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(54) Title: APPARATUS AND METHOD FOR PROVIDING ACCESS TO INTERNET RESOURCES IN A WIRELESS COMMUNICATIONS NETWORK

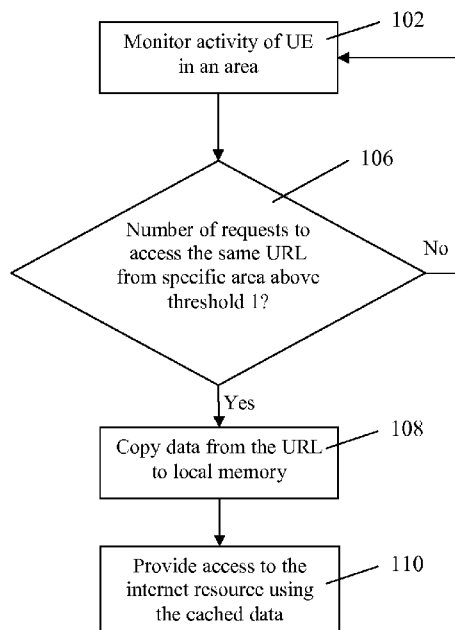


FIG. 1

(57) Abstract: A method and apparatus for providing access to internet resources in a wireless communications network is disclosed. The method comprises storing (108) in a memory located in said communications network at least one file from an internet resource if monitoring (102) user equipment in a predefined area shows that a number of requests from said user equipment in said area to access said internet resource exceeds (106) a first threshold. The method further comprises providing (110) access to said internet resource using said at least one file stored in said memory.

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**APPARATUS AND METHOD FOR PROVIDING ACCESS TO INTERNET
RESOURCES IN A WIRELESS COMMUNICATIONS NETWORK**

Technical Field

5 The present invention relates to wireless communications networks, in general, and in particular to providing location based caching access to internet resources to user equipment operating in a wireless communications network.

Background

10 In cellular wireless communications networks each cell has a base station that a user's mobile phone communicates directly with. The number of cells that serves an area depends on the density of population in that specific area. Traditionally, these cells have mainly handled voice and limited data (e.g. SMS) but more recently in 3G networks mobile broadband has brought the World Wide Web and other Internet based
15 communications (email, Instant Messaging, etc) directly to a user's handset.

 With the advent of HSDPA (High-Speed Downlink Packet Access) and LTE (Long Term Evolution) more and more data will need to be transferred to the radio network. 3G
LTE/SAE (Long Term Evolution/System Architecture Evolution) is the next step in terms
20 of user-service experience, improving latency, capacity and throughput. It will allow data rates above 100 Mbps. 3G LTE supports both FDD (Frequency Division Duplex) and TDD (Time Division Duplex) with the same specification and hardware components, allowing for a large increase in system capacity and reduced cost per gigabyte. Present solutions, however, make repeated, often redundant, calls for data from the edge of the network
25 through the radio and core parts of the telecoms network to load balanced, solutions and on to the internet in order to obtain the requested data. Subsequently, the number of requests to a given URL (Uniform Resource Locator) increases and response times for the delivery of information as well as amount of data being transferred across the network increase significantly.

Summary

According to a first aspect of the present invention there is provided a method of providing access to internet resources in a wireless communications network. The method comprises storing in a memory located in said communications network at least one file from an internet resource if monitoring user equipment in a predefined area shows that a number of requests from said user equipment in said predefined area to access said internet resource exceeds a first threshold. The method further comprises providing access to said internet resource using data stored in said memory.

According to a second aspect of the present invention there is provided an apparatus for a wireless communications network. The apparatus comprises a number of interfaces to network nodes of said wireless communications network and is adapted to receive from said network nodes information about a number of user equipment in a predefined area and information about internet resources requested to access by user equipment. The apparatus further comprises a control unit, wherein if a number of requests to access a specific internet resource from user equipment in said predefined area exceeds a first threshold said control unit is adapted to request storing in a memory located in said communications network at least one file from said specific internet resource requested by said user equipment.

According to a third aspect of the present invention there is provided a wireless communications network comprising a first node for location registration of user equipment, a second node operating as a gateway between said communications network and Internet as well as an apparatus comprising a number of interfaces to said first and second network nodes. Said apparatus is adapted to receive via a first interface information about a number of user equipment in a predefined area and via a second interface information about internet resources requested to access by user equipment. The apparatus further comprises a control unit, wherein if a number of requests to access a specific

internet resource from user equipment in said predefined area exceeds a first threshold said control unit is adapted to request storing in a memory located in said communications network at least one file from said specific internet resource requested by said user equipment.

5

Further features of the present invention are as claimed in the dependent claims.

The present invention has several advantages over the known solutions. The main advantages are mentioned below.

- 10 - Reduced calls to the same information at a URL. When the caching mechanism is active then the S-GW (Serving Gateway) only needs to update the cache periodically according to the above method (as if the cache itself was a user seeking information). In this situation the number of calls to a URL is reduced when many users make requests to that URL.
- 15 - Increased efficiency in transferring data for the core network. The amount of data that is transferred in the core network decreases as the number of calls to a URL decreases when the caching mechanism is active.
- Faster delivery of the requested content to the subscriber. When the data is stored closer to the user in the telecoms network then latencies can be reduced.
- 20 This means that the requested content is delivered to the subscriber in a shorter period of time.

Brief description of the drawings

25 The present invention will be understood and appreciated more fully from the following detailed description taken in conjunction with the drawings in which:

FIG. 1 is a diagram illustrating a method of providing access to internet resources in a wireless communications network in one embodiment of the present invention;

FIG. 1A is a diagram illustrating a method of providing access to internet resources in a wireless communications network in one embodiment of the present invention;

FIG. 2 is a diagram illustrating a method of providing access to internet resources
5 in a wireless communications network in one embodiment of the present invention

FIG. 3 is a diagram illustrating a method of providing access to internet resources in a wireless communications network in one embodiment of the present invention;

10 FIG. 4 is a diagram illustrating a method of providing access to internet resources in a wireless communications network in one embodiment of the present invention;

FIG. 5 is a block diagram illustrating an apparatus in one embodiment of the present invention;
15

FIG. 6 is a block diagram illustrating an apparatus in one embodiment of the present invention;

FIG. 7 is a block diagram illustrating an apparatus in one embodiment of the present invention;
20

FIG. 8 is a diagram illustrating cellular communications network in one embodiment of the present invention;

25 FIG. 9 is a diagram illustrating cellular communications network in one embodiment of the present invention.

Detailed description

The invention is based on introduction of a cache and a caching algorithm into cellular network in order to introduce added data transfer efficiencies into the network, specifically, although not exclusively, for Mobile Internet information. In this invention a cache is placed close to the subscriber in the network.

5 One can imagine a scenario where 50,000 football fans are exiting football stadium. The base stations providing 3G communications and Mobile Internet to subscriber handsets are very active after the match as fans go to web sites to get the latest score lines of other matches. As the hundreds, or thousands, of fans check the same football score website identified by a specific URL the data is repeatedly sought and transferred across
10 the cellular network through the core and the Internet.

 In one embodiment, illustrated in Fig. 1 a method of providing access to internet resources 810 in a wireless communications network is presented. The method comprises monitoring 102 activity of user equipment in a predefined area (e.g. vicinity of a football
15 stadium after a match). If the monitoring shows that one website is very popular amongst the users of user equipment present in said predefined area. The content of this website, identified by a URL, is copied 108 to a local memory within the telecommunications network. When the data from the website is finally copied, the access to this internet resource is provided to the users in said predefined area using the data stored in said local
20 memory. In operation, in order to initiate copying data from said popular URL a number of requests to access said URL from user equipment in said predefined area must exceed a predefined threshold.

 In an alternative embodiment illustrated in Fig. 1A a method of providing access to
25 internet resources in a wireless communications network is presented. The method is based on an algorithm that checks the number of user equipment (UE) operating in a predefined area and the number of requests to access specific internet resource. In operation, activity of UE is monitored 102 in a predefined area.

In one embodiment the predefined area is a cell in a cellular network. In an alternative embodiment it can be a cluster of cells in a specific area. In yet another embodiment the area may be defined regardless of the cells of the communications
5 network (e.g. 1km around a football stadium).

If said monitoring 102 of UE activity shows that a number of user equipment in said predefined area exceeds a second threshold 104 in the next step it is checked if a number of requests from said user equipment in said area to access the same internet
10 resource 810 exceeds a first threshold 106. When these two conditions are met it means that it would be beneficial for the users and for the network itself to bring the frequently accessed data closer to the users. Therefore in the next step the data from the internet resource requested by the users is copied 108 to a memory located in the cellular network. The way the data is located and then transferred from said URL is as if the cache itself was
15 a user seeking information on this web site. In a simplest case the data copied to local memory can be a single file, e.g. a audio and video content frequently accessed by the UE. In most likely scenario it will be content of a web identified by a specific URL in order to give the user experience that is not different from accessing the URL itself. Once the data is stored 108 in said local memory users requesting access to said URL are provided with
20 data stored in said local memory.

The benefit of checking additionally if a number of user equipment in said predefined area is above a second threshold allows for quick discrimination of situations when there is simply not enough user equipment in said predefined area to exceed the first
25 threshold.

In one embodiment all requests to access said URL are directed to the local memory. However, in an alternative embodiment it is possible that in case of really huge

demand to access said URL a load balancing algorithm is implemented and part of the users is directed to the cached data and part to the original URL.

In a preferred embodiment the method comprises updating Call Data Records of
5 users accessing the data stored in said memory.

Also preferably the method comprises updating the contents of the cache with newer versions of the files copied from said internet resource 810. In one embodiment, illustrated in Fig. 3, the content of the cache is updated 306 periodically and this is
10 triggered by expiring timer 302, 304. In this embodiment the content of the cache is replaced with content taken from the URL and it is not checked if the files have been changed at source (i.e. URL).

In an alternative embodiment, illustrated in Fig. 4, after expiring of the timer 302,
15 304 it is checked if the version of the files at said URL changed. If a new version is available 402 the new version of the file is used to update the cache 404.

With reference to Fig. 2 a preferred embodiment of the present invention is presented. In this embodiment the steps performed in order to provide access to internet
20 resources using a memory located in the cellular network containing cached content a of specific URL are the same as in the embodiment illustrated in Fig. 1A. This embodiment further comprises removing 204 said cached content from the memory if a number of requests to access said file drops below a third threshold 202.

25 In one embodiment the third threshold is equal the first threshold, which means that in order to keep the content of a specific web site cached in said memory the number of request to access it must remain above the threshold required to form the cache.

In an alternative embodiment the third threshold lies below the first threshold and this provides a hysteresis that prevents the cache from being emptied due to some statistical oscillations in the number of requests.

- 5 One possible example of the algorithm implemented in the embodiments of the present invention is presented below in a pseudocode.

WHEN [threshold_2] is exceeded AND IF [threshold_1] for URL request is exceeded

THEN (i) start cache for that URL

- 10 *(ii) intercept all requests to that URL from subscribers*
(iii) reply to subscriber with recently cached data
(iv) update the cache every [update] seconds, until requests for URL
decrease below [threshold_3]

- 15 Note:

[threshold_2] is the numeric value that represents the number of mobile terminals at a particular location;

[threshold_1] and [threshold_3] are arbitrary numeric values that can be set statically or dynamically depending on the popularity of a URL;

- 20 [update] is an arbitrary value of time in seconds that can be set statically or dynamically depending on the popularity of a URL.

- With reference to Fig. 5 one embodiment of an apparatus 500 for use in a wireless communications network in accordance with the present invention is presented. The
- 25 apparatus 500 comprises a first interface 502 for connecting to a Mobility Management Entity node. Via said first interface 502 the apparatus 500 receives information about a number of user equipment in a predefined area.

Embodiments of this invention are described herein with reference to 3GPP Long Term Evolution networks; however the invention is also applicable to other types or generations of wireless telecommunications networks. Mobility Management Entity is a term used in 3GPP Long Term Evolution networks, but in alternative embodiments,
5 different nodes capable of providing this information can use said first interface to provide the required information.

The apparatus 500 also comprises a second interface 504 for connecting to a Gateway GPRS Support Node (GGSN) 808 of the network 800. Said GGSN 808 provides
10 to the apparatus 500 information about internet resources access to which has been requested by all User Equipment served by said GGSN 808 or PDN Gateway 826. In this embodiment the apparatus 500 filters out and discards information about UE served by said GGSN 808 that is not located in the predefined area. In this embodiment, in order to carry out the filtering, the information received via the first interface 502 includes a list of
15 User Equipment ID that is located in the predefined area.

Alternatively, the information received via the second interface 504 comprises information about internet resources requested by said user equipment located in said predefined area.

20

In alternative embodiment the second interface 504 can be used for connecting the apparatus 500 to a Packet Data Networking Gateway (PDN Gateway) 826 of the wireless communications network. In yet another alternative embodiment the second interface 504 connects the apparatus 500 to a Serving Gateway (S-GW) 806 of the wireless
25 communications network in order to receive information about internet resources access to which has been requested by the UE 812.

The apparatus 500 further comprises a control unit 506 which receives said information about the number of UE in said predefined area and URLs access to which has

been requested by said UE. The control unit 506 processes the received information and if the number of the user equipment exceeds a second threshold and a number of requests to access a specific internet resource 810 exceeds a first threshold said control unit 500 requests storing in a memory the contents of said specific internet resource requested by
5 said user equipment.

With reference to Fig. 6 a preferred embodiment of the present invention is presented. The apparatus 600 comprises, in addition to the components illustrated in Fig. 5, a third interface 602. This third interface 602 is used for providing information required for
10 updating Call Data Records for charging users accessing internet resources (whether directly on the remote server in the internet 824 or locally cached in said memory). If the internet access is charged at a flat rate the updates to Call Data Records are charged at zero cost, but the usage of the service can be audited. In one embodiment the third interface 602 is for connecting said apparatus 600 to the PDN Gateway 826. Alternatively the third
15 interface is connected to the GGSN 806. In yet another alternative embodiment the third interface 602 is adapted to provide said information for updating Call Data Records via a Serving Gateway (S-GW) 806.

The memory used for caching data from the popular website identified by the URL
20 requested by the user equipment can be located in various parts of said communications network. In one embodiment, illustrated in Fig. 7, the apparatus 700 comprises all the components illustrated in Fig. 6 and additionally a memory 702. In this embodiment the memory 702 is adapted to store the at least one file requested by the UE from a specific internet resource. As discussed earlier in most cases it will be more than one file – the
25 memory 702 will store a large number of files from a website in order to give the user the same experience as when accessing said website located on a remote server. It is also possible that the embodiment of the invention illustrated in Fig. 5 can be modified by adding a memory unit in a similar way as illustrated in Fig. 7

It is not, however, required that the apparatus which carry out the algorithm discussed earlier is co-located with the memory. The memory can be part of one of the other nodes of the cellular network. Possible examples of implementing the memory for storing data requested from said internet resource include co-locating it with MME 804,
5 eNodeB 814, 816 in the case of LTE networks or with NodeB 910 in the case of 3G networks illustrated in Fig. 9.

Fig. 8 and Fig. 9 illustrate networks 800 and 900 in which the apparatus 500, 600, 700 discussed above is implemented in form of a logical function called a Radio Network
10 Caching Node (RnCN) 802 in Fig. 8 or 902 in Fig. 9.

In one embodiment the apparatus 500, 600, 700 is a standalone node for use in the wireless communications network or alternatively it can be a part of another node operating in said network (e.g. GGSN 808 or PDN Gateway 826). In order to implement
15 the method and apparatus of the invention in the network a tunnelling mechanism between two tunnels in S-GW 806 (one towards eNodeB 814, 816 and one towards PDN GW 826) should be implemented. This means that the tunnel may have to be broken in order to implement the mapping. However in one embodiment if the apparatus 802 is co-located at the tunnel endpoint (i.e. PDN-GW 826) then the tunnel does not need to be broken. In an
20 alternative embodiment it is possible to break the tunnel for redirecting to standalone RnCN node 802.

Although the embodiments discussed above considered only one URL access to which was requested so frequently that it crossed the first threshold it is within
25 contemplation of the present invention that in its various embodiments the invention also covers situations when more than one internet resource is requested so frequently that the conditions specified by the algorithm are met. In these situation data from more than one internet resource is cached in said memory in the cellular communications network.

Fig. 8 illustrates a wireless communications network 800 in accordance with one embodiment of the present invention. A logical function called a Radio Network Caching Node (RnCN) 802, which is an implementation of the apparatus 500, 600 and 700 is deployed in the network 800. In various embodiments the RnCN 802 can be implemented in hardware or in software or partially in hardware and software. It is important to note that operations, functionality, and workflows in the core network and radio network are not affected by the addition of the RnCN 802.

Fig. 8 illustrates how the RnCN 802 interacts with LTE environment. In the embodiment presented in Fig. 8 the RnCN 802 is located on the border between LTE 800 and core networks 822. It is important to note that the S-GW 806, GGSN 808, RNC 818, SGSN 820, MME 804, eNode B 814 and 816, PDN-GW 826 as well as RnCN 802 are all elements that can be managed through the OSS/BSS (Operations Support System / Business Support Systems) environment.

In the embodiment depicted in Fig. 8 the connections between the RnCN 802 and the Mobility Management Element 804, Serving Gateway (S-GW) 806, and GGSN 808 are used for the reasons discussed below.

KQm (Mobility Information)

A first interface for connection between the RnCN 802 and the Mobility Management Entity (MME) 804 is used to query mobility information. In this way mobility information is retrieved over said first interface from the MME labeled 'KQm' in Fig. 8. The mobility information allows the caching algorithm to take into account the density of users in a predefined area. This density information can be used in the decision making process regarding the activation of the cache memory. In a preferred embodiment the MME 804 provides a list of user equipment located in the predefined area.

KQd (URL Information)

The connection (labeled 'KQd' in Fig. 8) between the S-GW 806 and the RnCN 802 enables the RnCN 802 to retrieve URL identifiers from the S-GW 806. These URL's are required by the caching algorithm as they will be used to select URL's that need to be cached and subsequently provided to requesting users. In a preferred embodiment S-GW 806 provides a list of URL identifiers and a list of UE requesting access to said URLs. In order to retrieve this information a deep packet inspection mechanism within the S-GW to parse URLs is implemented. In one embodiment the mechanism is based on the packet filtering mechanism that is present in the Packet Data Networking (PDN) Gateway 826. In alternative embodiments of this invention the RnCN 802 can be connected via a second interface (KQd) to a node other than S-GW 806 if said node has or can obtain information about URLs access to which is requested by the user equipment 812. In these alternative embodiments the RnCN 802 can receive via the second interface said information from GGSN 808 or Packet Data Networking Gateway (PDN-GW) 826. In alternative embodiments the present invention is also as applicable to URI's (Uniform Resource Identifier) as it is to URL's (Uniform Resource Locator).

The RnCN 802, whether implemented in software or in hardware, comprises a control unit that processes information received on the first and second interfaces. This information is processed in accordance with the algorithm described above with reference to embodiments of the method according to the present invention. If the number of the user equipment in said predefined area exceeds a second threshold and a number of requests to access a specific internet resource from user equipment in said predefined area exceeds a first threshold said control unit requests storing in a memory located in said communications network the contents of the popular internet resource. Popular in the context of this invention means that a number of requests to access this internet resource is high (e.g. above said first threshold). In this way if there is a high density of UE and there is an internet resource (website) very popular amongst the users in said area the network can react to the increased demand by caching locally contents of the website popular

amongst the user at that time and in that place, and provide access to said popular website from said local cache.

In one embodiment the memory used for caching the contents of the website is shared between the RnCN 802 and another node of the network. This allows the logic function of the RnCN 802 to be located in one physical location (it can be co-located with another node) and the memory in another physical location. Alternatively the RnCN can be implemented in a way the both memory and logical function are co-located (as illustrated in Fig. 7).

Preferably the RnCN 802 uses a third interface for providing information necessary for updating Call Data Records of users accessing data stored in said memory. This interface is discussed below.

KQb (Billing Information)

The third interface (labeled 'KQb' Fig. 8) between the RnCN 802 and the GGSN 808 is used to update the CDR (Call Data Records) of data connections to the internet 824. A new field in the CDR indicates Caching [enabled | disabled]. When caching is enabled the RnCN 802 updates the users CDR for the session to indicate if the user accessed the cached data. This information can in turn be used for a flexible billing model relating to the use of the caching of data services. Note that the 'KQb' connection is purely functional and could be implemented via the S-GW 806.

Fig. 9 illustrates a communications network 900 in another embodiment. In this embodiment 3G network is considered. Interfaces KQm (first interface), KQd (second interface) and KQb (third interface) illustrated in Fig. 9 have the same functions as corresponding interfaces in Fig. 8. Mobility information or information about a number of user equipment in a predefined area is provided via the first interface from a Radio Network Controller (RNC) 904. Information about internet resources access to which is

requested by UE 912 is received via the second interface from a Serving GPRS Support Node (SGSN) 906 operating in 3G core network 914. Using the information provided via said first and second interfaces RnCN 902 determines if the internet resource should be cached by executing the algorithm discussed earlier. As is the embodiment illustrated in Fig. 8 also in the case of the network 900 the third interface ('KQb' Fig. 9) between the RnCN 902 and the GGSN 908 is used to update 206 the CDR (Call Data Records) of data connections to the internet 824. A new field in the CDR indicates Caching [enabled | disabled]. When caching is enabled the RnCN 902 updates 206 the users CDR for the session to indicate if the user accessed the cached data.

Example Operation

It's 4.45 on a Saturday afternoon and 50,000 people are exiting football stadium and the surrounding area. Several thousand football fans begin to access the internet 824 to check the results from other matches on their mobile phones. Assume that the OSS/BSS management system has configured the RnCN 802 to operate when $[\text{threshold_2}] > 30,000$ AND $[\text{threshold_1}] > 1,000$. It is only under these configured circumstances that the caching algorithm will begin to operate, yet this configuration can be changed in the OSS/BSS. As there is a $[\text{threshold_2}]$ of 50,000 people around the stadium, and as the number of requests to the same web site has passed 1,000, the data from this website starts to be cached. All subsequent requests to access this website from the mobile users are serviced from this cache. The cache for that particular URL is updated periodically every n seconds until the number of request subsides below a defined threshold.

If the time was 11.00 on a Tuesday morning then the area around the stadium would be relatively empty and the caching algorithm may not begin depending on how the RnCN 802 is configured for this specific area. In the Saturday afternoon example a $[\text{threshold_2}] > 30,000$ AND $[\text{threshold_1}] > 1,000$ was required. In this Tuesday morning example the caching algorithm would likely not be in operation under Saturday's

configuration. However, the present invention is flexible enough to apply different configurations for different day of the week and/or different time of the day.

5 The present invention, as described above, allows for creating local cache, close to the user at time when it is needed, in place where it is needed and with a content that is required by the user. Once the demand for accessing the specific internet resource drops the cache is emptied and the logical function waits until the conditions for creation of the cache are met again.

CLAIMS

1. A method of providing access to internet resources in a wireless communications network comprising storing in a memory located in said communications network at least one file from an internet resource if monitoring user equipment in a predefined area shows that a number of requests from said user equipment in said predefined area to access said internet resource exceeds a first threshold, and providing access to said internet resource using said at least one file stored in said memory.
10
2. A method according to claim 1, wherein said storing is carried out if a number of user equipment in said predefined area exceeds a second threshold and the number of requests from said user equipment in said predefined area to access said internet resource exceeds said first threshold.
15
3. The method according to claim 1 or claim 2 comprising updating Call Data Records of users accessing the at least one file stored in said memory.
4. The method according to any one of preceding claims comprising replacing the at least one file with a newer version of said file taken from said internet resource.
20
5. The method according to claim 4, wherein said replacing is carried out periodically.
- 25 6. The method according to claim 4, comprising monitoring the internet resource and replacing the at least one file if there is a newer version of said file stored in said internet resource.

7. The method according to any one of preceding claims comprising storing internet web site identified by a Universal Resource Locator of the internet resource requested by the user equipment.

5 8. The method according to any one of preceding claims comprising removing said at least one file from the memory if a number of requests to access said file drops below a third threshold.

9. An apparatus for a wireless communications network comprising a number of
10 interfaces to network nodes of said wireless communications network and adapted to receive from said network nodes information about a number of user equipment in a predefined area and information about internet resources requested to access by user equipment and further comprising a control unit, wherein if a number of requests to access a specific internet resource from said user equipment in said predefined area
15 exceeds a first threshold said control unit is adapted to request storing in a memory located in said communications network at least one file from said specific internet resource requested by said user equipment.

10. The apparatus according to claim 9, wherein said control unit is adapted to
20 request said storing in said memory if the number of the user equipment in said predefined area exceeds a second threshold and the number of requests to access said specific internet resource from user equipment in said predefined area exceeds said first threshold.

25 11. The apparatus according to claim 9 or 10 comprising said memory.

12. The apparatus according to any one of claims 9 to 11 comprising a first interface for receiving said information about the number of user equipment in said predefined area from a Mobility Management Entity or from a Radio Network Controller.

13. The apparatus according to any one of claims 9 to 12 comprising a second interface for receiving from a Gateway GPRS Support Node or from a Packet Data Networking Gateway, or from a Serving Gateway, or from a Serving GPRS Support
5 Node said information about internet resources requested to access by said user equipment.

14. The apparatus according to any one of claims 9 to 13 comprising a third interface for providing information for updating Call Data Records of users accessing
10 the at least one file stored in said memory.

15. The apparatus according to claim 14, wherein the third interface is adapted to provide said information for updating Call Data Records to said Packet Data Networking Gateway or to said Gateway GPRS Support Node.
15

16. The apparatus according to claims 14 or claim 15, wherein the third interface is adapted to provide said information for updating Call Data Records via a Serving Gateway.

20 17. The apparatus according to any one of claims 9 to 16, wherein said apparatus is a standalone network node.

18. A wireless communications network comprising a first node for location registration of user equipment, a second node operating as a gateway between said
25 communications network and Internet as well as an apparatus comprising a number of interfaces to said first and second network nodes adapted to receive via a first interface information about a number of user equipment in a predefined area and via a second interface information about internet resources requested to access by user equipment and further comprising a control unit, wherein if a number of requests to access a

specific internet resource from user equipment in said predefined area exceeds a first threshold said control unit is adapted to request storing in a memory located in said communications network at least one file from said specific internet resource requested by said user equipment.

5

19. The network according to claim 18, wherein said control unit is adapted to request said storing in said memory if the number of the user equipment in said predefined area exceeds a second threshold and the number of requests to access said specific internet resource from user equipment in said predefined area exceeds said first
10 threshold.

20. The network according to claim 18 or claim 19, wherein the apparatus comprises said memory.

15 21. The network according to any one of claims 18 to 20, wherein said apparatus is adapted to receive via said first interface information from a Mobility Management Entity or from a Radio Network Controller.

22. The network according to any one of claims 18 to 21, wherein said apparatus is
20 adapted to receive via said second interface information from a Gateway GPRS Support Node or from a Packet Data Networking Gateway, or from a Serving Gateway, or from a Serving GPRS Support Node.

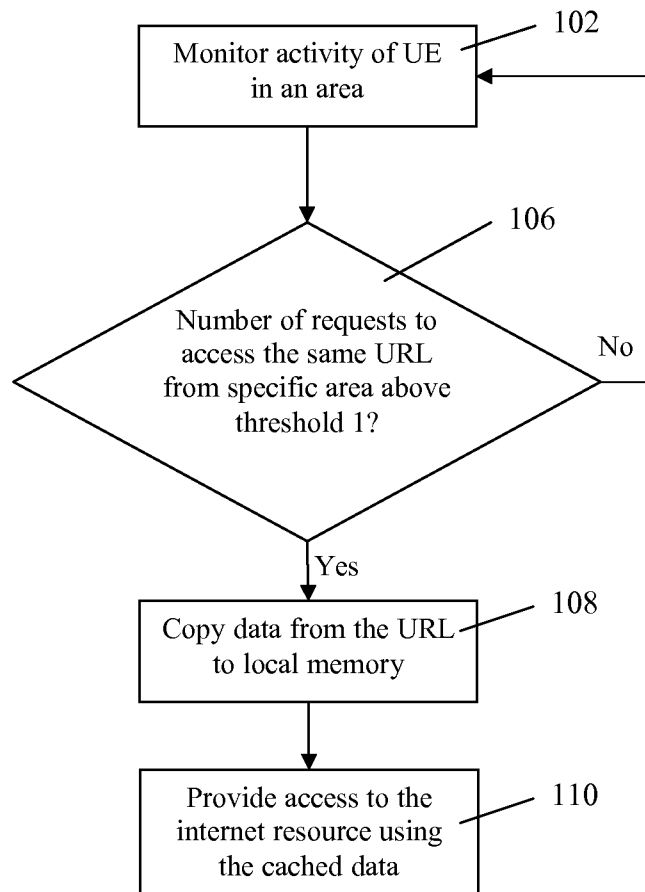
23. The network according to any one of claims 18 to 22, wherein the apparatus
25 comprises a third interface for providing information for updating Call Data Records of users accessing the at least one file stored in said memory.

24. The network according to claim 23, wherein the third interface is adapted to provide said information for updating Call Data Records to said Packet Data Networking Gateway or to said Gateway GPRS Support Node.

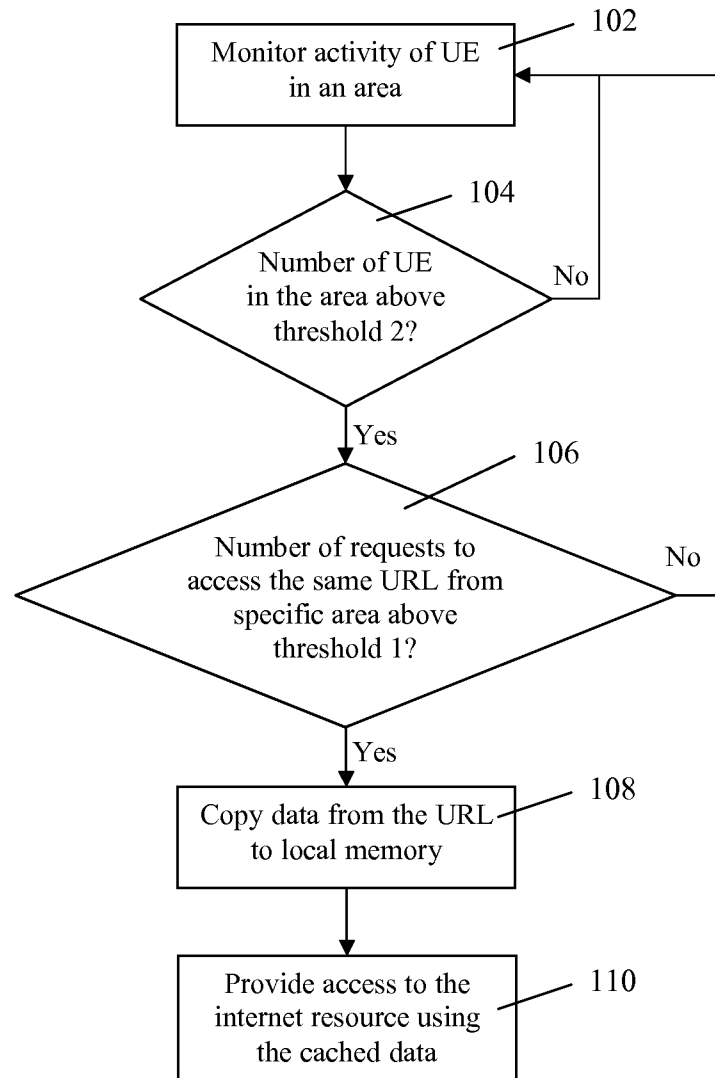
5 25. The network according to claims 23 or claim 24, wherein the third interface is adapted to provide said information for updating Call Data Records via a Serving Gateway.

26. The network according to any one of claims 21 – 31, wherein said apparatus is a
10 standalone network node.

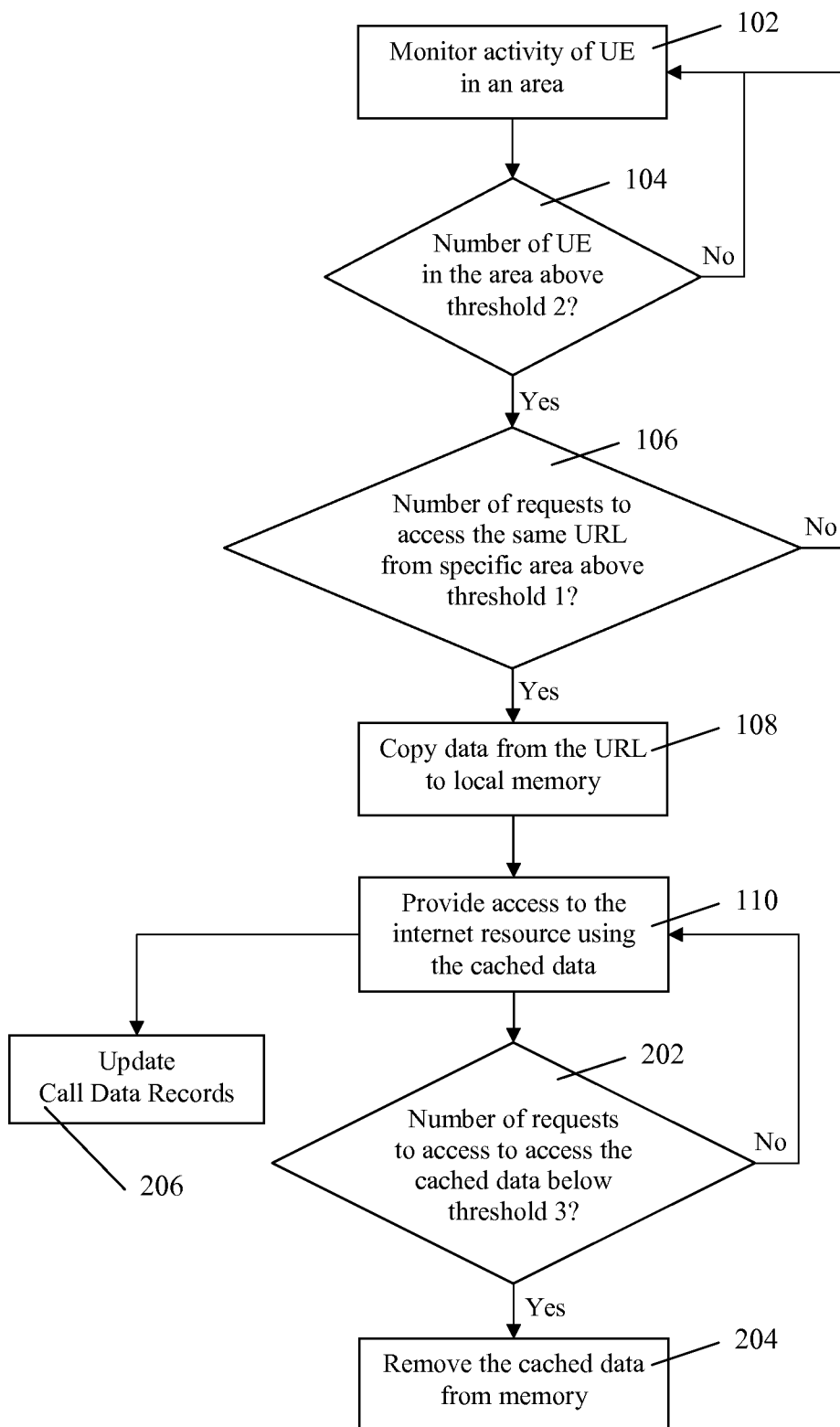
1/7

**FIG. 1**

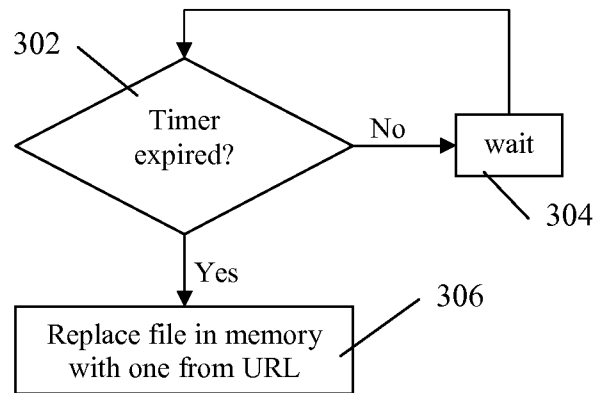
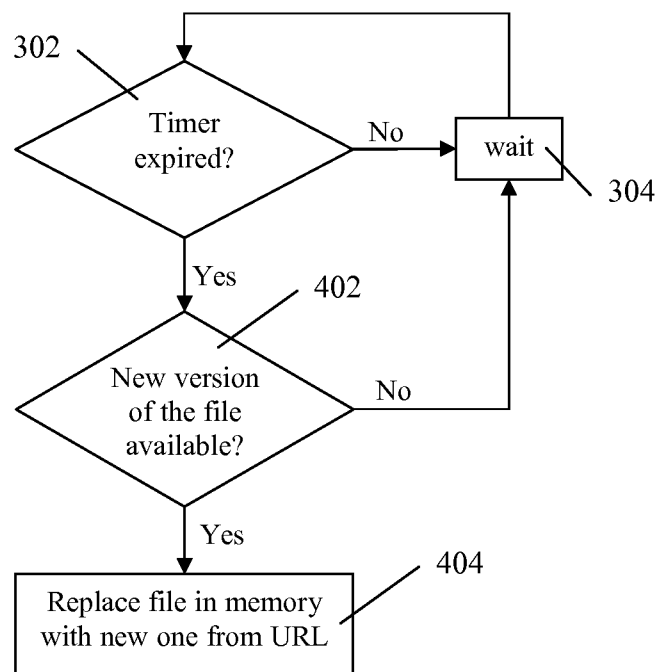
2/7

**FIG. 1A**

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**FIG. 2**

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**FIG. 3****FIG. 4**

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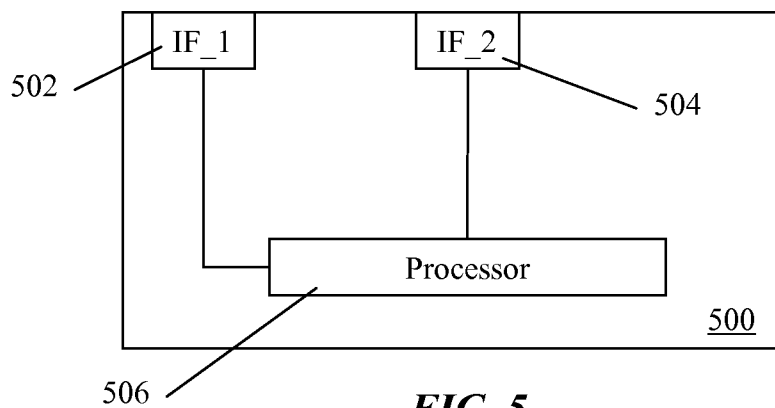


FIG. 5

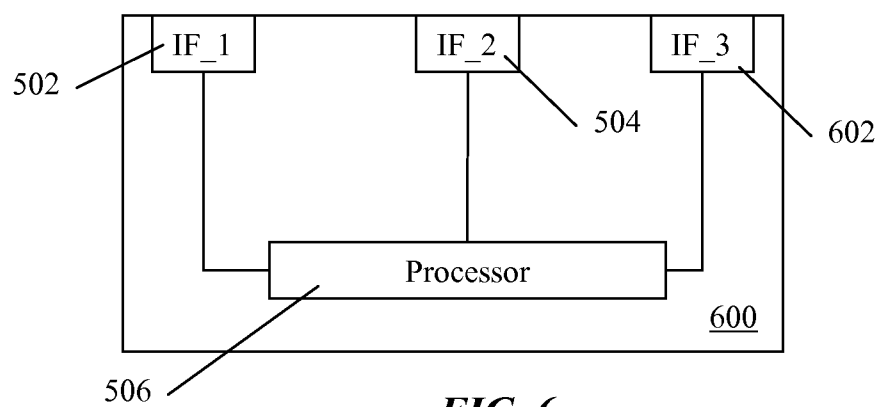


FIG. 6

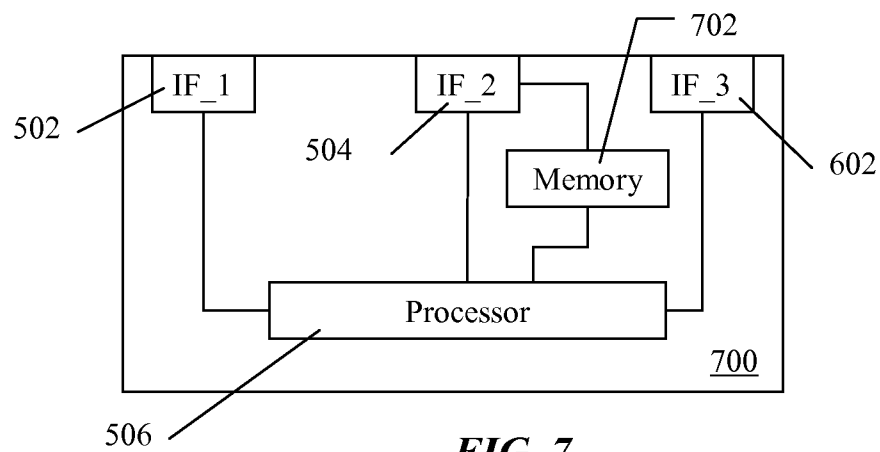


FIG. 7

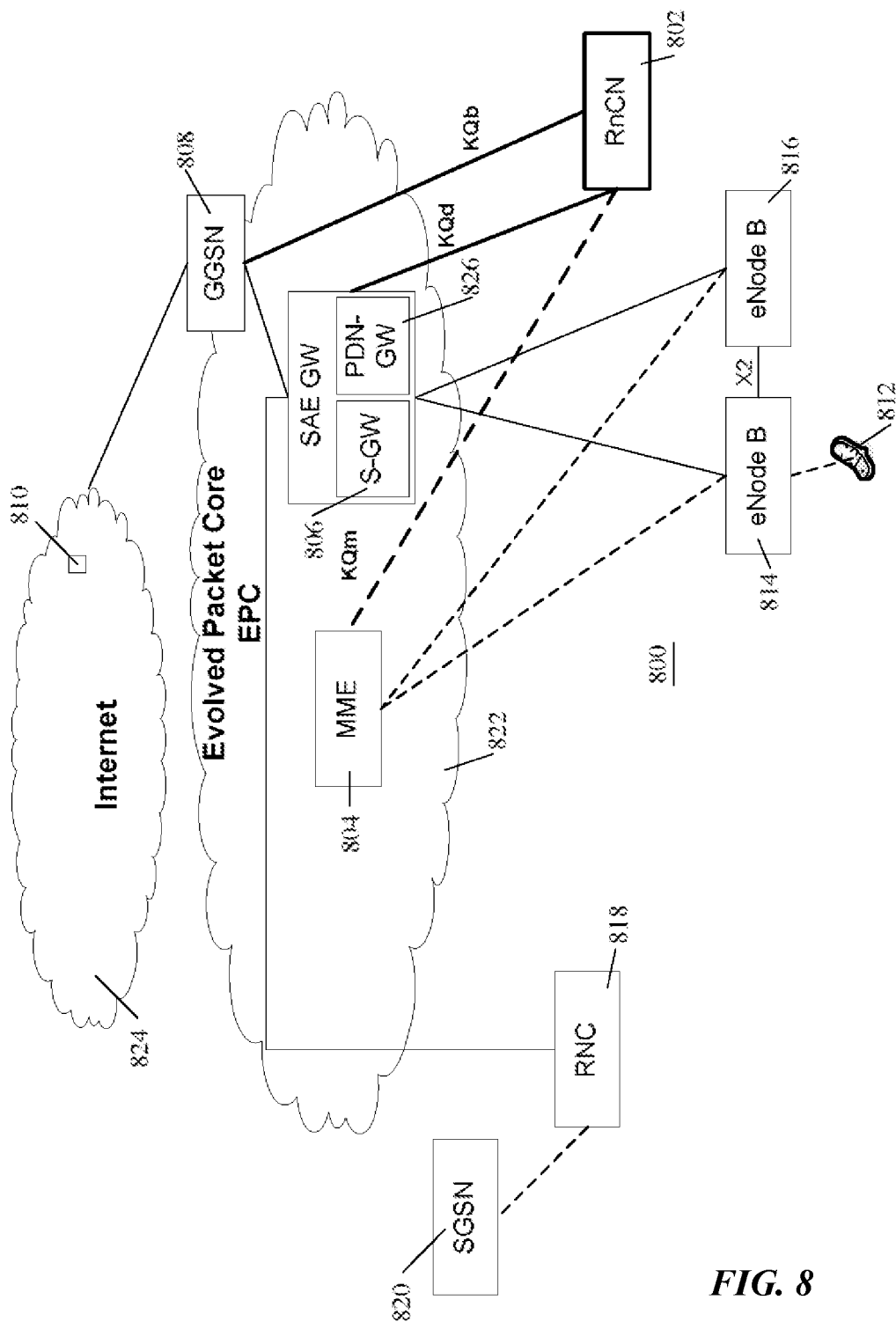
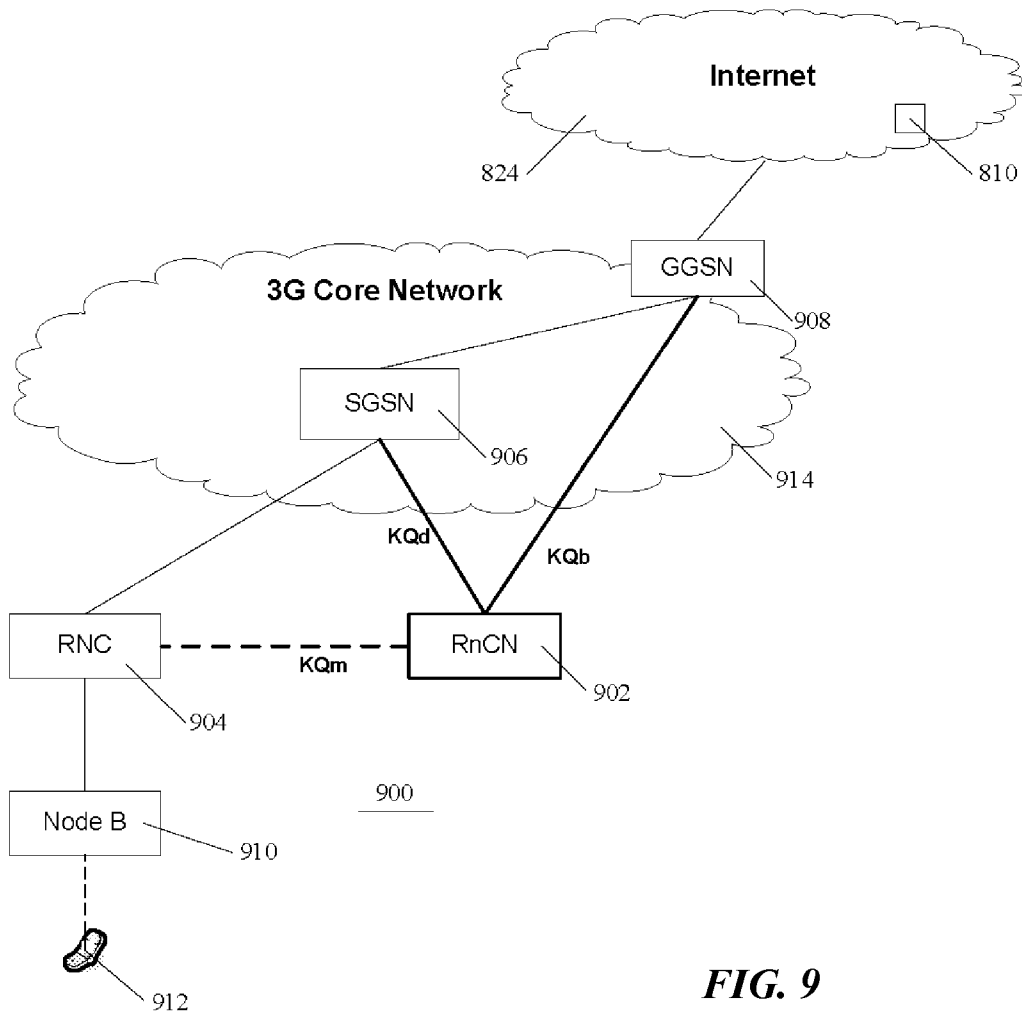


FIG. 8

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**FIG. 9**

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2008/054038

A. CLASSIFICATION OF SUBJECT MATTER

INV. H04L29/08
ADD. H04W4/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04L H04W G06F

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

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

EPO-Internal, WPI Data, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2008/043692 A1 (MORITA KUGO [JP]) 21 February 2008 (2008-02-21) paragraphs [0225], [0230], [0232] -----	1-26
X	US 2007/047568 A1 (WANG TIEHONG [US] ET AL) 1 March 2007 (2007-03-01) paragraphs [0011], [0012] paragraph [0041] - paragraph [0044] -----	1-26
A	US 2005/132049 A1 (INOUE ATSUSHI [JP] ET AL) 16 June 2005 (2005-06-16) paragraph [0018] -----	1-26

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search

19 February 2009

Date of mailing of the international search report

03/03/2009

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de la Peña Álvarez

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2008/054038

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2008043692 A1	21-02-2008	CN 1574700 A	02-02-2005
		EP 1482751 A2	01-12-2004
		KR 20040103321 A	08-12-2004
		KR 20060096188 A	08-09-2006
		KR 20060093311 A	24-08-2006
		US 2004259545 A1	23-12-2004
US 2007047568 A1	01-03-2007	WO 2007021910 A2	22-02-2007
US 2005132049 A1	16-06-2005	NONE	