified service activation and sign up, user service usage or service activity notification and service preference feedback and other service capabilities.

[0081] As discussed below, product designs that move certain aspects of one or more of these service profile or service policy implementation elements into the device provide several advantageous solutions to the needs described above. For example, benefits of certain embodiments include the ability to manage or bill for a richer and more varied set of network services, better manage overall network capacity, better manage end user access costs, simplify user or new device service activation, simplify development and deployment of new devices with new service plans (e.g., service profile and billing/costs information associated with that service profile), equip central service providers with more effective open access networks for new third party solutions, simplify the equipment and processes necessary to deploy wireless base stations and simplify the core networking equipment required to deploy certain access networks.

[0082] As discussed below, there are two network types that are discussed: a central provider network and a service provider network. The central provider network generally refers to the access network required to connect the device to other networks. The central provider network generally includes the physical layer, the Media Access Control (MAC) and the various networking functions that can be implemented to perform authentication, authorization and access control, and to route traffic to a network that connects to the control plane servers, as discussed below. The service provider network generally refers to the network that includes the control plane servers. In some embodiments, a central provider network and a service provider network are the same, and in some embodiments, they are different. In some embodiments, the owner or manager of the central provider network and the owner or manager of the service provider network are the same, and in some embodiments, they are different.

[0083] In some embodiments, control of the device service policies is accomplished with a set of service control plane servers that reside in the access network or any network that can be reached by the device. This server based control plane architecture provides for a highly efficient means of enabling third party control of services and billing, such as for central carrier open development programs or Mobile Virtual Network Operator (MVNO) relationships. As device processing and memory capacity expands, moving to this distributed service policy processing architecture also becomes more efficient and economical. In some embodiments, several aspects of user privacy and desired network neutrality are provided by enabling user control of certain aspects of device based service usage or service activity reporting, traffic reporting, service policy control and customer resource management (CRM) reporting.

[0084] In many access networks, such as wireless access networks, bandwidth capacity is a valuable resource in the face of the increasing popularity of devices, applications and content types that consume more bandwidth. To maintain reasonable service profit margins, a typical present service provider practice is to charge enough per user for access to make service plans profitable for the higher bandwidth users. However, this is not an optimal situation for users who desire to pay less for lower bandwidth service usage or service activity scenarios.

[0085] Accordingly, in some embodiments, a range of service plan pricing can be enabled that also maintains service profitability for the service provider, for example, by

providing a more refined set of management and control capabilities for service profiles. For example, this approach generally leads to service management or traffic shaping where certain aspects of a service are controlled down based on service policies to lower levels of quality of service. Generally, there are three problems that arise when these techniques are implemented. The first problem is maintaining user privacy preferences in the reporting of service usage or service activity required to set, manage or verify service policy implementation. This problem is solved in a variety of ways by the embodiments described below with a combination of user notification, preference feedback and approval for the level of traffic information the user is comfortable or approves and the ability to filter service usage or service activity, in some embodiments, specifically traffic usage or CRM reports so that only the level of information the user prefers to share is communicated. The second problem is satisfying network neutrality requirements in the way that traffic is shaped or services are managed. This problem is solved in a variety of ways as described in the embodiments described below by empowering the user to make the choices on how service usage, service activity, traffic usage or CRM data is managed down to control costs, including embodiments on user notification and service policy preference feedback. By allowing the user to decide how they want to spend and manage their service allowance or resources, a more neutral or completely neutral approach to network usage can be maintained by the service provider. The third problem is to help the user have an acceptable and enjoyable service experience for the lower cost plans that will result in much wider scale adoption of connected devices and applications but are more constrained on service activity usage or options or bandwidth or traffic usage. As lower cost service plans are offered, including plans where the basic connection service may be free, these service plans will require service provider cost controls to maintain profitability or preserve network capacity that result in lower limits on service usage or service activity. These lower service usage or service activity limit plans will result in more users who are likely run over service usage limits and either experience service shutdown or service cost overages unless they are provided with more capable means for assistance on how to use and control usage for the lower cost services. This problem is solved in a variety of ways with a rich collection of embodiments on user notification, service usage and cost projection, user notification policy feedback, user service policy preference feedback, and adaptive traffic shaping or service policy implementation. As described herein, some embodiments allow a wide range of flexible and verifiable service plan and service profile

implementations ranging from examples such as free ambient services that are perhaps sponsored by transaction revenues and/or bill by account sponsored service partner revenues, to intermediately priced plans for basic access services for mass market user devices or machine to machine communication devices, to more expensive plans with very high levels of service usage or service activity limits or no limits at all. Several bill by account embodiments also provide for the cataloging of service usage that is not a direct benefit to end users but is needed for basic maintenance of the device control channels and access network connection, so that the maintenance traffic service cost can be removed from the user billing or billed to non-user accounts used to track or account for such service costs. These embodiments and others result in a service usage or service activity control capability that provides more attractive device and service alternatives to end users while maintaining profitability for service providers and their partners.

[0086] In some embodiments, the above described various embodiments for device based service policy and/or service profile communications control are implemented using network based service control, for example, for satisfying various network neutrality and/or privacy requirements, based on indication(s) received from the device (e.g., user input provided using the device UI using the service processor) and network based service control (e.g., using a DPI service monitor or DPC policy implementation and/or other network elements).

[0087] In some embodiments, a virtual network overlay includes a device service processor, a network service controller and a control plane communication link to manage various aspects of device based network service policy implementation. In some embodiments, the virtual network overlay networking solution is applied to an existing hierarchical network (e.g., for wireless services), and in some embodiments, is applied to simplify or flatten the network architecture as will be further described below. In some embodiments, the large majority of the complex data path network processing required to implement the richer service management objectives of existing hierarchical networks (e.g., for wireless services) are moved into the device, leaving less data path processing required in the edge network and in some cases even less in the core network. Because the control plane traffic between the service control servers and the device agents that implement service policies can be several orders of magnitude slower than the data plane traffic, service control server network placement and back-haul

infrastructure is much less performance sensitive than the data plane network. In some embodiments, as described further below, this architecture can be overlaid onto all the important existing access network architectures used today. In some embodiments, this architecture can be employed to greatly simplify core access network routing and data plane traffic forwarding and management. For example, in the case of wireless networks, the incorporation of device assisted service policy implementation architectures can result in base stations that directly connect to the Internet local loop and the data traffic does not need to be concentrated into a dedicated core network. This results, for example, in a large reduction in backhaul cost, core network cost and maintenance cost. These cost savings can be re-deployed to purchase and install more base stations with smaller cells, which results in higher data capacity for the access network leading to better user experience, more useful applications and lower service costs. This flattened networking architecture also results in latency reduction as fewer routes are needed to move traffic through the Internet. In some embodiments, the present invention provides the necessary teaching to enable this powerful transformation of centralized network service architectures to a more distributed device based service architectures.

[0088] Device based billing can be compromised, hacked and/or spoofed in many different ways. Merely determining that billing reports are being received from the device, that the device agent software is present and properly configured (e.g., the billing agent is present and properly configured) is insufficient and easily spoofed (e.g., by spoofing the agent itself, providing spoofed billing reports using a spoofed billing agent or providing spoofed agent configurations). Accordingly, in some embodiments, verifiable device assisted and/or network based service policy implementation is provided. For example, verifiable service usage and/or service usage billing can be provided as described herein with respect to various embodiments.

[0089] While much of the below discussion and embodiments described below focus on paid service networks, those of ordinary skill in the art will appreciate that many of the embodiments also apply to other networks, such as enterprise networks. For example, the same device assisted network services that create access control services, ambient activation services and other service profiles can be used by corporate IT managers to create a controlled cost service policy network for corporate mobile devices. As another example, embodiments described below for providing end user service control can also allow a service provider to offer

parental controls by providing parents with access to a website with a web page that controls the policy settings for the access control networking service for a child's device.

Network Architecture for Device Assisted/Based Service Control

[0090] FIG. 1 illustrates a simplified (e.g., "flattened") network architecture in accordance with some embodiments. As shown, this provides for a simplified service infrastructure that exemplifies a simplified and "flattened" network architecture in accordance with some embodiments that is advantageous for wireless network architectures. This also reduces the need for complex data path protocol interaction between the base station and network infrastructure. For example, in contrast to a complex edge and core network infrastructure connecting base stations to the central service provider network, as shown the base stations 125 are connected directly to the Internet 120 via firewalls 124 (in some embodiments, the base stations 125 include the firewall functionality 124). Accordingly, in some embodiments, a central provider network is no longer required to route, forward, inspect or manipulate data plane traffic, because data plane traffic policy implementation is conducted in the device 100 by the service processor 115. However, it is still an option, in some embodiments, to bring data plane traffic in from the base stations 125 to a central provider network using either open or secure Internet routing if desired. Base station control plane communication for access network AAA (Authentication, Authorization, and Accounting) server 121, DNS/DHCP (Domain Name System/Dynamic Host Configuration Protocol) server 126, mobile wireless center 132 (sometimes referenced to in part as a home location register (HLR) or other acronym) or other necessary functions are accomplished, for example, with a secure IP tunnel or TCP connection between the central provider network and the base stations. The base station 125 is used to refer to multiple base station embodiments where the base station itself is directly connected to the RAN, or where the base station connects to a base station controller or base station aggregator function that in turn connects to the RAN, and all such configurations are collectively referred to herein as base station 125 in FIG. 1 and most figures that follow that reference base station 125 as described below.

[0091] As shown, the central provider access network is both 3G and 4G capable, the devices 100 can be either 3G, 4G or multi-mode 3G and 4G. Those of ordinary skill in the art

will also appreciate that in the more general case, the network could be 2G, 3G and 4G capable, or the device could be 2G, 3G and 4G capable with all or a subset of Global System for Mobile (GSM), General Packet Radio Service (GPRS), Code Division Multiple Access (CDMA) 1X, High Speed Packet Access (HSPA), Evolution Data Optimized (EVDO), Long Term Evolution (LTE) and WiMax modem capability. If the devices are single mode, then the 3G devices 100 will be activated with a service profile applied to service processor 115 that is consistent with the 3G network capacity and speed, and the 4G devices will be activated with service profiles applied to service processor 115 that are consistent with 4G network capacity and speed. In both cases, the same service controller 122 manages services for both sets of devices in accordance with some embodiments. If the devices are multimode, then the service processor 115 can be activated with a dual mode service profile capability in which the service profile for 3G offers a similar rich set of services as the service profile for 4G but with, for example, scaled back bandwidth. For example, this approach is allows central providers to offer a richer set of service offerings with 3G and then migrate the same set of service offerings to 4G but with higher performance. In particular, this approach allows 3G to 4G rich service migration to occur, for example, with the only change being the increased bandwidth settings in the service profiles that will be available in 4G at the same cost as 3G with lower service profile bandwidth settings.

[0092] In some embodiments, if the devices are multimode, a network selection policy implementation within service processor 115 is provided, or in some embodiments, a network selection policy is driven by policy decisions made in service controller 122 based on service availability reports received from service processor 115. The network selection policy allows the selection of the network that corresponds to the most desirable service profile to meet the user's service preferences. For example, if the user specifies, within the framework of the service notification and user preference feedback embodiments described below, that maximum performance is the most important factor in selecting which access network to connect to, then the best profile is likely to be the 4G network as 4G is typically faster, except perhaps, for example, if the device 100 is closer to the 3G base station so that there is a much stronger signal or if the 4G network is much more heavily loaded than the 3G network. On the other hand, if the user preference set specifies cost as the most important factor, then depending on the central provider service costs the 3G network may prove to be the most desirable service profile. This is

a simple example and many other selection criteria are possible in the network selection embodiment as discussed further below.

Network Based Service Usage Monitoring for Verification and Other Purposes

[0093] In some embodiments, if the base station data plane traffic is transmitted via the Internet 120 as discussed above, then IPDRs (Internet Protocol Detail Records, also sometimes and interchangeably referred to herein as Charging Data Records or CDRs, which as used herein refer to any network measure of service usage or service activity for voice and/or data traffic (e.g., IPDRs can include a time stamp, a device ID, and various levels of network measures of service usage for the device associated with that device ID, such as perhaps total traffic usage, network destination, time of day or device location)) are generated by and collected from the access network equipment. Depending on the specific network configuration, as discussed herein, for a WWAN network the IPDRs can be generated by one or more of the following: base station 125, RAN or transport gateways and AAA 121. In some access network embodiments, the IPDRs are transmitted to equipment functions that aggregated the IPDRs for the purpose of service billing and other functions. Aggregation can occur in the AAA, the transport gateways or other functions including the billing system 123. As discussed below, it is often the case that the IPDRs is assumed to be obtained from the AAA server 121 and/or a service usage data store 118 (e.g., a real-time service usage collection stored in a database or a delayed feed service usage collection stored in a database), or some other network function. However, this does not imply that the IPDRs may not be obtained from a variety of other network functions, and in some embodiments, the IPDRs are obtained from other network functions as disclosed herein. In some embodiments, existing IPDR sources are utilized to obtain network based service usage measures for multiple purposes including but not limited to service policy or profile implementation verification, triggering service verification error responds actions, and service notification synchronization. Certain types of IPDRs can be based on, or based in part on, what are sometimes referred to as CDRs (Charging Data Records, which can track charges for voice and data usage) or modifications of CDRs. Although the capability to monitor, categorize, catalog, report and control service usage or service activity is in general higher on the device than it is in the network, and, as described herein, device based service monitoring or control assistance is in some ways desirable as compared to network based implementations, as described herein many

embodiments take advantage of network based service monitoring or control to augment device assisted service monitoring or control and vice versa. For example, even though many embodiments work very well with minimal IPDR service usage or service activity information that is already available in a network, deeper levels of IPDR packet inspection information in general enable deeper levels of service monitoring or service control verification, which can be desirable in some embodiments. As another example, deeper levels of network capability to control service usage or service activity can provide for more sophisticated error handling in some embodiments, for example, providing for more options of the Switched Port Analyzer (SPAN) and network quarantine embodiments as described herein. As another example, in some embodiments it is advantageous to take advantage of network based service monitoring or control for those service aspects the network is capable of supporting, while using device assisted service monitoring or control for the service aspects advantageously implemented on the device.

[0094] In some embodiments, where base station data plane traffic is backhauled and concentrated in a central provider core network 110, then the IPDRs can originate in the base stations or a router or gateway in the central provider network 110, and the IPDRs are collected at the AAA server 121 and stored in the service usage data store 118. In some embodiments, the central billing system 123 collects the IPDRs from the AAA server 121 for service billing accounting purposes. In some embodiments, a central billing system 123 collects the IPDRs directly from the initial IPDR source or some other aggregator. In some embodiments, outside partners like MVNOs gain access to the IPDRs from the central billing system 123. As discussed below, it is assumed that the IPDRs are obtained from the AAA server 121, and it is understood that the source of the IPDRs is interchangeable in the embodiments.

[0095] In some embodiments, the IPDR information is used by the service processor 115, the service controller 122 and/or other network apparatus or device apparatus to implement service control verification is provided as described below. In some embodiments, an IPDR feed (e.g., also referred to as a charging data record (CDR)) flows between network elements. For example, an IPDR feed can flow from the RAN gateway 410 (e.g., SGSN 410, BSC packet control 510 or RNC 512) and the transport gateway 420 (e.g., GGSN or PDSN). In other embodiments, the IPDRs originate and flow from the base station 125 or some other

component/element in the network. In some embodiments, one or more of these IPDR feeds is transmitted to an IPDR aggregation function (e.g., also referred to as a charging gateway). For example, this aggregation function can be located in the AAA 121, in the mobile wireless center 132 (and/or in the home location register (HLR) or other similar function referred to by other common industry names), in the transport gateway 420, or in some other network element. This aggregation function collects the IPDR feeds into a database with an entry for each device 100. In some embodiments, an intermediate aggregation function is provided that feeds a higher level aggregation function, for example, the transport gateway 420 can receive IPDR feeds from the RAN gateway 410 or the base station 125 before sending them to another aggregation function. At some point in time (e.g., at the end of a specified time period, at the end of a device network connection session and/or at a specified time of day), the IPDR aggregation function sends summary information or detailed information of the IPDRs for a given device or group of devices to the billing system for billing and/or reconciliation. In some embodiments, in which the IPDR aggregation feed to the billing system is frequent enough for one or more of the IPDR information purposes described herein, the IPDR feed for the service controller 122 is derived from the aggregated feed, either by having the billing system 123 transmit it to the service controller 122, or by copying it from the IPDR aggregation function.

[0096] In some embodiments, the IPDR feed is obtained from the network function that is generating or aggregating the IPDR feed as described herein. In some embodiments, the IPDR feed is copied from the aggregation function in a manner that does not interrupt the operation of the network. For example, a switch based port analysis function can be used to copy the traffic to a traffic analysis or server element that filters out the IPDR traffic and records it to a data base that is then either pushed to the service controller 122 (or any other network element that uses IPDR information as described herein), or is queried by the service controller 122 (or any other function that uses the IPDR information as described herein). In some embodiments, if the aggregated IPDR information transmitted to the billing system is delayed from real-time traffic usage events by an amount of time that is, for example, too long for desired operation, or for any other reason that makes it less desirable to obtain the IPDR information from the same aggregated feed used for the billing system 123, the IPDR information can be collected from one or more of the sources discussed above including, for example, from another aggregation point (e.g., the feed to the charging gateway, AAA server and/or mobile wireless center/HLR), one or

more of the gateways 410, 420, 508, 512, 520, 608, 612, 620, 708, 712, 720 the base station 125 and/or another network element. In some embodiments, the IPDR feeds from these or other network functions are copied to a database as described above, which is either pushed or queried to get the information to the service controller 122 or other network elements that request the IPDR information.

[0097] In some embodiments, the service processor 115 includes various components, such as device agents, that perform service policy implementation or management functions. In some embodiments, these functions include service policy or implementation verification, service policy implementation tamper prevention, service allowance or denial, application access control, traffic control, network access control services, various network authentication services, service control plane communication, device heartbeat services, service billing, transaction billing, simplified activation services and/or other service implementations or service policy implementations. It will be apparent to those of ordinary skill in the art that the division in functionality between one device agent and another is a design choice, that the functional lines can be re-drawn in any technically feasible way that the product designers see fit, and that the placing divisions on the naming and functional breakouts for device agents aids in understanding, although in more complex embodiments, for example, it can make sense to the product designer to break out device agent functionality specifications in some other manner in order to manage development specification and testing complexity and workflow.

[0098] In some embodiments, network control of the service policy settings and services as discussed above is accomplished with the service controller 122 which in various embodiments includes one or more server functions. As with the service processor 115 agent naming and functional break out, it is understood that service controller 122 server naming and functional breakout is also a design choice and is provided mainly to aid in the discussion. It will be apparent to those of ordinary skill in the art that the server names and functional breakouts do not imply that each name is an individual server, and, for example, a single named function in the various embodiments can be implemented on multiple servers, or multiple named functions in the various embodiments can be implemented on a single server.

[0099] As shown, there are multiple open content transaction partner sites 134 (e.g., open content transaction servers), which represent the websites or experience portals offered by content partners or ecommerce transaction partners of the service provider. For example, transaction servers 134 can provide an electronic commerce offering and transaction platform to the device. In some embodiments, the central provider has ownership and management of the service controller 122, so the central provider and the service provider are the same, but as discussed below the service provider that uses the service controller 122 to manage the device services by way of service processor 115 is not always the same as the central provider who provides the access network services.

[00100] In some embodiments, further distribution of central provider access networking functions such as access network AAA server 121, DNS/DHCP server 126, and other functions are provided in the base stations 125. In some embodiments, network based device service suspend/resume control are also provided in the base stations 125 (or in some embodiments, for hierarchical or overlay networks, this function is provided by one or more of the following: RAN gateways, transport gateways, AAA 121 or some other network function). As shown, the following are connected (e.g., in network communication with) the central provider network 110: central provider billing system 123, dedicated leased lines 128 (e.g., for other services/providers), central provider service controller 122, a content management (e.g., content switching, content billing, and content catching) system 130, central provider DNS/DHCP server 126, access network AAA server 121, service usage data store 118 and central provider mobile wireless center 132. These embodiments may be advantageous particularly for flat networks as that shown in FIG. 1 that are provided by the present invention.

[00101] In some embodiments, the base stations 125 implement a firewall function via firewall 124 and are placed directly onto the local loop Internet for backhaul. Voice traffic transport is provided with a secure protocol with Voice Over IP (VOIP) framing running over a secure IP session, for example, Virtual Private Network (VPN), IP Security (IPSEC) or another secure tunneling protocol. In some embodiments, the VOIP channel employs another layer of application level security on the aggregated VOIP traffic trunk before it is placed on the secure IP transport layer. Base station control traffic and other central provider traffic can be provided in a number of ways with secure transport protocols running over Transmission Control Protocol

(TCP), Internet Protocol (IP) or User Datagram Protocol (UDP), although TCP provides a more reliable delivery channel for control traffic that is not as sensitive to delay or jitter. One example embodiment for the control channel is a control link buffering, framing, encryption and secure transport protocol similar to that described below for the service control link between a device and the network. In some embodiments, a service control heartbeat function is provided to the base stations 125 similar to that implemented between the service controller 122 and the service processor 115 as described below. If the need to maintain a bandwidth efficient control plane channel between the base stations and the central provider base station control network is not as critical as it is in the case of access network connection to the device, then there are many other approaches for implementing a secure control channel over the Internet including, for example, one or more of various packet encryption protocols running at or just below the application layer, running TCP Transport Layer Security (TLS), and running IP level security or secure tunnels.

[00102] In some embodiments, the device based services control plane traffic channel between the service processor 115 and the service controller 122 is implemented over the same control plane channel used for the flat base station control architecture, or in some embodiments, over the Internet. As discussed below, it is assumed that the device bases services control plane channel for service processor 115 to service controller 122 communications is established through the Internet 120 or through the access network using IP protocols as this is the more general case and applies to overlay network applications for various embodiments as well as applications where various embodiments are used to enable flattened access networks.

[00103] In some embodiments, by enabling the device to verifiably implement a rich set of service features as described herein, and by enabling the base station 125 to connect directly to the Internet 120 with a local firewall for device data traffic, tunnel the voice to a voice network with VOIP and secure Internet protocols, and control the base station 125 over a secure control plane channel using base station control servers located in a central provider network, base stations 125 can be more efficiently provisioned and installed, because, for example, the base station 125 can accommodate a greater variety of local loop backhaul options. In such embodiments, it is advantageous to perform certain basic network functions in the base station 125 rather than the central provider network.

[00104] In some embodiments, a basic device suspend/resume function for allowing or disallowing the device Internet access is provided by the base stations 125 (or in some embodiments, for hierarchical or overlay networks in some embodiments this function is provided by one or more of the following: RAN gateways, transport gateways, AAA 121 or some other network function). This functionality, as will be discussed below, is important for certain embodiments involving taking action to resolve, for example, service policy verification errors. In some embodiments, this function is performed at the base station (e.g., base stations 125) thereby eliminating the need for a more complex networking equipment hierarchy and traffic concentration required to perform the suspend/resume function deeper in the network. Access network base stations control media access and are therefore designed with awareness of which device identification number a given traffic packet, group of packets, packet flow, voice connection or other traffic flow originates from and terminates to. In some embodiments, the suspend/resume function is implemented in the base station 125 by placing an access control function in the traffic path of each device traffic flow. The suspend resume function can be used by various network elements, and in the context of the present embodiment can be used by the service controller 122 (e.g., in some embodiments, access control integrity server 1654 (FIG. 16) of service controller 122 or other service controller elements) to suspend and resume device service based on the assessment of the service policy implementation verification status as described below.

[00105] In some embodiments, at least a basic traffic monitoring or service monitoring function is performed at the base station (e.g., base stations 125) similar to the service history records or IPDRs collected deeper in the network in more conventional hierarchical access network infrastructure architectures. For example, the service or traffic monitoring history records are advantageous for tracking device network service usage or service activity behavior and for certain verification methods for device based service policy implementation or higher device based services as discussed below. In some embodiments, a traffic monitoring function is provided in the base station 125 in which the traffic for each device is at least counted for total traffic usage and recorded. In some embodiments, traffic inspection beyond simply counting total traffic usage is provided. For example, the base station traffic monitor can record and report IP addresses or include a DNS lookup function to report IP addresses or IP addresses and associated Uniform Resource Locators (URLs). Another example allows the base station 125 to

attach location data to the IPDR to provide device location data in the records. In some embodiments, traffic inspection includes recording deeper levels of traffic or service monitoring.

[00106] In some embodiments, device traffic associated with service verification conditions indicating service usage is out of policy or profile limits or allowances is routed to a quarantine network rather than or as an initial alternative to a suspending service. For example, the advantages for this approach and a more detailed description of the quarantine network are discussed below. In some embodiments, the quarantine network capability is provided for in which rather than simply suspending device traffic completely from the network as described above, the base station 125 includes a firewall function (e.g., firewall 124) that is capable of passing device access traffic with the quarantine network destinations and blocking device access to all other destinations. In some embodiments, when it is discovered that service verification conditions indicate that service usage is out of policy or profile limits or allowances, then one or more of the following actions are taken: the user is notified of the overage condition, the user is required to acknowledge the overage condition, the user account is billed for the overage condition, and the device is flagged for further analysis by a network device analysis function or a network manager.

[00107] In some embodiments, network complexity is reduced using the device without moving completely to a flat base station network as described above. Device participation in the core network services implementation provides for numerous measures for simplifying or improving network architecture, functionality or performance. For example, two approaches are discussed below ranging from a simple overlay of the service processor 115 onto devices and the service controller 122 in a conventional hierarchical access network as illustrated in FIGS. 4 through 7, to a completely flat network as illustrated in FIGS. 1 through 3 and 8. Those of ordinary skill in the art will appreciate that the disclosed embodiments provided herein can be combined with the above embodiments and other embodiments involving flat network base stations to provide several advantages including, for example, richer service capability, less access network complexity, lower access network expenses, more flexible base station deployments, or less complex or less expensive base station back haul provisioning and service costs.

[00108] In most of the discussion that follows, the network based service history records and the network based suspend-resume functionality used in certain embodiments involving service implementation verification are assumed to be derived from the device service history 1618 (as shown in FIG. 16) central provider network element and the AAA server 121 central provider network element, and in some embodiments, working in conjunction with other central provider network elements. It is understood that these functions provided by the network can be rearranged to be provided by other networking equipment, including the base station as discussed above. It is also understood that the network based device traffic monitoring, recording and reporting to the device service history 1618 element can be accomplished at the base stations. Furthermore, it is understood that while the AAA server 121 is assumed to provide the suspend/resume functionality, quarantine network routing or limited network access called for in some embodiments, the AAA server 121 can be a management device in which the actual implementation of the traffic suspend/resume, firewall, routing, re-direction forwarding or traffic limiting mechanisms discussed in certain embodiments can be implemented in the base stations as discussed above or in another network element.

[00109] In some embodiments, an activation server 160 (or other activation sequencing apparatus) provides for provisioning, as described below, of the devices 100 and/or network elements in the central provider network so that, for example, the device credentials can be recognized for activation and/or service by the network. In some embodiments, the activation server 160 provides activation functions, as described below, so that, for example, the devices can be recognized by the network, gain access to the network, be provided with a service profile, be associated with a service account and/or be associated with a service plan. As shown in FIG. 1, the activation server 160 is connected to the central provider core network 110. In this configuration, the activation server 160 acts as, an over the network or over the air, activation function. In some embodiments, the activation server 160, or variations of the activation server 160 as described below, is connected to apparatus in the manufacturing or distribution channel, or over the Internet 120, or as part of the service controller 122 to service provisioning or activation functions. In some embodiments, the activation server 160 is connected to the central provider core network 110. In some embodiments, the activation server 160 is connected to other network extensions such as an MVNO network or the Internet 120 if, for example, the routers in the service gateways or base stations have the capability to direct traffic from devices

that are not fully activated or provisioned to an Internet destination, or if the service processor 115 is used for such direction. In some embodiments, the activation server 160 is included in the service controller 122.

[00110] FIG. 2 illustrates another simplified (e.g., "flattened") network architecture including an MVNO (Mobile Virtual Network Operator) relationship in accordance with some embodiments. As shown, an open MVNO configuration is provided in a simplified network as similarly described above with respect to FIG. 1. In some embodiments, the service provider (e.g., service owner) is defined by the entity that maintains and/or manages the service controller 122 associated with and controlling the service processors 115 that are inside the devices 100 using the service. In some embodiments, the service controller 122 requires only a non-real time relatively low data rate secure control plane communication link to the service processors 115. Accordingly, in some embodiments, the service controller 122 servers can reside in any network that can connect to (e.g., be in network communication with) the Internet 120. For example, this approach provides for a more efficient provisioning of the equipment used to set up an MVNO partnership between the central provider and the service provider, and as shown in FIG. 2, an MVNO network 210 is in network communication with the Internet 120 just as with the central provider network 110 is in network communication with the Internet 120. As shown, the following are connected to (e.g., in network communication with) the MVNO core network 210: MVNO billing system 123, MVNO service controller 122, MVNO content management system 130, MVNO DNS/DHCP server 126, MVNO AAA server 121, and MVNO mobile wireless center 132.

[00111] By showing two service controllers 122, one connected to (e.g., in network communication with) the MVNO network 210 and one connected to the central provider network 110, FIG. 2 also illustrates that some embodiments allow two entities on the same access network to each use the service controller 122 and service processor 115 to control different devices and offer different or similar services. As described below, the unique secure communication link pairing that exists between the two ends of the service control link, 1691 and 1638 (as shown in FIG. 16), ensure that the two service controllers 122 can only control the devices associated with the correct service provider service profiles.

[00112] FIG. 3 illustrates another simplified (e.g., "flattened") network architecture including two central providers in accordance with some embodiments. For example, this provides for roaming agreements while maintaining rich services across different networks with completely different access layers. As shown, the mobile devices 100 are assumed to have a dual mode wireless modem that will operate on both a 4G network, for example LTE or WiMax, and a 3G network, for example HSPA or EVDO. One example roaming condition would be both Central Provider #1 and Central Provider #2 providing 3G and 4G network resources. In this example, the mobile devices 100 can connect to both 3G and 4G base stations 125 owned and operated by the central provider with whom they have signed up for service, or when neither is available from the central provider the user signed up with the device can roam onto the other central provider access network and still potentially offer the same rich service set using the same service profiles provided, for example, the roaming service costs are reasonable. In some embodiments, if roaming service costs are significantly more expensive than home network service costs, then the service processor 115 is configured with a roaming service profile that reduces or tailors service usage or service activity through a combination of one or more of user notification, user preference feedback regarding traffic shaping or service policy management preference collected and acted on by service processor 115, adaptive policy control in service processor 115 that tracks increasing roaming service costs and scales back service, or recognition of the change in network that causes the service controller 122 to configure service processor 115 of device 100 with a roaming service profile. In some embodiments, in roaming situations, network selection can be based on an automatic network selection with network selection being determined, for example, by a combination of user service profile preferences, service provider roaming deals and/or available roaming network capabilities and cost, as discussed further below.

[00113] In some embodiments, the devices 100 are again assumed to be multimode 3G and 4G devices (e.g., the mobile devices 100 are assumed to have a dual mode wireless modem that will operate on both a 4G network, for example LTE, and a 3G network, for example HSPA or EVDO), with the devices 100 being billed for service by Central Provider #1 being, for example, EVDO and LTE capable, and the devices 100 being billed for service by Central Provider #2 being, for example, HSPA and LTE capable. For example, the devices 100 can roam using the 4G LTE network of the roaming central provider when neither the 3G nor 4G

networks are available with the home central provider. As similarly discussed above with respect to the above described roaming embodiments, the service processors 115 and service controllers 122 are capable of providing similar services on the 4G roaming network and the 3G home network as on the 4G home network, however, the varying costs and available network capacity and speed differences of 3G home, 4G roaming and 4G home may also encourage the use of different, such as three different, service profiles to allow for the most effective and efficient selection and control of services based on the current network.

[00114] FIG. 4 illustrates a network architecture including a Universal Mobile Telecommunications System (UMTS) overlay configuration in accordance with some embodiments. As shown, FIG. 4 includes a 4G/3G/2G HSPA/Transport access network operated by a central provider and two MVNO networks 210 operated by two MVNO partners. In some embodiments, the central provider can offer improved service capabilities using a conventional UMTS network. As shown, the base stations 125 do not connect directly to the Internet 120, and instead the base stations 125 connect to the conventional UMTS network. However, as in various previous embodiments, the service processor 115 still connects through the secure control plane link to service controller 122. In some embodiments, the data plane traffic is backhauled across the various UMTS network routers and gateways as is the control plane traffic, and the IPDRs are obtained from the access network AAA server 121. Referring now to the 4G/3G/2G HSPA/Transport access network as shown in FIG. 4, the LTE/HSPA and HSPA/GPRS base stations/nodes 125 are in communication with 4G/3G/2G Service/Serving GPRS Support Nodes (SGSNs) cluster 410 via a radio access network 405, which are in communication with 4G/3G/2G Gateway GPRS Support Nodes (GGSNs) cluster 420 via an access transport network 415 (e.g., a GPRS-IP network), which are then in communication with central provider core network 110.

[00115] As shown in FIG. 4, as discussed elsewhere, service usage data store 118 is a functional descriptor for a network level service usage information collection and reporting function located in one or more of the networking equipment boxes attached to one or more of the sub-networks in the figure (e.g., RAN, transport and/or core networks). As shown in FIG. 4, service usage 118 is shown as an isolated function connected to the central provider core network 110 and the intention of this depiction is to facilitate all the possible embodiments for

locating the service usage 118 function. In some UMTS network embodiments, the service usage 118 function is located or partially located in the GGSN gateway (or gateway cluster) 420. In some embodiments, service usage 118 functionality is located or partially located in the SGSN gateway (or gateway cluster) 410. In some embodiments, service usage 118 functionality is located or partially located in the equipment cluster that includes the AAA 121 and/or the mobile wireless center 132. In some embodiments, service usage 118 functionality is located or partially located in the base station, base station controller and/or base station aggregator, collectively referred to as base station 125 in FIG. 4 and many other figures described herein. In some embodiments, service usage 118 functionality is located or partially located in a networking component in the transport network 415, a networking component in the core network 110, the billing system 123 and/or in another network component or function. This discussion on the possible locations for the network based service usage history logging and reporting function can be easily generalized to all the other figures described herein by one of ordinary skill in the art (e.g., RAN Gateway 410 and/or Transport Gateway 420), and this background will be assumed even if not directly stated in all discussion above and below.

[00116] In some embodiments, a central provider provides open development services to MVNO, Master Value Added Reseller (MVAR) and/or Original Equipment Manufacturer (OEM) partners. In some embodiments, all three service providers, central provider service provider, MVNO #1 service provider and MVNO #2 service provider have service control and billing control of their own respective devices 100 through the unique pairing of the service processors 115 and service controllers 122. For example, MVNO #1 and MVNO #2 can each have open development billing agreements with the central provider and each can own their respective billing systems 123. As shown in FIG. 4, MVNO #1 core network 210 is in communication with the central provider core network 110 via the Internet 120, and MVNO #2 core network 210 is in communication with the central provider core network 110 via an alternate landline(LL)/VPN connection 425. In some embodiments, the two MVNOs each offer completely different devices and/or services, and the devices and/or services also differ significantly from those offered by the central provider, and the service profiles are adapted as required to service the different devices and respective service offerings. In addition, the central billing system 123 allows all three service provider user populations to access ecommerce experiences from transaction provider partners operating transaction servers 134, to choose

central provider billing options that combine their third party transaction bills on their service provider bill, and each subscriber population can experience a service provider specified look and feel that is unique to the respective service provider even though the different user populations are interfacing to the same transaction servers and the transaction partners do not need to require significant custom development to provide the unique central billing and unique consistent user experience look and feel.

[00117] In some embodiments, a central provider offers open network device and service developer services using one service controller server 122 (e.g., a service controller server farm) and allows the open development partners to lease server time and server tools to build their own service profiles. The central provider also provides service billing on behalf of services to the open development partners. For example, this reduces costs associated with setting up an MVNO network for the open development partners and does not require the partners to give up significant control or flexibility in device and/or service control.

[00118] FIG. 5 illustrates a network architecture including an Evolution Data Optimized (EVDO) overlay configuration in accordance with some embodiments. This figure is similar to FIG. 4 except for the various particular variations of the EVDO network architecture as compared to the HSPA/GPRS wireless access network architecture as will be apparent to one of ordinary skill in the art. As shown, FIG. 5 includes an EVDO access network operated by a central provider and two MVNO networks 210 operated by two MVNO partners. The EVDO access network includes LTE/EVDO and EVDO/1xRTT base stations 125 in communication with Base Station Controller (BSC) packet control 508 and radio network controller 512 via a radio access network (RAN) 505, which are in communication with packet data service node 520 via an access transport network 515, which is in communication with central provider core network 110. As shown, a RAN AAA server 521 is also in communication with the access transport network 515.

[00119] In some embodiments, the central provider can offer improved service capabilities using a wireless access network. As shown, the base stations 125 do not connect directly to the Internet 120, and instead the base stations 125 connect to the wireless access network. However, as in various previous embodiments, the service processor 115 still connects through the secure

control plane link to service controller 122. In some embodiments, the data plane traffic is backhauled as shown across the various network routers and gateways as is the control plane traffic, and the IPDRs are obtained from the access network AAA server 121.

[00120] FIG. 6 illustrates a network architecture including a 4G LTE and Wi-Fi overlay configuration in accordance with some embodiments. This figure is also similar to FIG. 4 except for the various particular variations of the 4G LTE/Wi-Fi network architecture as compared to the HSPA/GPRS wireless access network architecture as will be apparent to one of ordinary skill. As shown, FIG. 6 includes a 4G LTE and Wi-Fi access network operated by a central provider and two MVNO networks 210 operated by two MVNO partners. The 4G LTE/Wi-Fi access network as shown includes LTE eNodeB and HSPA/EVDO base stations 125 in communication with Base Station Controller (BSC) packet control (EVDO & 1xRTT) 608 and SGSN (HSPA & GPRS) 612 via a radio access network (RAN) 605, which are in communication with System Architecture Evolution (SAE) Gateway (GW) 620 via an access transport network 615, which is then in communication with central provider (core) network 110. As shown, a Mobile Management Entity (MME) server 619 is also in communication with the access transport network 615. Also as shown, a Wi-Fi Access Point (AP) 602 is also in communication with the access transport network 615 via Wi-Fi Access Customer Premises Equipment (CPE) 604. As will be apparent to those of ordinary skill in the art, the embodiments of network architectures shown, for example, in FIGS. 1-8 are exemplary network architecture embodiments in which one or more of the shown network elements may not be required or included, alternative network elements included, and/or additional network elements included based on network design choices, network standards and/or other functional/design considerations and choices.

[00121] In some embodiments, the central provider can offer improved service capabilities using the wireless access network as depicted in FIG. 6. As shown, the base stations 125 do not connect directly to the Internet 120, and instead the base stations 125 connect to the wireless access network. However, as in various previous embodiments, the service processor 115 still connects through the secure control plane link to service controller 122. In some embodiments, the data plane traffic is backhauled as shown across the various network routers and gateways as is the control plane traffic, and the IPDRs are obtained from the access network AAA server 121.

Accordingly, as shown in FIGS. 4 through 6, various embodiments can be implemented independent of the wireless access network technology, and for example, can be implemented in 3G, 4G and any other wireless access network technology.

[00122] FIG. 7 illustrates a network architecture including a WiMax and Wi-Fi overlay configuration in accordance with some embodiments. This figure is also similar to FIG. 4 except for the various particular variations of a combined WiMax/Wi-Fi network as compared to the HSPA/GPRS wireless access network architecture as will be apparent to one of ordinary skill in the art. As shown, FIG. 7 includes both a WiMax and Wi-Fi network (e.g., a combined WiMax/Wi-Fi network) operated by a central provider and two MVNO networks 210 operated by two MVNO partners. Although the Wi-Fi and WiMax access technologies are different wireless access networking technologies, with WiMax providing a wide area networking technology and Wi-Fi providing a local area networking technology, which efficiently operates using the two wireless access networking capabilities. As similarly discussed above with respect to the switching between 3G and 4G networks, some embodiments employ the automatic network selection capability as described above to choose the best available network service profile, and, for example, the user can force the decision or the service controller can make the decision. For example, if free Wi-Fi services have adequate coverage, in most cases, the decision criteria programmed into the automatic network selection algorithm will select Wi-Fi as long as the Wi-Fi access points are associated with a known and trusted provider. In some embodiments, transaction billing from central provider billing system 123 or MVNO #1 or MVNO #2 billing systems 123 will work with the transaction servers when connected over Wi-Fi just as when connected over any other access technology (including wire line based connections). The WiMax/Wi-Fi access network as shown includes WiMax base stations 125, Wi-Fi access points/hotspots 702 and/or Wi-Fi mesh access networks 702 (in some embodiments, femto cells can be used in addition to and/or as an alternative to Wi-Fi), and Wi-Fi access customer-premises equipment (CPE) 704 in communication with WiMax service controller 708 and Wi-Fi service controller 712 via a radio access network 705, which are in communication with WiMax core gateway 720 via an access transport network 715, which is then in communication with central provider (core) network 110.

[00123] In some embodiments, the central provider can offer improved service capabilities using the wireless access network as depicted in FIG. 7. As shown, the base stations 125 do not connect directly to the Internet 120, and instead the base stations 125 connect to the wireless access network. However, as in various previous embodiments, the service processor 115 still connects through the secure control plane link to service controller 122. In some embodiments, the data plane traffic is backhauled as shown across the various network routers and gateways as is the control plane traffic, and the IPDRs are obtained from the access network AAA server 121.

[00124] Referring to FIG. 7, the Wi-Fi connection can be replaced with a femto cell (and the Wi-Fi modem shown in FIGS. 15D and 15E can be replaced with a femto cell modem (base station side functionality)). In some embodiments, the service processor 115 is provided on the femto cell to control subscriber access in a verifiable manner as similarly described herein with respect to various embodiments (e.g., the Wi-Fi related embodiments). For example, the femto cell service provider (e.g., the entity that owns the spectrum the femto cell is using) can operate the femto cell as a local access mechanism for the home subscriber (or other who purchased or installed the femto cell), and then also use it to provide pay-for-service or additional free services, with controlled access and/or traffic control and/or service control and/or billing control performed locally or in combination with network equipment as described herein. In some embodiments, the WWAN devices being used at home or work with the femto cell include a portion of the service processor functionality. For example, this allows the service provider for femto cells to provide service and monetize service in a controlled way even though the femto cell is not connected to the service provider network the way conventional base stations are connected to the service provider network, but is connected through the Internet 120. For example, the secure heartbeat function can be extended to include data traffic so that it is encrypted and secured along with the control plane traffic. The decision of whether or not to admit a device onto the femto cell can be made through the service processor 115 connection to the service controller 122 and subsequent look up of the credentials for the device and the associated service plan and service profile that is then programmed into the service processor on the femto cell and/or the device itself. The femto cell can also offer a landing page to devices through the service processor so that devices that do not belong to the network can gain access to the network by signing up over the femto cell. For example, the intermediate device embodiments for Wi-Fi on one end and WWAN on the other can be accomplished by using the

Wi-Fi connection in the cell phone in AP mode so that it becomes the intermediate device. The service processor 115 on the cell phone can then act in the same manner as described for the intermediate device as described herein.

[00125] FIG. 8 illustrates another simplified (e.g., "flattened") network architecture including multiple wireless access networks (e.g., 3G and 4G Wireless Wide Area Networks (WWANs)) and multiple wire line networks (e.g., Data Over Cable Service Interface Specification (DOCSIS) and Digital Subscriber Line Access Multiplexer (DSLAM) wire line networks) in accordance with some embodiments. It is a common network architecture for multi-access central providers to have one or more wired access networks and one or more wireless access networks. As shown, FIG. 8 includes both 3G and 4G wireless access networks, including a 4G base station 125 and a 3G base station 125, and both DOCSIS and DSLAM wire line networks (e.g., a combined WWAN/wire line network), including DOCSIS Head End 125 and DSLAM 125, operated by a central provider via central provider (core) network 110 and an MVNO partner via MVNO network 210 via the Internet 120.

[00126] As shown, the service processor 115 can reside on a number of different types of devices 100 that work on 3G or 4G wireless, DSL or DOCSIS, and the service controller 122 is capable of controlling each of these types of devices with a consistent service experience, for example, using different service profiles, service capabilities and service profile cost options depending on which network the device is connected to and/or other criteria. For example, a download of a High Definition (HD) movie can be allowed when the service controller 122 is managing service profile policies for a service processor 115 residing on a DOCSIS device 100 (e.g., a computer or laptop connected to a cable modem), but not when the same service controller 122 is managing service profile policies for a service processor 115 residing on a 3G device 100 (e.g., a smart phone connected to a mobile 3G network).

[00127] As will now be apparent to one of ordinary skill in the art in view of the above description of FIGS. 1 through 8, the present invention can be provided across any access network and a set of service profiles can be defined in a variety of ways including, for example, to user preference feedback, access network performance, access network cost, access network central provider partnership status with the service provider central provider and roaming deals

and costs. For example, as discussed below, various embodiments allow for users to have superior service experiences based on the ability to control certain of their service settings, and service providers can also more efficiently deploy a greater variety of services/service plans to users.

[00128] In some embodiments, the service processor 115 and the service controller 122 provide an overlay for existing networks without significantly changing the billing system 123, gateways/routers or other network components/elements, and also provide verifiable service monitoring to control services and/or service usage/costs without involving, for example, a service provider or MVNO (e.g., for smart phone devices and/or laptops or netbooks (or any other network accessible device) with an unlimited data plan or any other service plan). For example, applications that are deployed by device owners or service subscribers (e.g., an IT manager) and do not involve a service provider include roaming services provided as an after-market product without carrier/service provider involvement. In this example, device activity is recorded by the service processor 115 and transmitted to the service controller 122 (e.g., the IT manager controls the service controller 122). In another example, a third party after-market product is provided in which the service controller 122 is hosted by the third party and the device management entity (e.g., the IT manager or parents of the device user for parental controls) uses a secure Virtual Service Provider (VSP) website to control the devices that belong to that management entity's device partition (e.g., VSP partitions and techniques are described below with respect to FIG. 49). The VSP secure website techniques described herein can also be applied to service provider owned servers with device partitions for the purpose of controlling, for example, Deep Packet Inspection (DPI) controllers (e.g., DPC policy implementation 5402 as shown in FIG. 54) to provide similar or substantially equivalent service usage/control capabilities using network based service control techniques, as similarly described in detail below with respect to FIGS. 49 and 54 (e.g., IT manager VSP control of a group partition and/or MVNO VSP control of a group partition).

Service Processor Configurations for Devices

[00129] FIG. 9 illustrates a hardware diagram of a device 100 that includes a service processor 115 in accordance with some embodiments. As shown in FIG. 9, the service processor

115 is stored in a non volatile memory 910 and a memory 920 of the device 100. As will be appreciated by those of ordinary skill in the art, the present invention can operate with virtually any device architecture, and the device architectures discussed herein (e.g., with respect to FIGS. 9-14 and 15A-15F) are examples of various implementations on certain devices (e.g., of different representations of device 100).

[00130] As shown in FIG. 9, device 100 also includes a processor 930, sometimes referred to as a CPU or central processor unit, an APU or application processor unit, a core processor, a computing device, or many other well known terms. In some embodiments, device 100 includes one or more processors and/or a multicore processor. As shown, processor 930 includes a sub-processor 935. In some embodiments, processor 930 and/or sub-processor 935 are based on an architecture sometimes referred to as a complex instruction set computer or CISC, a reduced instruction set computer or RISC, a parallel processor, a combination of two or more architectures or any other processor architecture. In some embodiments, processor 930 has a design that is based on logic and circuitry from one or more standard design library or published architecture, or includes specialized logic and circuitry designed for a given device 100 or collection of such devices. In some embodiments, a device includes more than one processor and/or sub-processor, and in such a device, one processor and/or sub-processor can have one architecture while another may have a somewhat different or completely different architecture. In some embodiments, one or more of the processors and/or sub-processors can have a general purpose architecture or instruction set, can have an architecture or instruction set that is partially general or partially specialized, or can have an instruction set or architecture that is entirely specialized. In some embodiments, a device includes more than one processor and/or sub-processor, and in such a device, there can be a division of the functionality for one or more processors and/or sub-processors. For example, one or more processors and/or sub-processors can perform general operating system or application program execution functions, while one or more others can perform communication modem functions, input/output functions, user interface functions, graphics or multimedia functions, communication stack functions, security functions, memory management or direct memory access functions, computing functions, and/or can share in these or other specialized or partially specialized functions. In some embodiments, any processor 930 and/or any sub-processor 935 can run a low level operating system, a high level operating system, a combination of low level and high level operating systems, or can include

logic implemented in hardware and/or software that does not depend on the divisions of functionality or hierarchy of processing functionality common to operating systems.

[00131] As shown in FIG. 9, device 100 also includes non-volatile memory 910, memory 920, graphics memory 950 and/or other memory used for general and/or specialized purposes. As shown, device 100 also includes a graphics processor 938 (e.g., for graphics processing functions). In some embodiments, graphics processing functions are performed by processor 930 and/or sub-processor 935, and a separate graphics process 938 is not included in device 100. As shown in FIG. 9, device 100 includes the following modems: wire line modem 940, WWAN modem 942, USB modem 944, Wi-Fi modem 946, Bluetooth modem 948, and Ethernet modem 949. In some embodiments, device 100 includes one or more of these modems and/or other modems (e.g., for other networking/access technologies). In some embodiments, some or all of the functions performed by one or more of these modems are performed by the processor 930 and/or sub processor 935. For example, processor 930 can implement some or all of certain WWAN functional aspects, such as the modem management, modem physical layer and/or MAC layer DSP, modem I/O, modem radio circuit interface, or other aspects of modem operation. In some embodiments, processor 930 as functionality discussed above is provided in a separate specialized processor as similarly shown with respect to the graphics and/or multimedia processor 938.

[00132] As also shown in FIG. 9, device 100 includes an internal (or external) communication bus structure 960. The internal communication bus structure 960 generally connects the components in the device 100 to one another (e.g., allows for intercommunication). In some embodiments, the internal communication bus structure 960 is based on one or more general purpose buses, such as AMBA, AHP, USB, PCIe, GPIO, UART, SPI, I^2C, Fire wire, DisplayPort, Ethernet, Wi-Fi, Bluetooth, Zigbee, IRDA, and/or any other bus and/or I/O standards (open or proprietary). In some embodiments, the bus structure is constructed with one or more custom serial or parallel interconnect logic or protocol schemes. As will be apparent to one of ordinary skill in the art, any of these or other bus schemes can be used in isolation and/or in combination for various interconnections between device 100 components.

[00133] In some embodiments, all or a portion of the service processor 115 functions disclosed herein are implemented in software. In some embodiments, all or a portion of the service processor 115 functions are implemented in hardware. In some embodiments, all or substantially all of the service processor 115 functionality (as discussed herein) is implemented and stored in software that can be performed on (e.g., executed by) various components in device 100. FIG. 9 illustrates an embodiment in which service processor 115 is stored in device memory, as shown, in memory 920 and/or non-volatile memory 910, or a combination of both. In some embodiments, it is advantageous to store or implement certain portions or all of service processor 115 in protected or secure memory so that other undesired programs (and/or unauthorized users) have difficulty accessing the functions or software in service processor 115. In some embodiments, service processor 115, at least in part, is implemented in and/or stored on secure non-volatile memory (e.g., non volatile memory 930 can be secure non-volatile memory) that is not accessible without pass keys and/or other security mechanisms. In some embodiments, the ability to load at least a portion of service processor 115 software into protected non-volatile memory also requires a secure key and/or signature and/or requires that the service processor 115 software components being loaded into non-volatile memory are also securely encrypted and appropriately signed by an authority that is trusted by a secure software downloader function, such as service downloader 1663 as discussed below (and as shown in FIG. 16). In some embodiments, a secure software download embodiment also uses a secure non-volatile memory. Those of ordinary skill in the art will also appreciate that all memory can be on-chip, off-chip, on-board and/or off-board. In some embodiments, the service processor 115 which as shown in FIG. 9 is stored or implemented in non volatile memory 910 and memory 920, can be implemented in part on other components in device 100.

[00134] As shown, device 100 also includes a user interfaces device component 980 for communicating with user interface devices (e.g., keyboards, displays and/or other interface devices) and other I/O devices component 985 for communicating with other I/O devices. User interface devices, such as keyboards, display screens, touch screens, specialized buttons or switches, speakers, and/or other user interface devices provide various interfaces for allowing one or more users to use the device 100.

[00135] FIG. 10 illustrates another hardware diagram of a device 100 that includes a service processor 115 in accordance with some embodiments. As shown in FIG. 10, the service processor 115 is implemented on the processor 930 of the device 100. In some embodiments, this implementation can be in part or whole accomplished in software stored, implemented and/or executed on the processor 930. In some embodiments, the implementation and/or execution can be in part or whole accomplished in hardware that is on the processor 930. While the service processor 115 is shown in FIG. 10 as stored, implemented and/or executed on the processor 930, in other embodiments, the service processor 115 is implemented in part on other components in device 100, for example, as discussed below.

Service Processor Implemented on a Communications Modem

[00136] FIG. 11 illustrates another hardware diagram of a device 100 that includes a service processor 115 in accordance with some embodiments. As shown in FIG. 11, the service processor 115 is implemented on the WWAN modem 942 of the device 100. In some embodiments, this implementation can be in part or whole accomplished in software stored, implemented and/or executed on the WWAN modem 942. In some embodiments, the implementation and/or execution can be in part or whole accomplished in hardware that is on the WWAN modem 942. In some embodiments, service process 115 is implemented on another modem component of device 100 and/or one or more of the modem components of device 100.

[00137] In some embodiments, the service processor 115 is implemented on a modem processor (e.g., WWAN modem 942 or WWAN/Wi-Fi modem), and the service processor 115 can be installed and/or executed in protected and/or secure memory or processor hardware on the modem. The modem memory can be made robust to hacking or tampering and, in some embodiments, is only accessible from a secure network management channel or secure device management port and not by most end users. In some embodiments, a portion of the service processor 115 is implemented on a modem processor (e.g., WWAN modem 942 hardware or software), and a portion of the service processor 115 is implemented on another device 100 processor 930. For example, the device service monitor agent 1696 and one or more service usage measurement points (see discussion associated with FIG. 21) can be implemented on a modem processor, and other service processor 115 elements can be implemented in the main

device operating system processor 930. As another example, a second (or first) service monitor agent 1696 and one or more service usage measurement points can be implemented on a modem processor, and a first (or second) service monitor 1696 with one or more service measurement points can be implemented on the main operating system processor 930 for device 100. For example, such embodiments can be configured to provide a service usage measurement and reporting system that offers a diversified countermeasure to protect against hacking, tampering or other errors for device based service usage measurements that can be made harder to hack or tamper with than certain software embodiments on the processor 930. For example, such embodiments can be employed when one or more of the following capabilities are not available: network based service usage measures, network based service profile or policy implementation verification measures, and network based service usage verification error response action capabilities.

[00138] In some embodiments, certain portions of the service processor 115 that deal with application layer service monitoring or traffic flow identification (e.g., tagging or traffic flow shaping as disclosed elsewhere) are implemented on a main processor 930, and other portions of the service processor 115 are implemented on a modem processor (e.g., WWAN modem 942).

[00139] In some embodiments, the WWAN modem is a wide area access technology modem such as 2G, 2.5G, 3G or 4G. As discussed above and below, the connection to the WWAN modem 942 can be a connection internal to device 100, for example a USB, GPIO, AMBA or other bus, or can be a connection that extends external to the device such as for example a USB, Ethernet, Wi-Fi, Bluetooth or other LAN or PAN connection. Three example embodiments in which the bus is internal to the device are as follows: a PCIe modem card running over USB or PCIe, a GPIO connection running from a processor 930 chipset to a modem chipset inside a mobile device, or a Wi-Fi connection running from a Wi-Fi modem inside of device 100 to an intermediate modem or networking device combination that forwards the access network traffic between the access network connection and the device via the Wi-Fi connection. In some embodiments, in addition to the service processor 115 being implemented on the WWAN modem 942 either internal or external to the device 100, similarly service processor 115 can be implemented on a wire line modem 940, such as DSL, Cable or fiber, another wireless LAN or PAN modem, such as Wi-Fi, Zigbee, Bluetooth modem 948, White Space, or some other

modem, connected internal to device 100 or external to device 100 via a LAN or PAN extension of internal or external communications bus structure 960.

[00140] In some embodiments, a complete turn-key reference design product for the device modem (one or more of 942, 946, 948, 949, 944, 940) combined with a built-in service processor 115, possibly with a well defined and documented application interface and a well defined and documented service processor developers kit (SPDK) provides for a powerful product embodiment for the purpose of achieving mass market distribution and usage for the modem with service processor 115 and associated service controller 122 features. For example, embodiments that include the WWAN modem 942, possibly in combination with one or more additional modems including Wi-Fi modem 946, bluetooth modem 948, USB modem 944 and Ethernet modem 949, can be combined with a pre-tested or pre-certified integrated embodiment of the service processor 115, possibly in combination with a well defined API for writing software applications that interface to, reside on or communicate with this turn-key modem embodiment. As disclosed herein, the advantageous capabilities of the service processor 115, possibly in conjunction with the service controller 122, to assist in monitoring, control, billing and verification for services is made more available for device 100 manufacturers in such a form, because the manufacturers do not need to spend as much time and resources to develop a custom modem only for a subset of devices that the turn-key modem can be used to support. In some embodiments, the service processor 115, as discussed herein, can be configured to provide device assisted service monitoring, control, billing and/or verification across not just when connected to the WWAN network via the WWAN modem, but also when connected to the other networks corresponding to the other access modems included in the turn-key combined module plus service processor 115 (or SPDK or chipset plus service processor 115) design. The pre-integrated service processor 115 and API possibly in combination with testing and certification can be packaged in a small form factor that may have standardized interfaces such as USB, PCIe, firewire, Display Port, GPIO, or other interface. The form factor may be miniaturized into standard configurations such as minicard, half minicard or even smaller form factors, or it can be designed into a non-standard or proprietary form factor. The module form factor can be well documented to simplify integration into various device 100 designs. The SPDK embodiments can be designed to contain one or more of the following: hardware integration and use documentation, software integration documentation, software programming documentation,

application interface documentation, service controller documentation, overall testing guidelines and overall use guidelines. In some embodiments, the modem module can be integrated with the service processor 115 functionality as a combined chipset, firmware and/or software product, with other SPDK features very similar to those listed above. The service controller programming guide for these turn-key embodiments can also be documented for the SPDK service processor 115 software, turn-key module with service processor 115 or integrated chipset with service processor 115. Accordingly, these embodiments provide various solutions to simplify the OEM task of integrating, developing, testing and shipping device 100 products (or integrated networking device products) with any of the device assisted service monitoring, control, billing or verification capabilities disclosed herein.

[00141] FIG. 12 illustrates another hardware diagram of a device 100 that includes a service processor 115 in accordance with some embodiments. As shown in FIG. 12, the service processor 115 is implemented on the other I/O devices component 980 of the device 100. In some embodiments, this implementation can be in part or whole accomplished in software stored, implemented and/or executed on the other I/O devices component 980 (e.g., a SIM/USIM card or other secure hardware I/O device). In some embodiments, the implementation and/or execution can be in part or whole accomplished in hardware that is on the other I/O devices component 980.

[00142] As discussed above, various embodiments include product designs in which the service processor 115 resides on device volatile or non-volatile memory (see FIG. 9), the device application processor or CPU (see FIG. 10), the wireless access modem (see FIG. 11) (or any other modem), or another I/O device (see FIG. 12). While these are just a few of the example service processor 115 placement embodiments, these embodiments show that the placement of where the software or hardware for implementing the service processor 115 can reside in the device 100 is very flexible and can be implemented in a myriad of places and ways depending on the device and/or other technical design choices.

[00143] FIG. 13 illustrates another hardware diagram of a device 100 that includes a service processor 115 implemented in external memory of a System On Chip (SOC) 1310 in accordance with some embodiments. As shown in FIG. 13, the service processor 115 is

implemented on the external memory 1320 of the device 100. In some embodiments, this implementation can be in part or whole accomplished in software stored, implemented and/or executed on the external memory 1320. In some embodiments, the implementation and/or execution can be in part or whole accomplished in hardware that is on the external memory 1320. In some embodiments, SOC chipset 1310 and external memory 1320 provide a portion or all of the hardware of device 100.

[00144] FIG. 14 illustrates another hardware diagram of a device 100 that includes a service processor 115 implemented in external memory of a System On Chip (SOC) 1310 in accordance with some embodiments. As shown, the service processor 115 is stored in a non volatile memory 910 and a memory 920 of the SOC chipset 1310, as similarly discussed above with respect to FIG. 9. In some embodiments, SOC chipset 1310 and external memory 1320 provide a portion or all of the hardware of device 100.

[00145] As similarly discussed above with respect to FIGS. 9 through 12, various embodiments include product designs including the SOC chipset 1310 in which the service processor 115 resides on internal volatile or non-volatile memory 910 of the SOC chipset 1310 (see FIG. 14), the device application processor or CPU 930 and/or sub processor 935, the modems 940, 942, 944, 946, 948, and/or 949 (or any other modem), another I/O device 985, and/or external memory 1320 (see FIG. 13) (and/or any combinations thereof). While these are just a few of the example service processor 115 placement embodiments, these embodiments show that the placement of where the software or hardware for implementing the service processor 115 can reside in the SOC chipset 1310 and/or the external memory 1320 of the device 100 is very flexible and can be implemented in a myriad of places and ways depending on the device and/or other technical design choices.

[00146] The above discussion with respect to FIGS. 9 through 14 illustrating various internal hardware embodiments for device 100 applies equally to this partitioning of device functionality or any other partitioning of how the components in device 100 are configured, whether they are all separate components, some of the components are combined into a single chipset but there are still multiple chipsets, or all of the components are combined into a chipset. For example, FIGS. 9 through 14 illustrating various internal hardware embodiments for device

100 show several access modem components including the wire line modem 940, wireless wide area network (WWAN) modem 942, USB modem 944, Wi-Fi modem 946, Bluetooth modem 948, and Ethernet modem 949. In some embodiments, wire line modem 940 is a DSL or cable modem such as DOCSIS, or some other modem with a hard connection such as fiber. In some embodiments, as discussed above and below, connection to the wire line or wireless access network is accomplished through an extension of the internal or external communications bus structure 960. For example, such an extension is accomplished using one or the other modems, such as Wi-Fi modem 946 or Ethernet modem 949, connecting to a local area network that in turn connects to the access network via a device that bridges the local area network to the access network. One of ordinary skill in the art will appreciate that when discussing device connection to any access network the connection can be via a direct connection to the network, such as a 3G or 4G WWAN modem 942 connection to a 3G or 4G WWAN network, or can be a connection to the access network through an intermediate connection, such as a Wi-Fi modem 946 connection to a modem or networking device combination that has a Wi-Fi LAN connection and a 3G or 4G network access network connection. Another example of an extended modem connection embodiment includes a Wi-Fi modem 946 device connection to a modem or networking device combination that includes a Wi-Fi LAN connection and a DOCSIS or DSL network access connection. Other examples of such combinations will be readily apparent to one of ordinary skill in the art.

Service Processor Configurations for Intermediate Networking Devices

[00147] FIGS. 15A through 15F illustrate hardware diagrams of a device 100 that include a service processor 115 and a bus structure extension 1510 using intermediate modem or networking device combinations in accordance with various embodiments . For example, FIGS. 15A through 15E illustrate various extended modem alternatives for access network connection through an intermediate modem or networking device combination that has a connection (e.g., LAN connection) to one or more devices 100.

[00148] In some embodiments, device 100 includes a 3G and/or 4G network access connection in combination with the Wi-Fi LAN connection to the device 100. For example, the intermediate device or networking device combination can be a device that simply translates the

Wi-Fi data to the WWAN access network without implementing any portion of the service processor 115 as shown in FIG. 15B. In some embodiments, an intermediate device or networking device combination includes a more sophisticated implementation including a networking stack and some embodiments a processor, as is the case for example if the intermediate networking device or networking device combination includes a router function, in which case the service processor 115 can be implemented in part or entirely on the intermediate modem or networking device combination. The intermediate modem or networking device combination can also be a multi-user device in which more than one user is gaining access to the 3G or 4G access network via the Wi-Fi LAN connection. In the case of such a multi-user network, the access network connection can include several managed service links using multiple instantiations of service processor 115, each instantiation, for example, being implemented in whole or in part on device 100 with the intermediate modem or networking device combination only providing the translation services from the Wi-Fi LAN to the WWAN access network.

[00149] Referring now to FIGS. 15A, 15C, 15D, and 15E, in some embodiments, the service processors 115 are implemented in part or in whole on the intermediate modem or networking device combination. In the case where the service processor 115 is implemented in part or in whole on the intermediate modem or networking device combination, the service processor 115 can be implemented for each device or each user in the network so that there are multiple managed service provider accounts all gaining access through the same intermediate modem or networking device combination. In some embodiments, the functions of service processor 115 are implemented on an aggregate account that includes the WWAN access network traffic for all of the users or devices connected to the Wi-Fi LAN serviced by the intermediate modem or networking device combination. In some embodiments, the central provider can also provide an aggregated account service plan, such as a family plan, a corporate user group plan and/or an instant hotspot plan. In the case where there is one account for the intermediate modem or networking device combination, the intermediate modem or networking device combination can implement a local division of services to one or more devices 100 or users in which the services are controlled or managed by the intermediate modem or networking device combination or the device 100, but the management is not subject to service provider control and is auxiliary to the service management or service policy implementation performed

by service processors 115. In some embodiments, another service model can also be supported in which there is an aggregate service provider plan associated with one intermediate modem or networking device combination, or a group of intermediate modems or networking device combinations but where each user or device still has its own service plan that is a sub-plan under the aggregate plan so that each user or device has independent service policy implementation with a unique instantiation of service processor 115 rather than aggregate service policy implementation across multiple users in the group with a single instantiation of service processor 115.

[00150] As shown in FIGS. 15A and 15C, in some embodiments, device 100 includes a Wi-Fi modem 946, a Wi-Fi modem 946 combined with a 3G and/or 4G WWAN modem 1530 on intermediate modem or networking device combination 1510, and the intermediate modem or networking device combination forwards WWAN access network traffic to and from device 100 via the Wi-Fi link. For example, the service processor 115 can be implemented in its entirety on device 100 and the service provider account can be associated exclusively with one device. This is an embodiment associated with one or more of FIGS. 29, 31, 32 or 34 discussed below, in which the modem bus represents the Wi-Fi LAN connection via the Wi-Fi modem 946. Similarly, as shown in FIGS. 15A and 15D, such an implementation can be provided using a different access modem and access network, such as a 2G and/or 3G WWAN, DSL wire line, cable DOCSIS wire line or fiber wire line configuration in place of the 3G and/or 4G access network connection to the intermediate modem or networking device combination 1510. In addition, various other embodiments similarly use DSL as shown in FIGS. 15A and 15E, USB, Ethernet, Bluetooth, or another LAN or point to point connection from device 100 to the intermediate modem or networking device combination 1510.

[00151] In some embodiments, a portion of the service processor 115 is implemented on the device 100, such as the application interface agent 1693 and other supporting agents (see FIG. 16), and another portion of the service provider 115 is implemented on the intermediate modem or networking device combination, such as policy implementation agent 1690 or possibly modem firewall 1655 as well as other agents (see FIG. 16). This is an embodiment associated with one or more of FIGS. 30 or 36 discussed below, in which the modem bus in the figure represents the Wi-Fi LAN connection via the Wi-Fi modem 946. In this example, the

service provider 115 can still offer individual service plans associated exclusively with one device, or can offer an aggregate plan in which the portion of the service processor 115 located on the intermediate modem or networking device combination 1510 aggregates service plans into one WWAN connection but each individual device 100 has a unique service interface via the application interface agents and associated agents located on device 100. Similarly, such an implementation can be provided using a different access modem and access network, for example a 2G and/or 3G WWAN, DSL wire line, cable DOCSIS wire line or fiber wire line configuration in place of the 3G and/or 4G access network connection to the intermediate modem or networking device combination 1510. In addition, various other embodiments similarly use USB, Ethernet, Bluetooth, or another LAN or point to point connection from device 100 to the intermediate modem or networking device combination 1510.

[00152] In some embodiments, all of the service processor 115 is implemented on the intermediate modem or networking device combination 1510 and the aggregate device or user traffic demand from the LAN port is serviced through one service provider service plan account. This is an embodiment associated with FIG. 35 in which as discussed below the modem bus in the figure represents the Wi-Fi LAN connection via the Wi-Fi modem 946. Similarly, such an implementation can be provided using a different access modem and access network, for example a 2G and/or 3G WWAN, DSL wire line, cable DOCSIS wire line or fiber wire line configuration in place of the 3G and/or 4G access network connection to the intermediate modem or networking device combination 1510. In addition, various other embodiments similarly use USB, Ethernet, Bluetooth, or another LAN or point to point connection from device 100 to the intermediate modem or networking device combination 1510.

[00153] In some embodiments, the device 100 uses the on-board WWAN modem 942 when it is outside of Wi-Fi LAN coverage area for one or more trusted access networks for the device, and when the device comes within range of a Wi-Fi network associated with a intermediate modem or networking device combination connected to a trusted wire line access network, the device can switch to the Wi-Fi link service to connect service processor 115 to the trusted wire line access network. In some embodiments, the decision to switch to the Wi-Fi LAN associated with a trusted wire line access network can be made automatically by the device based on the policy implementation rules settings for the modem selection and control 1811

and/or the policy control agent 1692, can be made by the user, or can be made by the service controller 122 (see FIG. 18). In addition, various other embodiments similarly use USB, Ethernet, Bluetooth, or another LAN or point to point connection from device 100 to the intermediate modem or networking device combination 1510.

[00154] FIG. 15F illustrates another hardware diagram of a device 100 that includes a service processor 115 and a bus structure extension 1510 using intermediate modem or networking device combinations in accordance with various embodiments . In some embodiments, more than one access network connection is implemented in the intermediate modem or networking device combination 1510. This allows the device 100 to potentially connect through the intermediate modem or networking device combination with a choice of access network services. An example of such an embodiment is illustrated in FIG. 15F in which an access network router (e.g., an enterprise router) connected to a LAN with a wire line primary backhaul connection and a back up WWAN connection, for example 3G or 4G, to provide access services when the primary wire line connection fails. As discussed above, the service provider service profile for service processor 115 and the service plan account can be set up as an aggregate account with multiple users connected to the LAN. The service provider can elect to use an embodiment that includes a portion of the service processor 115 on each device 100 so that the account can be managed for each user or each device, or the service provider can elect to implement all of the necessary features in the service processor 115 on the intermediate modem or networking device combination so that there is no visibility to the individual devices 100 or users.

[00155] As described herein, various embodiments provide many service policy implementation options that can enhance the service provider control of the service experience and cost, or enhance the user control of the service experience and cost by providing a verifiable or compromise resistant solutions to manage service policy implementation on the intermediate modem or networking device combination, for one or both of the WWAN or wire line access networks, when the WWAN access network is active, or when the WWAN access network is inactive. The level of service control, user preference feedback and service policy implementation verification or compromise resistance enabled by these embodiments improves the offered back up services and primary wire line services. One of ordinary skill in the art will

also now appreciate that any number of wire line and/or wireless network access connections can be supported by the various embodiments as described herein, with any number of device architectures and architectures for intermediate modem or networking device combinations bridging the device to the access network of choice. Accordingly, various embodiments provide a verifiable managed service architecture, design and implementation for any number of single access and/or multi-access networks in which the service account can be consistent across multiple networks, and the service policies can be changed from network to network as deemed appropriate by the service provider with service notification, service cost control and privacy preference inputs from the user.

[00156] In various embodiments, the verification embodiments discussed herein for service policy implementation verification or service policy implementation compromise protection can be applied. In some embodiments, rather than attaching a service provider service plan account to a single device, it is attached to (e.g., associated with) a user. For example, when the user logs onto an access network with a service controller controlled by a service provider, regardless of what device the user logs onto with the user's service plan profile can be automatically looked up in the central billing system 123 and dynamically loaded (e.g., downloaded) onto the device 100 from the service controller 122 (e.g., a service profile provided on demand based on the user's identity). In some embodiments, in addition to dynamically loading the user's service policy implementation and control settings, one or more of the user's preferences including notification, service control, traffic monitor reporting privacy and Customer Relationship Management (CRM) reporting privacy are also dynamically loaded. For example, this allows the user to have the same service settings, performance and experience regardless of the device the user is logged into and using on the network. In addition, as discussed herein, in the various embodiments that call for roaming from one type of access network to another, the user service plan profile, that includes all of the above in addition to the service plan profile changes that take effect between different types of access network, can be used on any device and on any network, providing the user with a verifiable or compromise resistant, consistent service experience regardless of network or device.

[00157] Many of the embodiments described herein refer to a user using device 100. It is understood that there are also applications for these various embodiments that do not involve

user interfaces. Examples of such applications include equipment, apparatus or devices for automation, telemetry, sensors, security or surveillance, appliance control, remote machine to machine data connections, certain remote access configurations, two way power metering or control, asset tracking, people tracking or other applications in which a human user interface is not required for device 100.

[00158] Various embodiments of the device 100 described above include other I/O devices 985. In some embodiments, these other devices include other modems, other special purpose hardware components, and/or other I/O devices or drivers or modems to connect to other I/O devices. In some embodiments, these other devices include a Subscriber Identity Module (SIM) or Universal Subscriber Identity Module (USIM) device. In some embodiments, it is advantageous to implement some or all of the service processor 115 functions on an embodiment of device 100 that includes a SIM and/or a USIM. In some embodiments, the other I/O devices 985 include a hardware device designed to implement a portion or all of the service processor 115 functions. For example, this is advantageous in cases in which the original device 100 was not manufactured with the service processor 115; in cases in which dedicated hardware is desired to improve one or more aspects of service processor 115 performance; allowing users, for example, to have the same service settings, performance and experience regardless of the device the user is using on the network by using such a SIM and/or USIM (e.g., or implemented as a type of dongle); and/or in cases in which a separate component is desired to assist in compromise protection for one or more aspects of service processor 115.

[00159] As discussed above, some embodiments described herein provide for billing of certain access services. In some embodiments, various applications do not require or involve billing of certain services. For example, applications like enterprise IT (Information Technology) group management of enterprise workforce access policy implementation or access cost control or access security policy, privacy control, parental control, network quality of service control or enhancement, private network services, free access services, publicly funded access services, flat rate no-options service and other services, or other examples that will be apparent to one of ordinary skill in the art do not require billing functionality but benefit from many other aspects of various embodiments.

Service Processor and Service Controller for Verifiable Service Monitoring, Notification and Control

[00160] FIG. 16 is a functional diagram illustrating a device based service processor 115 and a service controller 122 in accordance with some embodiments. For example, this provides relatively full featured device based service processor implementation and service controller implementation. As shown, this corresponds to a networking configuration in which the service controller 122 is connected to the Internet 120 and not directly to the access network 1610. As shown, a data plane (e.g., service traffic plane) communication path is shown in solid line connections and control plane (e.g., service control plane) communication path is shown in dashed line connections. As previously discussed, it is understood that the division in functionality between one device agent and another is based on, for example, design choices, networking environments, devices and/or services/applications, and various different combinations can be used in various different implementations. For example, the functional lines can be re-drawn in any way that the product designers see fit. As shown, this includes certain divisions and functional breakouts for device agents as an illustrative implementation, although other, potentially more complex, embodiments can include different divisions and functional breakouts for device agent functionality specifications, for example, in order to manage development specification and testing complexity and workflow. In addition, the placement of the agents that operate, interact with or monitor the data path can be moved or re-ordered in various embodiments. For example, as discussed below in some embodiments, one or more of the policy implementation or service monitoring functions can be placed on one of the access modems located below the modem driver and modem bus in the communication stack as illustrated in certain figures and described herein. As discussed below, some simplified embodiment figures illustrate that not all the functions illustrated in all the figures are necessary for many designs, so a product/service designer can choose to implement those functions believed to be most advantageous or sufficient for the desired purposes and/or environment. The functional elements shown in FIG. 16 are described below.

[00161] As shown, service processor 115 includes a service control device link 1691. For example, as device based service control techniques involving supervision across a network become more sophisticated, it becomes increasingly important to have an efficient and flexible

control plane communication link between the device agents and the network elements communicating with, controlling, monitoring, or verifying service policy. In some embodiments, the service control device link 1691 provides the device side of a system for transmission and reception of service agent to/from network element functions. In some embodiments, the traffic efficiency of this link is enhanced by buffering and framing multiple agent messages in the transmissions. In some embodiments, the traffic efficiency is further improved by controlling the transmission frequency or linking the transmission frequency to the rate of service usage or traffic usage. In some embodiments, one or more levels of security or encryption are used to make the link robust to discovery, eavesdropping or compromise. In some embodiments, the service control device link 1691 also provides the communications link and heartbeat timing for the agent heartbeat function. As discussed below, various embodiments disclosed herein for the service control device link 1691 provide an efficient and secure solution for transmitting and receiving service policy implementation, control, monitoring and verification information with other network elements.

[00162] In some embodiments, the service control device link 1691 agent messages are transmitted asynchronously as they are generated by one or more of the service agents. In some embodiments, the service control device link 1691 performs collection or buffering of agent messages between transmissions. In some embodiments, the service control device link 1691 determines when to transmit based potentially on several parameters including, for example, one or more of the following parameters: periodic timer trigger, waiting until a certain amount of service usage or traffic usage has occurred, responding to a service controller message, responding to a service controller request, initiated by one or more agents, initiated by a verification error condition, initiated by some other error or status condition. In some embodiments, once a transmission trigger has occurred, the service control device link 1691 assembles all buffered agent communications and frames the communications.

[00163] In some embodiments, the transmission trigger is controlled by waiting for an amount of service usage, such as waiting until a certain amount of data traffic has passed, which reduces the control plane communication channel traffic usage to a fraction of the data plane traffic. For example, this approach preserves network capacity and reduces service cost even in traffic scenarios in which data traffic is light.

[00164] In some embodiments, the transmission trigger is based on waiting for an amount of service usage, and also including a minimum transmission rate that triggers a transmission according to one or more of the following parameters: a maximum time between transmissions clock to keep the service processor 115 in communication with the service controller 122 when little or no service usage is occurring, a polling request of some kind from the service controller 122, a response to a service controller heartbeat, a transmission generated by a service verification error event, or a transmission generated by some other asynchronous event with time critical service processor 115 (or service controller 122) messaging needs, such as a transaction or service billing event or a user request. For example, service control plane traffic down is reduced to a relatively inexpensive and capacity conserving trickle when device 100 data traffic is not significant. At the same time, this approach also provides an effective flow of real time or near real-time service control plane traffic that is both cost and capacity efficient, because the service control plane traffic is a relatively small percentage of the data plane traffic when data plane traffic usage is heavy. For example, when data plane traffic usage is heavy is generally the time when close monitoring of service policy implementation verification or compromise prevention can be particularly important and by keeping the control plane overhead to a fraction of data plane traffic close monitoring and control of services are maintained at a reasonable cost in terms of percentage of both bandwidth used and network capacity. In some embodiments, the service usage or service activity trigger occurs based on some other measure than traffic usage, such as a number of messages transacted, one or more billing events, number of files downloaded, number of applications run or time that an application has been running, usage of one or more specified applications, GPS coordinate changes, roaming event, an event related to another network connection to the device and/or other service related measures.

[00165] In some embodiments, the service control device link 1691 provides for securing, signing, encrypting or otherwise protecting communications before sending. For example, the service control device link 1691 can send to the transport layer or directly to the link layer for transmission. In some embodiments, the communications are further secured with transport layer encryption, such as TCP TLS (Transport Control Protocol Transport Layer Security) or another secure transport layer protocol. In some embodiments, communications are encrypted at the link layer, such as IPSEC (Internet Protocol Security), various VPN (Virtual Private

Network) services, other forms of IP layer encryption and/or another link layer encryption technique.

[00166] In some embodiments, the service control link 1691 includes the above discussed agent heartbeat function in which the agents provide certain required reports to the service controller 122 for the purpose of service policy implementation verification (e.g., verification related reports on certain aspects of the service processor 115) or for other purposes. For example, such agent heartbeat messages can be in the open/clear (unencrypted) or encrypted, signed and/or otherwise secured. In some embodiments, these messages include one or more of the below described types of messages: an agent information message, an agent check-in message and/or agent cross check message.

[00167] In some embodiments, an agent information message is included in the agent heartbeat service policy implementation verification message, which includes, for example, any information the agent needs to communicate to the service controller 122 as part of the operation of the service policy implementation system. For example, an agent response to a service controller challenge, as described below, can be included in the agent heartbeat service policy implementation verification message.

[00168] In some embodiments, an agent check-in message is included in an agent heartbeat service policy implementation verification message, which includes, for example, a transmission of a unique agent identifier, secure unique identifier, and/or hashed encrypted and signed message beginning with some shared secret or state variable for the hash. For example, an agent self-check can be included in the agent heartbeat service policy implementation verification message, which includes reporting on agent configuration, agent operation, agent code status, agent communication log, agent error flags, and/or other agent associated information potentially hashed, encrypted, signed or otherwise secured in the message (e.g., using a shared secret unique to that agent).

[00169] In some embodiments, an agent cross-check message is included in the agent heartbeat service policy implementation verification message, which includes, for example, reports on the status, configuration, operation observations, communication log or other aspects of another agent. For example, agent environment reports can be included in the agent heartbeat

service policy implementation verification message, which includes, for example, reports on certain aspects of the service processor 115 operating environment, such as software presence (e.g., installation status of certain operating system and/or application software and/or components thereof), observed communication with agents or communication attempts, memory accesses or access attempts, network accesses or access attempts, software downloads or attempted downloads, software removal or download blocking, service policy implementation verification or compromise event error conditions with respect to the operating environment for the service processor 115, and/or other messages regarding the verification or possibility of compromise associated with the service processor 115 operating environment or agents.

[00170] In some embodiments, the agent heartbeat function also provides regular updates for information important to user service notification services. For example, the network based elements can provide regular synchronization updates for the device based service usage or service activity counters in which service usage or service activity measures available from one or more network service history elements is transmitted to the device 100. This allows the service usage counter errors between the device service counter and the counters used for central billing to be minimized. A common service usage or service activity measure is total traffic usage measured to date within a time frame over which a service limit is applicable. Other service usage or service activity measures can also be tracked and reconciled in a similar manner.

[00171] In some embodiments for the heartbeat function, the service controller 122 verifies that the scheduled agent reports are being received and that the reports are within expected parameters. In some embodiments, the access control integrity server 1654 issues signed challenge/response sequences to the policy implementation agent 1690. For example, the challenges can be asynchronous, issued when an event or error condition occurs, issued on a schedule or issued when a certain amount of data has passed. This approach, for example, provides a second layer of service policy implementation verification that strengthens the service usage or service activity measurement verification. For example, a challenge/response can be sent over the heartbeat link for the purpose of verifying device agent integrity. Various challenge/response related verification embodiments are described below.

[00172] In some embodiments, the challenge/response heartbeat message can include sending any kind of command or query, secure or transmitted in the open, receiving a response from the agent and then evaluating the response to determine if the response is within a range of parameters expected for a correctly configured agent, an agent that is operating properly, an agent that is not partially compromised or an agent that is not entirely compromised. In some embodiments, the agent is only required to respond with a simple acknowledgement of the challenge. In some embodiments, the agent is required to respond with a message or piece of information that is known by the agent. In some embodiments, the agent is required to respond with a message or piece of information that is difficult for the agent to respond correctly with if it were to be partially or entirely compromised. In some embodiments, the agent is required to respond back with information regarding the operation or configuration of the agent that is difficult for the agent to respond properly with if the agent is not properly configured, not operating properly, is partially compromised or is entirely compromised. In some embodiments, the first agent is required to respond back with information regarding the operation, configuration, status or behavior of a second agent that is difficult for the first or second agent to respond properly with if the first or second agent is not properly configured, not operating properly, is partially compromised or is entirely compromised. In some embodiments, the agent is required to respond with a response that includes a shared secret. In some embodiments, the agent is required to respond with information regarding the presence, configuration, operating characteristics or other information regarding other programs in the operating environment of the agent. In some embodiments, the agent is required to respond with hashed information to be portions of code or a code sample (e.g., the code portion or code sample can be specified by the service controller 122).

[00173] In some embodiments, the information the agent responds with is a response to a signed or encrypted message from the service controller 122 in which the agent must know how to decode the encrypted controller message in order to respond correctly or it would be difficult for the agent to respond properly if the agent is not configured properly, is not operating within appropriate limits, is partially compromised or is entirely compromised. In some embodiments, the agent signs or encrypts information in such a manner that it is difficult to respond correctly when the message is decoded by the service controller 122 unless the agent is configured properly, is operating within appropriate limits, is not partially compromised and is not entirely

compromised. In some embodiments, the agent is required to respond with a signed or encrypted hash of information that is difficult for the agent to generate unless the agent is configured properly, is operating within appropriate limits, is not partially compromised and is not entirely compromised. For example, the hashed information can be local device configuration information, portions of code or all of the code, and/or the code portion to be used in the response can be specified by the service controller. In another example, the hashed information the agent responds with can include a shared secret, and/or the hashed information can be information regarding the presence, configuration, operating characteristics or other information regarding other programs in the operating environment of the agent.

[00174] Accordingly, as described above, the agent heartbeat function provides an important and efficient system in some embodiments for verifying the service policy implementation or protecting against compromise events. For example, there are many other functions the agent heartbeat service can perform and some are described herein while others will be apparent to one of ordinary skill in the art given the principles, design background and various embodiments provided herein.

[00175] In some embodiments, the service control device link 1691 facilitates another important function, which is the download of new service processor software elements, revisions of service processor software elements, and/or dynamic refreshes of service processor software elements. There are many embodiments for such operations. In some embodiments, the software is received as a single file over the service control device link 1691. For example, the file can have encryption or signed encryption beyond any provided by the communication link protocol itself. In some embodiments, the software files are segmented into smaller packets that are communicated in multiple messages sent over the service control device link 1691. In some embodiments, once the file(s) are received, or the segmented portions of the file(s) are received, they are communicated to a service downloader 1663 for file aggregation and installation, which, in some embodiments, is performed after further measures to verify the service processor software are completed. In some embodiments, the files are sent using other delivery means, such a direct TCP socket connection to the service downloader 1663 or some other software installer, which can also involve secure transport and additional levels of encryption.

[00176] As shown in FIG. 16, an agent communication bus 1630 represents a functional description for providing communication for the various service processor 115 agents and functions. In some embodiments, as represented in the functional diagram illustrated in FIG. 16, the architecture of the bus is generally multipoint to multipoint so that any agent can communicate with any other agent, the service controller or in some cases other components of the device, such user interface 1697 and/or modem components. As described below, the architecture can also be point to point for certain agents or communication transactions, or point to multipoint within the agent framework so that all agent communication can be concentrated, or secured, or controlled, or restricted, or logged or reported. In some embodiments, the agent communication bus is secured, signed, encrypted, hidden, partitioned and/or otherwise protected from unauthorized monitoring or usage.

[00177] In some embodiments, as described below, there are multiple layers of security applied to the agent communication bus 1630 communication protocols, such as including one or more of the following: point to point message exchange encryption using one or more keys that are partially shared or shared within the service processor 115 agent group and/or the service controller 122, point to point message exchange that using one or more keys that are private to the two endpoints of the communication, a bus-level message exchange encryption that can be in place of or in addition to other encryption or security, or using one or more keys that are partially shared or shared within the service processor 115 agent group and/or the service controller 122, a set of secure messages that can only be decoded or observed by the agents they are intended for, a set of secure messages that allow communication between certain agents or service processor functions and entities outside of the service processor operating environment. In some embodiments, and as described herein, the service control device link 1691 is assumed to be equivalent to an agent for communication purposes, and, in the case of the service control device link 1691, the communication is not restricted to the agent communication bus 1630 but also extends to the service control communications link 1653. In some embodiments, the system has the capability to replace keys or signatures on occasion or on a regular basis to further secure against monitoring, eavesdropping or compromise of the agent communication system.

[00178] For example, various forms of message encryption and security framework techniques can be applied to encrypt and/or secure the agent communication bus 1630, including

one or more of the following: agent bus encryption using shared key for all agents provided and updated by the secure server; agent bus encryption using point to point keys in which the secure server informs the bus and agents of keys and updates as appropriate; agent level encryption using agent to agent shared keys in which the secure server informs agents of the key and updates the key as appropriate; agent level encryption using agent to agent point to point key in which the secure server informs agent of the point to point keys that are required and updates the keys as appropriate; agent level access authorization, which only allows access to the agents that are on the secure authorization list and in which the list is provided by the secure server and signatures are provided by the secure server; UI messages are only analyzed and passed, in which the UI cannot have access to configuration information and cannot issue challenges; agent level heartbeat encryption, which can be point to point or shared key for that agent; control link level heartbeat encryption; TLS (Transport Layer Security) communication protocols; server level heartbeat encryption, which can be point to point or shared key for that secure server; and/or the access control integrity agent 1694 or heartbeat function can become point to multipoint secure communications hubs.

[00179] In some embodiments of the agent communication bus 1630, the design of the agent communication bus depends on the nature of the design embodiments for the agents and/or other functions. For example, if the agents are implemented largely or entirely in software, then the agent communication bus can be implemented as an inter-process software communication bus. In some embodiments, such an inter-process software communication bus is a variant of D-bus (e.g., a message bus system for inter-process software communication that, for example, helps applications/agents to talk to one another), or another inter-process communication protocol or system, running a session bus in which all communications over the session bus can be secured, signed, encrypted or otherwise protected. For example, the session bus can be further protected by storing all software (e.g., software components, applications and/or agents) in secure memory, storing all software in encrypted form in secure memory, and/or executing all software and communications within a secure execution environment, hardware environment and/or protected memory space. In some embodiments, if the agents and other functions are designed with a mixture of software and hardware, or primarily with hardware, then the implementation of the bus design will vary, and the principles and embodiments described herein

will enable one of ordinary skill in the art to design the specifics of the agent communication bus 1630 to meet a particular set of product and desired functional requirements.

[00180] As shown in FIG. 16, an access control integrity agent 1694 collects device information on service policy, service usage or service activity, agent configuration and agent behavior. In some embodiments, the access control integrity agent 1694 also cross checks this information to identify integrity breaches in the service policy implementation and control system. In some embodiments, the access control integrity agent 1694 also initiates action when a service policy violation or a system integrity breach is suspected. In some embodiments, the access control integrity agent 1694 also performs asynchronous or periodic agent checks to verify presence, configuration or proper operation of other agents. In some embodiments, the access control integrity agent 1694 also performs challenge-response sequence verification of other agents.

[00181] In some embodiments, the access control integrity agent 1694 obtains service usage or service activity measures from a service monitor agent 1696 and compares one or more first service usage measurement points against one or more second service usage measurement points to verify service policy implementation. For example, as shown in FIG. 21, if the service usage at measurement point IV is inconsistent with measurement point III, which, for example, can indicate, for example, that an unauthorized or unmonitored usage of the access modem (e.g., modems 2122, 2123, 2124, 2125 or 2141) is taking place. As another example, as also shown in FIG. 21, if one or more aspects of upstream traffic usage measurement point II, which represents the upstream demand side of policy implementation agent 1690, is inconsistent with upstream traffic measurement point III, which represents delivered traffic from the policy implementation agent 1690, then the policy implementation agent 1690 may not be operating properly. As another example, as also shown in FIG. 21, if service measurement point III and IV indicate that firewall agent 1655 is passing traffic to URLs or IP addresses that are in the blocked policy settings, then a verification error condition can be set for the access control policy. As another example, if the policy controller reports traffic usage statistics that are inconsistent with traffic usage policy settings, then a traffic usage policy verification error may have occurred. As another example, if the service usage counter synchronization information received from the service controller 122, the device service history 1618 and/or the central billing system 1619, is

compared to the service usage history reported by the service monitor agent and the two are found to be outside of acceptable tolerance limits for the comparison, then there may be a verification error in the service monitor service usage or service activity accounting. There are numerous additional embodiments of such comparisons as described herein and others as will be readily apparent to one of ordinary skill in the art given the principles, design background and specific examples and various embodiments described herein.

[00182] In some embodiments, device service policy implementations are verified by comparing various service usage measures used at the device against expected service usage or service activity behavior given the policies (e.g., one or more service policy settings, service profile or service profile settings for network based access/services, and/or service plan or service plan for network based access/services). For example, verification is performed based on a measure of total data passed at the device as compared to the service policy for total data usage. For example, verification is performed based on a measure of data passed in a period of time at the device as compared to the service policy for data passed in such a period of time. For example, verification is performed based on a monitoring of communications from the device based on IP addresses as compared to the policy for permissible IP addresses. For example, verification is performed based on a measure of total data passed from the device per IP address as compared to the policy for total data usage per IP address. Other examples include such actual versus policy comparisons based on other measures at/from/to the device, such as location, downloads, email accessed, URLs, and/or any other data, location, application, time or other criteria or any combination of criteria that can be measured for comparing with various policy settings and/or restrictions.

[00183] In some embodiments, the access control integrity agent 1694 monitors agent self-check reports to verify that agents are properly configured. In some embodiments, the access control integrity agent 1694 reports the agent self check reports to the service controller 122. In some embodiments, the access control integrity agent 1694 performs a role in service usage test transmission, reception and/or monitoring, with the usage test being tailored to test monitoring or control aspects for any subset of service activities. In some embodiments, the access control integrity agent 1694 performs a role in billing test event generation and/or monitoring. In some embodiments, the access control integrity agent 1694 checks and reports the result of service

usage monitoring verification tests, service usage billing verification tests and/or transaction billing verification tests.

[00184] In some embodiments, the access control integrity agent 1694 receives agent access attempt reports to determine if unauthorized agent access attempts are occurring. In some embodiments, the access control integrity agent 1694 acts as a central secure communications hub for agent to agent or service controller 122 to agent communication. For example, the access control integrity agent 1694 can be used so that no other software or function can access other agents or so that agents cannot access other agents except through the secure point to multipoint communications hub. In some embodiments, this approach further enhances compromise resistance for the agents. In some embodiments, some or all of the agent communications, including agent to agent or service controller 122 to agent communications, and possibly including unauthorized attempts to communication with agents, are monitored and logged so that a trace log of some or all agent communications can be maintained. For example, the agent communication trace log can be summarized and/or compressed for transmission efficiency or regularly reported, such as through the heartbeat function, or the agent communication trace log can be reported only when the service controller 122 requests the agent communication trace log or when there is a verification error event. As similarly described above, the partitioning of agent functions and server functions is provided herein mainly to aid in disclosing various embodiments but those of ordinary skill in the art will appreciate that other partitioning of agent functions and server functions can be used based on different design choices. For example, the central agent communication hub function is performed in some embodiments by the access control integrity agent 1694, however, in other embodiments that function is performed by the service control device link 1691. For example, when the central agent communication hub function is located in the service control device link 1691, then architecturally the device link can be a single point to multipoint secure communications hub for all agent to agent and service controller 122 to agent communications. In some embodiments, this approach has certain advantages from a service policy implementation verification or compromise protection robustness perspective, or has certain advantages from a communications protocol efficiency perspective, or simply can be more efficient to implement. It should be noted that in other embodiments described herein the agent to agent and agent to service controller 122 communications can be multipoint to multipoint, with each agent having the capability to

communicate with other agents or the service controller, this communication can be secure, signed or otherwise encrypted or protected in some embodiments and in the open/clear in others. Also, as discussed in some embodiments, the agents can maintain their own communications or attempted communications log, which can then be reported to the service controller 122. In some embodiments, the agents implement restrictions on which device components or agents the agents will conduct communications with so that only agents that need to communicate with one another can do so.

[00185] In some embodiments, the service control device link 1691 reviews local billing event history and compares such history to billing event reports to verify that a billing agent 1695 is functioning properly (e.g., has not been tampered with or compromised). In some embodiments, the service control device link 1691cross-checks service usage or service activity against billing event reports from the billing agent 1695 to verify that billing events are properly billing for service usage or service activity. In some embodiments, the service control device link 1691cross-checks transaction billing process or records against transaction billing reports to ensure that transaction billing events are being properly reported by the billing agent 1695. In some embodiments, the service control device link 1691 determines if one or more agents have been compromised, and if so, initiates a dynamic agent download process to replace any such potentially compromised agent.

[00186] In some embodiments, the access control integrity agent 1694 verifies that the service usage counter is reporting service usage or service cost to the user within acceptable limits of accuracy when compared to the service usage reports obtained from the service monitor agent 1696, the service controller 122, the device service history 1618 and/or the central billing system 1619. In some embodiments, the access control integrity agent 1694 checks to verify that user privacy filter preferences are being properly implemented. In some embodiments, the access control integrity agent 1694 checks to verify that the user is properly receiving UI warnings regarding service usage or roaming service usage conditions.

[00187] In some embodiments, the access control integrity agent 1694 checks to verify that the device is not beginning service usage until it has been authenticated, authorized or granted access to the network. In some embodiments, access control integrity agent 1694 checks

with the service controller 122 or the billing system 1619 to verify that the user or device has a valid service standing and should be admitted to access on the network.

[00188] In some embodiments, an Activation Tracking Service (ATS) is provided in which the service monitoring function (e.g., performed by the service monitor agent 1696 and/or some other agent/component or combinations thereof on the device) is used in part to determine which access networks are being connected to and to record and/or report this information. In some embodiments, the ATS is only enabled if the device user approves reporting of access networks connected to by the user device. In some embodiments, the ATS is protected from tampering. For example, the ATS can be hardened, that is, to be more tamper resistant, using a variety of techniques, including any of the following: the ATS can be located (e.g., stored) in secure memory and/or secure hardware; the ATS can be implemented in the system BIOS, the access modem and/or another hard to access portion of the device; a second device agent can confirm the presence of the ATS with a report to a network based server; the second agent or the network server can initiate a reinstall of the ATS if it is missing or is found to be operating improperly; and/or the ATS can be placed in a secure area of the OS so that it cannot be removed or if removed must be replaced for proper device operation to resume. A variety of other tamper resistance techniques can also be used to protect the ATS from tampering as similarly described herein with respect to other device based functions/software components/agents.

[00189] In some embodiments, the access control integrity agent 1694 verifies that ATS software or hardware is present, properly configured or operating properly. In some embodiments, the access control integrity agent 1694 reviews network connection or activity history and compares such to ATS reports to verify activation tracking service reports are occurring properly. In some embodiments, the access control integrity agent 1694 replaces ATS software if it has been removed. In some embodiments, the access control integrity agent 1694 monitors access or compromise of ATS software to determine if it may have been compromised. In some embodiments, the access control integrity agent 1694 reports status of ATS functions.

[00190] In some embodiments, the access control integrity agent 1694 scans the local agent execution environment to determine if there are unauthorized accesses to service processor functions, settings or code. In some embodiments, the access control integrity agent 1694

monitors software loading activity, protected memory access or communication with service processor 115 agents to detect unauthorized changes to service processor software or configuration. For example, the access control integrity agent 1694 can have a local database of potentially malicious elements and compare entries in the database against the elements detected locally. As another example, the access control integrity agent 1694 can communicate a list of some or all of the elements detected locally to the service controller 122 to augment or take the place of the database comparison function that may be performed locally. In some embodiments, the access control integrity agent 1694 detects new software downloads, installs or invocations and immediately issues an error flag report when potentially malicious software is downloaded, installed or invoked. In some embodiments, the access control integrity agent 1694 scans the local software loading and invocation activity along with a log of other software runtime events and regularly reports this trace so that when an error or compromise event occurs the trace preceding the event can be analyzed to determine the offending software or activity trace that took place to cause the compromise or error. Once the software or activity that caused the compromise is known, it can be entered into a refreshed version of the database that the device and other devices use to detect potentially malicious pre-cursor conditions. Examples of such pre-cursor events include software invocations, software downloads, attempts to uninstall certain agent and/or application software/components or OS components, a sequence of memory I/O events, a sequence of software access events, a sequence of network address or URL communications or downloads or a sequence of access modem I/O activity. In various other embodiments of the access control integrity agent 1694, the agent performs or (securely) communicates with other software/hardware device/network components that perform other well known signature, behavior blocking and/or intrusion detection identification/detection and/or blocking techniques based on the presence of potentially unwanted and/or potentially or known malicious software and/or intrusion attempts by unauthorized software and/or unauthorized users, using, for example, real-time, on access, periodic, and/or on demand scanning.

[00191] In some embodiments, the access control integrity agent 1694 detects or blocks potentially compromising behavior of other software programs/users attempting unauthorized behavior in the service processor 115 operating environment. In some embodiments, the access control integrity agent 1694 detects software that is being loaded that has the same or similar name, identification, memory location or function as one or more of the service processor 115

agents. In some embodiments, the access control integrity agent 1694 blocks operation or loading of such software. In some embodiments, the access control integrity agent 1694 detects or blocks unauthorized access of service processor 115 protected memory. In some embodiments, the access control integrity agent 1694 verifies configuration and operation of secure service downloader 1663. In some embodiments, the access control integrity agent 1694 monitors network and I/O activity to detect potentially compromising events, such as a program that is downloaded from known detrimental or potentially suspect IP addresses or URLs or a program that accesses certain IP addresses or URLs. In some embodiments, the access control integrity agent 1694 scans of the service processor operating environment are recorded and kept for a period of time, and if a service policy verification error occurs, then the scans immediately prior to the error are analyzed or reported to the service controller 122 for analysis. In some embodiments, such scans are regularly reported to the service controller 122 without the presence of service policy verification error conditions.

[00192] In some embodiments, the access control integrity agent 1694 requests a dynamic agent download of certain critical service processor functions, including in some cases the access control integrity agent 1694 on a periodic basis, or on a periodic basis when network access activity is not required or minimal.

[00193] In some embodiments, the access control integrity agent 1694 determines if a threshold has been surpassed for a max usage trigger for ambient and/or other services that should not be using significant amounts of data (e.g., based on the type of device and/or service profile settings).

[00194] In some embodiments, the access control integrity agent 1694 determines if verification errors exist in one or more of the verification process embodiments and, in some embodiments, reports errors immediately or in the next agent heartbeat to the service controller 122. In some embodiments, any number of results from the above checks, monitoring activities, reports or tests are reported to the service controller 122.

[00195] In some embodiments, a policy control agent 1692 receives policy instructions from the service controller 122 and/or the user via the billing agent 1695 and adapts device service policy settings (e.g., instantaneous device service policy settings) in one or more of the

following agents/components: a policy implementation agent 1690, the modem firewall 1655 and/or an application interface agent 1693. As shown in FIG. 16, the modem firewall 1655 is in communication with a modem driver 1640, which is in communication with the agent communication bus 1630 and access network 1610. As shown with respect to access network 1610, a central billing server 1619, an access network AAA server 1621 and device server history 1618 are also provided. As shown, the Internet 120 is accessible via the access network 1610 and firewall 124, from which device 100 can then access various Internet services 1615.

[00196] In some embodiments, the policy control agent 1692 adapts low level service policy rules/settings to perform one or more of the following objectives: achieve higher level service usage or cost objectives, reduce network control channel capacity drain, reduce network control plane server processing bandwidth, and/or provide a higher level of user privacy or network neutrality while satisfying service usage or service activity objectives. In some embodiments, the policy control agent 1692 performs a policy control function to adapt instantaneous service policies to achieve a service usage objective. In some embodiments, the policy control agent 1692 receives service usage information from the service monitor agent 1696 to evaluate service usage history as compared to service usage goals. In some embodiments, the policy control agent 1692 uses service monitor 1696 service usage or service activity history and various possible algorithm embodiments to create an estimate of the future projected service usage. In some embodiments, the policy control agent 1692 uses a future projection of service usage to determine what service usage or service activity controls need to be changed to maintain service usage goals. In some embodiments, the policy control agent 1692 uses service usage history to perform a service usage or service activity analysis to determine the distribution of service usage across service usage elements within categories, such as usage by application, usage by URL, usage by address, usage by content type, usage by time of day, usage by access network, usage by location, and/or any other categories for classifying service usage. In some embodiments, the policy control agent 1692 uses the service usage distribution analysis to determine which service usage elements or service activities are creating the largest service usage (e.g., if e-mail, social networking, or multimedia/online video application categories are creating the largest service usage).

[00197] In some embodiments, the policy control agent 1692 is instructed, for example, by the user, through billing agent 1695 to perform a service control algorithm, such as traffic shaping or download management, to manage service usage or service activities to assist the user in controlling service costs. As a basic example of such a traffic shaping algorithm, the traffic shaping algorithm can simply reduce traffic speed for all applications and traffic types successively until the service usage projections are within service usage limits for the present service billing period. To illustrate an algorithm that is more sophisticated and provides the advantage of leaving many service usage elements or service activities unaffected while only controlling down usage on the most aggressive service usage elements or service activities, the traffic shaping algorithm can identify the highest traffic usage applications and/or websites and successively reduce traffic speed just for the highest usage applications and/or websites until the service usage projections are within service usage limits for the present service billing period. These examples thereby reduce network traffic for the user in accordance with the user's service usage objectives while maintaining overall satisfactory service usage experience for the user in a manner that satisfies various net neutrality requirements (e.g., the traffic throttling of certain applications/websites based on user input in which categories based on service usage history are selected by the user, for example, a certain application may be using 90% of the aggregate traffic usage). For example, adaptive throttling algorithms can be used to throttle application traffic that the user requests throttling, such as recursively throttling of the specified application traffic (e.g., to denigrate the traffic usage associated with that application and thereby reduce overall service data usage).

[00198] In some embodiments, the policy control agent 1692 adjusts service policy based on time of day. In some embodiments, the policy control agent 1692 obtains a measure of network availability and adjusts traffic shaping policy settings based on available network capacity. In some embodiments, the policy control agent 1692 automatically and dynamically adjusts service policy based on one or more other service policy settings, the service profile and/or the service plan associated with the device and/or user of the device.

[00199] In some embodiments, various lower level service policy implementation embodiments are combined with a higher level set of service policy supervision functions to

provide device assisted verifiable network access control, authentication and authorization services.

[00200] In some embodiments, device based access control services are extended and combined with other policy design techniques to create a simplified device activation process and connected user experience referred to herein as ambient activation. In some embodiments, ambient access generally refers to an initial service access in which such service access is in some manner limited, such as where service options are significantly limited (e.g., low bandwidth network browsing and/or access to a specific transactional service), limited bandwidth, limited duration access before which a service plan must be purchased to maintain service or have service suspended/disabled or throttled or otherwise limited/reduced/downgraded, and/or any other time based, quality based, scope of service limited initial access for the network enabled device. In some embodiments, ambient activation is provided by setting access control to a fixed destination (e.g., providing access to a portal, such as a web page (e.g., for a hotspot) or WAP (Wireless Application Protocol) page, that provides the user with service plan options for obtaining a service plan for the user desired access, such as the service plan options for data usage, service types, time period for access (e.g., a day pass, a week pass or some other duration), and costs of service plan(s)). In some embodiments, service data usage of the ambient activated device is verified using IPDRs (e.g., using the device ID/device number for the device 100 to determine if the device has been used in a manner that is out of plan for the service plan associated with the device 100, such as based on the amount of data usage exceeding the service plan's service data usage limits, out of plan/unauthorized access to certain websites, and/or out of plan/unauthorized transactions). In some embodiments, service data usage of the ambient activated device is verified by setting a maximum data rate in the policy control agent 1692 and if/when it is determined that the device is exceeding a specified data rate/data usage, then the service data usage is throttled accordingly. In some embodiments, various other verification approaches are used for ambient activation purposes.

[00201] In some embodiments, the policy control agent 1692 (and/or another agent/component of the service processor 115 and/or service controller 122) performs a service control algorithm to assist in managing overall network capacity or application QoS (Quality of Service). In some embodiments, the policy control agent 1692 (and/or another agent/component

of the service processor 115) performs an access network selection algorithm to determine which access network to connect to based on connection options and determined strengths of available wireless networks, network preference or security settings, service usage cost based network preferences, and/or any other criteria.

[00202] Accordingly, as described herein with respect to various embodiments, service usage or service activities can be measured by various agents at various different measurement points, which provides for a more robust verification and integrity of device based services communication. For example, it is much less likely and more difficult to compromise and/or spoof multiple agents. As described herein, various verification and integrity checks are performed, including, for example, network based service usage measurement (e.g., using IPDRs); heartbeat monitoring; agent based heartbeat (e.g., challenge/response queries); agent operating environment protection; monitoring agent communications; agent cross-checks; comparing device based and network based measures (e.g., service usage measures); dynamic software/agent download; and/or any combination of these and various other verification/integrity check techniques described herein and/or apparent from the various embodiments described herein.

[00203] In some embodiments, the device 100 is capable of connecting to more than one network and device service policies are potentially changed based on which network the device is connected to at the time. In some embodiments, the network control plane servers detect a network connection change and initiate the service policy implementation established for the second network. In some embodiments, the device based adaptive policy control agent, as described herein (e.g., policy control agent 1692), detects network connection changes and implements the service policies established for the second network.

[00204] In some embodiments, when more than one access network is available, the network is chosen based on which network is most preferred according to a network preference list or according to which network that optimizes a network cost function. For example, the network preference list can be pre-established by the service provide and/or the user and/or later modified/adjusted by either the service provider and/or the user. For example, the cost function can be based on determining a minimum service cost, maximum network performance, whether

or not the user or device has access to the network, maximizing service provider connection benefit, reducing connections to alternative paid service providers, and/or any other cost related criteria for network selection purposes.

[00205] In some embodiments, the device 100 detects when one or more preferred networks are not available, implements a network selection function or intercepts other network selection functions, and offers a connection to the available service network that is highest on a preference list. For example, the preference list can be set by the service provider, the user and/or the service subscriber. In some embodiments, a notification is provided to the device/user when the device is not connected to a network (e.g., indicating in a pop-up/bubble or other UI based display a notification, such as "You are not connected to the network. Click here to learn more, get free trial, use a session, sign-up for service"). In some embodiments, the notification content can be determined based on usage service patterns, locally stored and/or programmable logic on the device and/or a server (e.g., device reports that user is not connected and WWAN is available). Decisions on what bubble to present when may be in pre-stored logic on device.

[00206] In some embodiments, service policies are automatically adapted based on the network to which device 100 is connected. For example, the device can be a cellular communication based device connected to a macrocell, a microcell, a picocell, or a femtocell (e.g., femto cells generally provide a low power, small area cellular network used, for example, in homes or offices, which, for example, can be used as an alternative to Wi-Fi access). In some embodiments, service monitoring agent 1696 and/or billing agent 1695 modify service usage counting and/or billing based on whether the device is connected to a macrocell, microcell, picocell or femtocell. In some embodiments, the device recognizes which type of network it is currently connecting to (e.g., looking up in a local or network table for the current base station connected to, and/or the information is broadcast to the device upon the connection with the base station), that is, whether it is a macrocell, microcell, picocell or femtocell. In other embodiments, the device does not recognize which type of network it is currently connected to, but reports its current base station, and the network uses a network lookup function to determine which type of network it is connected to. In some embodiments, the device adjusts the billing based on the type of network it is connected to, or in other embodiments, the device calculates an offset to such billing based on the type of network it is connected to, and/or in other

embodiments, the device records such service usage associated with the type of network it is connected to and the network billing can adjust the billing accordingly. For example, the billing can be lower for service data usage over a femtocell versus a macrocell. In some embodiments, service policies are adjusted based on the type of network that the device is connected, such as billing, user notification, data usage/bandwidth, throttling, time of day, who owns the cellular network connection (e.g., user's home femtocell, or user's work femtocell, or a commercial business's femtocell like a coffee shop or any other common area like an airport) and/or any other service policy can be different for a femtocell connection (or for any other type of connection, such as a macrocell, microcell, or picocell). In some embodiments, the local service usage counter is adjusted based on the type of network (and/or based on the time of day of such service activity) that the device is connected, such as billing, user notification, data usage/bandwidth, and/or any other service policy can be different for a femtocell connection (or for any other type of connection, such as a macrocell, microcell, or picocell). In some embodiments, the service policies and/or billing policies are adjusted based on network congestion.

[00207] In some embodiments, if adaptive service policy control is not required, then the policy control agent 1692 can simply pass instantaneous service policy settings directly to the agents responsible for implementing instantaneous service policies.

[00208] In some embodiments, a policy implementation agent 1690 implements traffic shaping and QoS policy rules for the device 100. In some embodiments, the policy implementation agent 1690 provides a firewall function. In some embodiments, the policy implementation agent 1690 performs traffic inspection and characterization. In some embodiments, packet inspection is aided by literal or virtual application layer tagging while in other embodiments packet inspection is performed entirely in/by the policy implementation agent 1690. In some embodiments, the policy implementation agent 1690 accepts service policy implementation settings from the policy control agent 1692 or directly from the service controller 122. More detail on specific embodiments for the policy implementation agent 1690 is provided below with respect to the figures associated with communication stack and communication protocol flow.

[00209] In some embodiments, the burst size, buffer delay, acknowledgement delay and drop rate used in upstream and downstream traffic shaping are optimized with the goal of reducing access network traffic overhead, and excess capacity usage that can result from mismatches in traffic transmission parameters with the access network MAC and PHY or from excess network level packet delivery protocol re-transmissions. In some embodiments, the application interface agent 1693 is used to literally tag or virtually tag application layer traffic so that the policy implementation agent(s) 1690 has the necessary information to implement selected traffic shaping solutions. As shown in FIG. 16, the application interface agent 1693 is in communication with various applications, including a TCP application 1604, an IP application 1605, and a voice application 1602.

[00210] In some embodiments, downstream literal or virtual application tagging are delayed until a traffic flow passes through the service policy implementation functions and to the application interface function where the service flow is then identified and associated with the underlying traffic and application parameters, and the literal or virtual tag is then communicated to the first policy implementation function or service monitoring function in the downstream traffic processing stack. In some embodiments, prior to being associated with a literal or virtual tag, the traffic flow is allowed to pass with no traffic shaping, and once the traffic flow is identified and tagged, the appropriate traffic shaping is applied. In some embodiments, a set of traffic shaping policy parameters are applied to the unidentified traffic flow before the flow is identified, and then the traffic shaping policy for the flow is updated when the flow is tagged. In some embodiments, the traffic flow can be blocked at the application interface agent even before the tag is passed to the policy implementation functions if it is found to be associated with traffic parameters that are blocked by policy once packet processing, framing and encryption are removed.

[00211] In some embodiments, a service monitor agent 1696 records and reports device service usage or service activities of device 100. In some embodiments, service usage history is verified by a number of techniques including verifying against network based service usage history (e.g., device service history 1618) and the various service policy implementation techniques as described herein.

[00212] In some embodiments, the service monitor agent 1696 includes the capability to filter service usage history reporting with the decision on which aspects of service history to report being determined by policies including possibly privacy policies defined by the device user or control plane servers in the network. In some embodiments, the service monitor agent 1696 monitors and possibly records or reports Customer Resource Management (CRM) information such as websites visited, time spent per website, interest indications based on website viewing, advertisements served to the device, advertisements opened by the user, location of the user, searches conducted by the user, application usage profile, device user interface usage history, electronic commerce transactions, music or video files played, applications on device, and/or when the user is actively working or playing or inactive. In some embodiments, to protect the privacy of this user CRM information, the user is provided with options on how much of the information to share and the user's response to the options are recorded and used to determine the filtering policy for how much of the CRM data to report (e.g., CRM filter level options selected by the user via the device UI and/or via various service plan or service profile or service policy options) and how much to suppress or to not even monitor/record/store in the first place. In some embodiments, to protect the privacy of this user's GPS/location tracking related information, the user is provided with options on how much of the information to share and the user's response to the options are recorded and used to determine the filtering policy for how much of the GPS/location tracking related data to report (e.g., GPS/location tracking filter level options) and how much to suppress or to not even monitor/record/store in the first place. In some embodiments, the service processor 115 allows the user to provide feedback on the user's preferences, such as for privacy/CRM data to report. In some embodiments, the user can also specify their preference(s) for notification (e.g., related to service usage/cost, traffic reporting and other service usage/monitored information) and/or service controls. In some embodiments, the service monitor agent 1696 observes and possibly records or reports service usage categorized by network possibly including roaming networks, paid service networks or free service networks. In some embodiments, the service monitor agent 1696 observes and possibly records or reports service usage categorized by sub-accounts for various types of traffic or various types of network.

[00213] For example, service monitor reports can be provided to the service controller 122. Service is monitored through various embodiments that can involve service usage logging

or traffic inspection and usage logging at the application level, various levels in the networking communication stack or the access modem. Some embodiments involve multiple levels of service or traffic measurement at various levels in the communications stack as described further below.

[00214] In some embodiments, service or traffic monitoring includes monitoring one or more of the following: traffic associated with one or more users; traffic downstream and/or upstream data rate; total traffic received and/or transmitted over a period of time; traffic transmitted and/or received by IP addresses, domain names, URLs or other network address identifiers; traffic transmitted and/or received by email downloads or uploads; traffic transmitted and/or received by an application; traffic transmitted and/or received by network file transfers; traffic transmitted and/or received by file download or upload content types; traffic transmitted and/or received by mobile commerce transactions; traffic transmitted and/or received by one or more time periods; traffic transmitted and/or received by differing levels of network activity and network capacity availability; traffic transmitted and/or received by one or more delivered levels of quality of service; traffic transmitted and/or received by software downloads; traffic transmitted and/or received by application downloads; traffic transmitted and/or received by one or more activities associated with the service control plane link or other network related functions, or traffic that may not directly result in service usage or service activity that the user values or desires; traffic transmitted and/or received to support one or more service provider third party service partner offerings; software usage history; application usage history; device discovery history for UI components, applications, settings, tutorials; ads served history; ads visited history; and/or device location history.

[00215] In some embodiments, some or all of the service usage monitoring occurs at the application layer. In some embodiments, the service monitor agent 1696 implements traffic inspection points between the applications and the networking stack application interface, such as the sockets API. In other embodiments, the application interface agent 1693 performs traffic inspection and reports the results to the service monitor agent 1696. Traffic inspection can be accomplished in several ways, including, for example, implementing a T-buffer at each socket connection and feeding the side traffic into a traffic flow analyzer, which in combination with a mapping of application to socket provides much of the information listed above. In cases in

which it is necessary to obtain traffic information from the application itself, some embodiments call for the application to be adapted to provide the information to either the application interface agent 1693 or the service monitor agent 1696. As an example, the application interface agent 1693 or the service monitor agent 1696 can monitor and decode advertisements downloaded via HTTP, but if the browser and HTTP server employ security above the sockets protocol stack layer then the application interface agent can communicate with the browser via a java applet or some other inter-process communication method. In some embodiments, the service monitor agent 1696, the billing agent 1695 and/or the policy control agent 1692 (or some other software or hardware function on the device) can monitor and/or control (e.g., allow, block and/or replace) advertisement traffic flow into the device. In some embodiments, the monitoring and control of advertisement traffic flow into the device is also used for bill by account purposes (e.g., charges, such as service charges, billed to the advertiser, sponsor, and/or service or transactional service provider).

[00216] In some embodiments, some or all of the service usage monitoring occurs below the application interface for the networking stack. In this case, some portion of the information listed above may not always be available due to encryption applied at the higher layers and/or the computational costs associated with performing deep packet inspection on mobile devices.

[00217] In some embodiments, the service monitor agent 1696 is also monitors the operating software install or loading systems, and/or otherwise monitors software installs or loads and/or software uninstalls/deinstallations.

[00218] Some of the information above may be considered by some users, advocacy groups or agencies as customer sensitive personal information. Simply sending the above information to the network for unspecified purposes may not, therefore, be acceptable for some service providers. However, if the user provides specific approval (e.g., informed consent) for the device, network or service provider to use some or all of the information that may be sensitive for specified purposes, then the user can control the level of information that is used and the purpose the information is used for. Accordingly, various embodiments described herein provide the user with control of what information is used and the purposes it is used for thereby allowing the user adequate control of any such sensitive information. In some embodiments,

information that is thought to perhaps be sensitive and is reported to the network must first receive user approval for the reporting. Some basic information is generally not considered sensitive and is necessary for certain basic service provider needs. For example, total data transmitted and/or received, traffic downstream and/or upstream speed, overall traffic usage by time of day are generally not considered private from the service provider's perspective and are necessary in many basic service policy implementations. As additional examples, perhaps other service usage history, such as total traffic email downloads and uploads but not the type of files or any specifics about the email traffic, the total web browsing traffic but nothing specific about the sites visited or content viewed, total file transfer traffic but not the type of files transferred or the addresses involved in the transfer, and other examples may not be viewed as private and, in some embodiments, provide valuable information for the service provider to manage services. Conversely, information such as websites visited, content viewed, mobile commerce transactions completed, advertisements visited, GPS location history and other service usage history the service monitor is capable of recording may be sensitive or private for some users and would thereby benefit from the various embodiments that provide enhanced user control of the reporting of such potentially sensitive or private data. It should also be appreciated that there is an inherent advantage to implementing traffic monitoring, traffic, service monitoring or service control on a device, because it is not necessary to report sensitive information to the network to accomplish many of these service policy implementation objectives.

[00219] In some embodiments, the service monitor agent 1696 assists in virtual application tagging of traffic flows through the networking stack policy implementation by tracking the virtually tagged packets through the stack processing and communicating the flow tags to the service policy implementation agent(s) 1690. In some embodiments, the service monitor agent 1696 maintains a history and provides reports or summary reports of which networks in addition to the networks controlled by the service controller 122 to which the device has connected. In some embodiments, this network activity summary includes a summary of the networks accessed, activity versus time per connection, and/or traffic versus time per connection. In some embodiments, the traffic reports that go to the network, possibly to service controller 122, billing system 1619 and/or device service history 1618, are first filtered according to rules defined by user preference selection at the time of service activation (e.g., service plan/service plan option selection), time of first device use, at a time the user selected the option on the

service UI or at a time the user chose to change the option on the service UI or some other time/mechanism allowing for user preference selection.

[00220] In some embodiments, the service monitor agent 1696 monitors application usage (e.g., which application the user executes on the device 100, such as e-mail applications, web browsing applications and/or media content streaming applications). In some embodiments, the service monitor agent 1696 monitors multimedia file usage (e.g., based on multimedia file type and/or based on specific multimedia files, such as specific movies and/or songs). In some embodiments, the service monitor agent 1696 monitors the device user interface, application, and content discovery history (e.g., monitoring which applications/content the user accesses from the device, including monitoring the pattern by which the user accesses such applications/content, such as how the user navigates the user interface on the device to access such applications/content and maintaining such patterns and history, such as which icons the user access on a home page, secondary or other portion/mechanism on the device for accessing various applications/content). In some embodiments, the service monitor agent 1696 monitors advertisements provided to the user on the device 100. In some embodiments, the service monitor agent 1696 monitors advertisements viewed (e.g., accessed, such as by clicking on a web advertisement) by the user on the device 100. In some embodiments, the service monitor agent 1696 monitors GPS/location information for the device 100. As will be appreciated by those of ordinary skill in the art, the service monitor agent 1696 can monitor a wide variety of activities performed by the device/user of the device and/or based on other information related to the device 100 such as GPS/location information. As described herein, in some embodiments, the user of the device 100 can also specify which activities that the user authorizes for such monitoring (e.g., the user may prefer to not allow for such GPS/location monitoring).

[00221] In some embodiments, the application interface agent 1693 provides an interface for device application programs. In some embodiments, the application interface agent 1693 identifies application level traffic, reports virtual service identification tags or appends literal service identification tags to assist service policy implementation, such as access control, traffic shaping QoS control, service type dependent billing or other service control or implementation functions. In some embodiments, the application interface agent 1693 assists with application layer service usage monitoring by, for example, passively inspecting and logging traffic or

service characteristics at a point in the software stack between the applications and the standard networking stack application interface, such as the sockets API. In some embodiments, the application interface agent 1693 intercepts traffic between the applications and the standard network stack interface API in order to more deeply inspect the traffic, modify the traffic or shape the traffic (e.g., thereby not requiring any modification of the device networking/communication stack of the device OS). In some embodiments, the application interface agent 1693 implements certain aspects of service policies, such as application level access control, application associated billing, application layer service monitoring or reporting, application layer based traffic shaping, service type dependent billing, or other service control or implementation functions.

[00222] In some embodiments, application layer based traffic monitoring and shaping can be performed as described below. The traffic from each application can be divided into one or more traffic flows that each flow through a traffic queue, with each queue being associated with one or more additional classifications for that application (e.g., the application can be a browser that is associated with multiple queues representing different destinations or groups of destinations it is connected to, with each destination or group of destinations having potentially different access control or traffic control policies, or the application can be associated with different content types or groups of content types with each content type having different queues, the application might be an email program with email text traffic going to one queue and downloads going to another with different policies for each). In some embodiments, queues are formed for all applications or groups of applications that are associated with one or more traffic parameters such as destination, content type, time of day or groups of applications can be similarly assigned to different queues. The functions performed by the application layer queues can be similar to the functions described for the policy implementation agent, such as pass, block, buffer, delay, burst in order to control the traffic or network access associated with the queue. The drop function can also be implemented, such as for application layer protocols that include reliable transmission methods, but if the application layer protocol does not involve reliable retransmission of lost information this can result in lost data or unreliable communication which may be acceptable in some cases. The manner in which the queues are controlled can be constructed to result in a similar approach for controlling services or implementing service activity control similar to the other embodiments described herein,

including, for example, the policy control agent 1692 implementing an higher layer of service control to achieve a higher level objective as discussed herein.

[00223] In some embodiments, the application interface agent 1693 interacts with application programs to arrange application settings to aid in implementing application level service policy implementation or billing, such as email file transfer options, peer to peer networking file transfer options, media content resolution or compression settings and/or inserting or modifying browser headers. In some embodiments, the application interface agent 1693 intercepts certain application traffic to modify traffic application layer parameters, such as email file transfer options or browser headers. In some embodiments, the application interface agent 1693 transmits or receives a service usage test element to aid in verifying service policy implementation, service monitoring or service billing. In some embodiments, the application interface agent 1693 performs a transaction billing intercept function to aid the billing agent 1695 in transaction billing. In some embodiments, the application interface agent 1693 transmits or receives a billing test element to aid in verifying transaction billing or service billing.

[00224] In some embodiments, a modem firewall 1655 blocks or passes traffic based on service policies and traffic attributes. In some embodiments, the modem firewall 1655 assists in virtual or literal upstream traffic flow tagging. Although not shown in FIG. 16, in some embodiments, the modem firewall 1655 is located on either side of the modem bus and in some embodiments it is advantageous to locate it on the modem itself.

[00225] In some embodiments, the billing agent 1695 detects and reports service billing events. In some embodiments, the billing agent 1695 plays a key role in transaction billing. In some embodiments, the billing agent 1695 performs one or more of the following functions: provides the user with service plan options, accepts service plan selections, provides options on service usage notification policies, accepts user preference specifications on service usage notification policies, provides notification on service usage levels, provides alerts when service usage threatens to go over plan limits or to generate excess cost, provides options on service usage control policy, accepts choices on service usage control policy, informs policy control agent 1692 of user preference on service usage control policy, provides billing transaction options and/or accepts billing transaction choices. In some embodiments, the billing agent 1695

interacts with transaction servers (e.g., open content transaction partner sites 134) to conduct ecommerce transactions with central billing 1619.

[00226] In some embodiments, service processor 115 includes one or more service usage or service activity counters. For example, the service monitor agent 1696, billing agent 1695 or a combination of these agents and/or other agents/components of service processor 115 can include such a local service usage counter(s) for the device 100. In some embodiments, a service usage counter monitors service usage including data usage to/from the device 100 with the access network 1610. In some embodiments, the service usage counter periodically, in response to a user request, in response to a service processor 115 agent's request (e.g., the billing agent 1695, the policy control agent 1692, or another agent of service processor 115), in response to the service controller 122, and/or in response to the central billing 1619 (e.g., for billing purposes and/or for storing in the device service history 1618), provides a service usage report, including monitored service usage for the device 100. In some embodiments, the service usage counter periodically, or in response to a request, synchronizes the service usage counter on the device 100 with a network (and/or billing) service usage counter, such as that maintained potentially at central billing 1619. In some embodiments, service processor 115 utilizes the service usage counter to provide a service usage projection. In some embodiments, service processor 115 utilizes the service usage counter to provide a service usage cost estimate. In some embodiments, service usage projections from policy control agent 1692 are used to estimate the projected future service usage if user service usage behavior remains consistent. In some embodiments, service processor 115 utilizes the service usage counter to provide a cost of service usage, and the service processor 115 then periodically, or in response to a request, synchronizes the cost of service usage with, for example, the central billing 1619. In some embodiments, the service processor 115 utilizes the service usage counter to determine whether the user is exceeding and/or is projected to exceed their current service plan for data usage, and then various actions can be performed as similarly described herein to allow the user to modify their service plan and/or modify (e.g., throttle) their network data usage. In some embodiments, the service usage counter can support providing to the user the following service usage related data/reports: service usage, known usage and estimated usage, projected usage, present costs, projected costs, cost to roam, cost to roam options, and/or projected roaming costs. For example, including a local service data usage counter on the device 100 allows the service processor 115

to more accurately monitor service data usage, because, for example, network (and/or billing) service usage counters may not accurately also include, for example, control plane data traffic sent to/from the device 100 in their monitored service data usage count.

[00227] In some embodiments, verifiable device based service billing solutions are provided. For example, as described herein, various device based service billing solutions can include a wide range of verification techniques to ensure that the device is properly reporting service billing events (e.g., to verify/ensure that the service billing is not malfunctioning and/or has not been tampered with/compromised such that it is not accurately or timely providing service billing information). As described herein, service billing generally refers the billing for one or more services for a device, such as device 100 (e.g., email service billing for data usage associated with received/sent email related data over the access network 1610, web browsing service billing for data usage associated with received/sent web browsing related data over the access network 1610 and/or any other network based service, and/or any transactional based services, such as for multimedia content purchases or other transactions).

[00228] In some embodiments, verifiable device based service billing is provided by sending dummy(/test) billing events, such as having an access control integrity server 1654 of the service controller 122 instruct the access control integrity agent 1694 to send a dummy(/test) billing event to the billing agent 1695. If the billing agent does not then send the expected report, which should reflect the dummy(/test) (or fails to timely send any report), then the system can verify whether the billing process is working properly. In addition, a dummy (/test) transaction can be used to verify transaction based billing through a variety of approaches (e.g., the access control integrity agent 1694 can similarly send a dummy(/test) transactional billing event to the billing agent 1695 as a test to determine whether the billing agent 1695 then provides the expected report reflecting that dummy(/test) transaction). For example, the test billing events can be trapped by a device assisted billing mediation server and removed from the user account billing.

[00229] In some embodiments, verifiable device based service billing is provided by sending one or more data bursts to the device to confirm that data was received and to confirm that the service monitor agent 1696 properly logged the data burst(s) in the local service usage or