

(12) STANDARD PATENT
(19) AUSTRALIAN PATENT OFFICE

(11) Application No. **AU 2006226450 B2**

- (54) Title
Optimum selection of a communication network in the location area of a terminal
- (51) International Patent Classification(s)
H04W 48/18 (2009.01) **H04L 12/28** (2006.01)
- (21) Application No: **2006226450** (22) Date of Filing: **2006.03.09**
- (87) WIPO No: **WO06/100184**
- (30) Priority Data
- (31) Number (32) Date (33) Country
10 2005 013 908.6 **2005.03.24** **DE**
- (43) Publication Date: **2006.09.28**
(44) Accepted Journal Date: **2009.06.11**
- (71) Applicant(s)
Nokia Siemens Networks GmbH & Co. KG
- (72) Inventor(s)
Ottl, Martin;Liebhart, Rainer;Langefeld, Dirk
- (74) Agent / Attorney
Spruson & Ferguson, Level 35 St Martins Tower 31 Market Street, Sydney, NSW, 2000
- (56) Related Art
3GPP: "3RD Generation Partnership Project; Technical Specification Group Services and System Aspects; 3GPP System to Wireless Local Area Network (WLAN) Interworking; System Description (Release 6)" 3GPP TS 23.234 V6.3.0 vol 3-SA Dec 2004
US 6 564 055
WO 2005/002140

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES
PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro



(43) Internationales Veröffentlichungsdatum
28. September 2006 (28.09.2006)

PCT

(10) Internationale Veröffentlichungsnummer
WO 2006/100184 A1

(51) Internationale Patentklassifikation:
H04L 12/28 (2006.01) **H04Q 7/38** (2006.01)

(21) Internationales Aktenzeichen: PCT/EP2006/060598

(22) Internationales Anmeldedatum:
9. März 2006 (09.03.2006)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

(30) Angaben zur Priorität:
10 2005 013 908.6 24. März 2005 (24.03.2005) DE

(71) Anmelder (für alle Bestimmungsstaaten mit Ausnahme von
US): **SIEMENS AKTIENGESELLSCHAFT** [DE/DE];
Wittelsbacherplatz 2, 80333 München (DE).

(72) Erfinder; und

(75) Erfinder/Anmelder (nur für US): **LANGFELD, Dirk**
[DE/DE]; Weissenstein 94b, 40764 Langenfeld (DE).
LIEBHART, Rainer [DE/DE]; Baslerstr. 68, 81476
München (DE). **ÖTTL, Martin** [DE/DE]; Deglergasse 7c,
82362 Weilheim (DE).

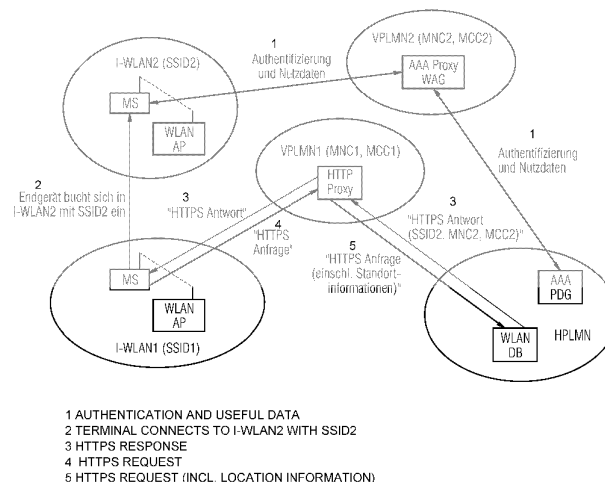
(74) Gemeinsamer Vertreter: **SIEMENS AKTIENGE-
SELLSCHAFT**; Postfach 22 16 34, 80506 München
(DE).

(81) Bestimmungsstaaten (soweit nicht anders angegeben, für
jede verfügbare nationale Schutzrechtsart): AE, AG, AL,
AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH,
CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES,
FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,
KG, KM, KN, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV,

[Fortsetzung auf der nächsten Seite]

(54) Title: OPTIMUM SELECTION OF A COMMUNICATION NETWORK IN THE LOCATION AREA OF A TERMINAL

(54) Bezeichnung: OPTIMALE AUSWAHL EINES KOMMUNIKATIONSNETZES IM AUFENTHALTSORT EINES ENDGE-
RÄTES



(57) Abstract: The invention relates to a method, a terminal, and a system for selecting a communication network (VPLMN2) and for connecting a terminal (MS) to the communication network (VPLMN2) in the covering region thereof in which it is located. According to the invention, a terminal (MS) is temporarily connected to a network unit (HTTP Proxy) of a first communication network (VPLMN1), and the terminal (MS) then sends a request, concerning at least one second communication network to be used for a communication (VPLMN2), to another network unit (WLAN DB) by means of the network unit (HTTP Proxy). Once the request has been checked, the other network unit (WLAN DB) sends at least one response message containing at least one information message to the terminal (MS), and the terminal (MS) connects to a communication network (VPLMN2) according to the at least one information message received.

(57) Zusammenfassung: Die Erfindung beschreibt ein Verfahren, ein Endgerät und ein System zur Auswahl eines Kommunikationsnetzes (VPLMN2) und zum Einbuchen eines Endgerätes (MS) in das Kommunikationsnetz (VPLMN2) in dessen Abdeckungsbereich es sich befindet. Erfindungsgemäß wird ein Endgerät (MS) temporär mit einer Netzeinheit (HTTP Proxy) eines ersten Kommunikationsnetzes

[Fortsetzung auf der nächsten Seite]

WO 2006/100184 A1



LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(84) Bestimmungsstaaten (soweit nicht anders angegeben, für jede verfügbare regionale Schutzrechtsart): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), eurasisches (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), europäisches (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC,

Veröffentlicht:

— mit internationalem Recherchenbericht

Zur Erklärung der Zweibuchstaben-Codes und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

(VPLMNI) verbunden und daraufhin sendet das Endgerät (MS) eine Anfrage betreffend mindestens ein zweites für eine Kommunikation zu verwendendes Kommunikationsnetz (VPLMN2) über die Netzeinheit (HTTP Proxy) an eine weitere Netzeinheit (WLAN DB). Die weitere Netzeinheit (WLAN DB) sendet nach Überprüfung der Anfrage mindestens eine Information enthaltende Antwort-Nachricht an das Endgerät (MS) und das Endgerät (MS) bucht sich abhängig von der empfangenen mindestens einen Information in ein Kommunikationsnetz (VPLMN2) ein.

Description

Optimum selection of a communication network in the location area of a mobile station

The invention relates to a method and a mobile station for selection of a communication network and for connecting a mobile station into a communication network within the coverage area of which it is located.

3GPP services will in future be offered over a very wide variety of IP-based access networks. Examples of such networks are so-called Interworking WLANs (I-WLAN, Interworking Wireless Local Area Network) which are connected to mobile radio networks and are standardized in 3GPP. Other examples are WIMAX and xDSL access networks, with the intention being with WIMAX especially to have a similar architecture for connection to mobile radio as with WLAN. One of the most significant problems in conjunction with wireless access networks such as WLAN is the network search. In such cases both searching for an optimum access network (a number of WLAN networks can be operated in one hotspot for example) and also searching during roaming for an optimum mobile radio network or further intermediate networks which can be reached via the access network is a problem to be resolved.

If the terminal has sought out an I-WLAN, this can be connected to a number of mobile networks. These communication networks must be notified to the terminal by the I-WLAN so that the terminal can seek out a preferred mobile radio network. The lists of the preferred networks are either stored in the terminal or on the USIM card. Especially when roaming, in which case the I-WLAN has no direct connection to the home mobile radio network of the subscriber, it is for important for the terminal to select a preferred roaming partner of its

home network in order to save connection and roaming costs and be able to make use of as many services as possible.

The assumption is made in the previous 3GPP standard that the terminal is looking for all available WLANs, connects in turn in each WLAN and attempts to authenticate itself with its home mobile radio network (automatic selection procedure). If the selected WLAN is not an I-WLAN, this attempt fails, and the terminal must connect to the next available WLAN. If the WLAN network is an I-WLAN in accordance with the 3GPP standard, but is not directly connected to the home mobile radio network of the subscriber (roaming), the I-WLAN sends the terminal a list of the mobile radio networks to which it is directly connected. The terminal then continues its search for I-WLAN networks. At the end of the search process, from the information obtained, the terminal uses preconfigured lists of preferred I-WLANs and mobile radio networks to select an I-WLAN and mobile radio network to which it connects. Optionally a method is also described in the standard for how an I-WLAN can communicate its interworking capability and the connected mobile radio networks to the terminal during its search for WLAN networks. Since this information (so-called SSID, Service Set Id) is sent out before connection into the WLAN network by the WLAN radio stations using a broadcast (multi-transmission method), this would lead to a simplification of the search procedure. Since WLAN 802.11 technology is not standardized by 3GPP but by IEEE, 3GPP cannot mandatorily prescribe the structures of the SSID in the WLAN broadcast. In addition the SSID field has a restricted length (32 bytes), so that it may also be possible for not all information to be stored there about all connected mobile radio networks. The SSID is also configured by the WLAN network operator and can thus be incorrect or misleading.

The search procedures currently specified are thus very tedious and require many resources in the terminal.

5 The 3GPP standard has so far offered only the optional possibility of sending out information within the WLAN-SSID information about the interworking capability of a WLAN. The connected mobile radio networks can only identify the terminal once it has connected to all available I-WLANs and has received the corresponding data from them. In this case the optimum
10 access network and the preferred mobile radio network are defined by statically preconfigured lists on the (U)SIM card or the terminal itself. These lists are either stored once by the home network operator on the (U)SIM or can be manually supplemented and prioritized by the user. This method of
15 operation is inflexible and expensive for the network operator, for the subscriber it is difficult and inconvenient.

Thus, a need exists to provide a simple and an efficient option by which a terminal can select a communication network.

20

According to a first aspect of the present disclosure, there is provided a method for selection of a communication network and for connection of a mobile station into a communication network in the coverage area of which it is located,
25 wherein

a mobile station is temporarily connected to a network unit of a first communication network, the mobile station sends a request relating to at least one second communication network to be used for communication via the network unit to a further
30 network unit,

the further network unit, after checking the request, sends at least one response message containing at least one item of information to the mobile station and the mobile station

connects into a communication network depending on the at least one item of information received.

According to a second aspect of the present disclosure, there is
5 provided a mobile station for selection of a communication network and for connecting into the communication network in the coverage area of which said mobile station is located,

with a receive unit and a transmit unit to execute the communication,

10 with a processing unit for temporary connection to a network unit of a first communication network, for sending a request relating to at least one second communication network to be used for a communication via the network unit to a further network unit and for connecting into a communication network,
15 depending on at least one item of information sent by the at least one further network unit to the mobile station in a response message.

According to a third aspect of the present disclosure, there is
20 provided A system for selection of a communication network and for connecting into the communication network in the coverage area of which a mobile station is located,

- with a mobile station for temporary connection to a network unit of a first communication network and for
25 sending a request relating to at least one second communication network to be used for a communication via the network unit to a further network unit,
- with the further network unit for checking the request and for sending at least one item of information contained in
30 a response message to the mobile station,
- with the mobile station for connecting into a communication network depending on the at least one item of information received.

An aspect of an embodiment of the present disclosure is to be seen as making the selection of a communication network, for example an access network, a WLAN-network, a cellular mobile radio network, an IP network or a further communication network
5 more flexible and faster by using a further network unit, for example a registration unit, a database, a memory unit etc. for example in the HPLMN network (home network). Alternatively this further network unit can also be operated in the Internet or in another communication network for example and accept data over
10 all possible communication networks. This naturally requires

ongoing discussions between the network operators and a body which then operates this further network unit. This further network unit could be called an "IP Access Register". In this case the terminal searches as previously for example for an access network with I-WLAN capabilities in a hotspot (the discrimination between I-WLAN and "normal" WLAN networks can for example be speeded up by specific SSID values). If any given I-WLAN network has now been found, the search is ended by the terminal and the terminal connects temporarily into this I-WLAN. The I-WLAN allows the terminal in this state to send a request via a network unit of the I-WLAN to the further network unit, for example in its home network. This can be achieved for example by specific port filters in the access routers or by using virtual LAN networks. Such a request can be executed with an SIP, H.323, HTTP, for security reasons HTTPS or another (secure) (signaling) protocol, with the server authentication being sufficient in this case. In principle it is also possible for the terminal to connect to any given WLAN and for example to reach the further network unit in the home network via the Internet for example. A network unit, for example an HTTP proxy server, in the I-WLAN or for example any given connected cellular mobile radio network uses origin information in such cases such as the MCC (Mobile Country Code) and the MNC (Mobile Network Code) or x/y location coordinates in the request message. As an alternative or in addition the terminal could also perform this function if it has this information available to it (e.g. using positioning methods via GPS (Global Positioning System)). The terminal or the application on the terminal can additionally send data or requests such as the bandwidths required for example or the security of the access network to the further network unit, which can be taken into account by the further network unit in selecting the communication networks.

The further network unit receives this request and determines from the origin data and the additional requirements of the terminal the optimum access network or communication network in the hotspot (coverage area of the communication network), the preferred visited communication network VPLMN and where necessary further intermediate networks or communication networks, and sends this information, in the form of the SSID and MNC/MCC for example, in a response message back to the terminal. In this case a great advantage lies in the fact that this information, by contrast with the data which is available pre-configured in the terminal, can be flexibly adapted in accordance with country, location, tariff, network loading and time.

After receiving the data, the terminal connects into a communication network depending on the information received. The terminal, for example a mobile computer, a computer, a mobile radio station, a mobile organizer etc., could also interrogate the further network unit at periodic intervals or after the network configuration has changed (e.g. by changing the location) in order if possible to obtain more favorable connection co-ordinates. Authentication messages are sent in accordance with the 3GPP standard via the visited mobile network which has been predetermined by the home network operator. This obviates the need for a reconciliation between the available mobile networks with those stored on the (U)SIM card. Existing (U)SIM cards can even continue to be used. After successful authentication in the home network the terminal is in a position for example to establish a connection into this network via the visited mobile radio network and use the services in the home network.

This invention disclosure describes a method for how a central further network unit, for example a register unit, may be used

to enable access to IP-based radio technologies such as WLAN to be simplified and optimized for mobile radio operators and subscribers. The selection procedure is thus accelerated and the use of resources in the terminal is reduced. The described register unit also offers the opportunity of storing a further data which can be relevant for the terminal or the communication network for an optimized roaming or handover. These IP-based access networks can in such cases be specified by 3GPP or can quite generally simply be connected via a router to the 3GPP core network.

The invention is explained in greater detail on the basis of an exemplary embodiment shown in a figure. The figures show

Figure 1 the method in accordance with the invention with reference to a simplified system architecture,

Figure 2 an inventive mobile station.

Figure 1 shows how a mobile station, for example a mobile radio terminal, a mobile computer, a mobile organizer, a computer etc., in a hotspot can connect itself temporarily into a communication network VPLMN 1 via the access network I-WLAN1 and send a request by means of the HTTPS protocol via a network unit HTTP Proxy of the communication network VPLMN 1 to a further network unit WLAN DB of the home network HPLMN of the mobile station MS. The network unit HTTP Proxy can in this case be a proxy server, a network unit of the access network I-WLAN 1 etc. The request could be supplemented by the network unit HTTP Proxy or also by the mobile station MS with at least one item of information such as the country code, the network code of the communication network currently being used, the location information relating to the current location of the mobile station MS etc. The mobile station MS in addition to the request, could also insert data or requests such as the

bandwidth required for example, the security requirements for the communication network etc. The further network unit WLAN DB, for example a register a unit, a database, a memory unit etc in the home network WLAN DB checks the request and sends a response with the least one item of information, for example the SSID identity of the preferred access network I-WLAN2 and the mobile country code or mobile Network Code MNC2/MCC2 of the preferred (visited) communication network VPLMN2.

Temporary in this case means that the mobile station only connects into the communication network VPLMN 1 via the access network I-WLAN1 to be able to make the request to the further network unit. After receiving the at least one item of information contained in the response, the mobile station MS, depending on the information received, connects into the communication network VPLMN2 (for example via the authentication network unit AAA Proxy WAG) via the access network I-WLAN2 (for example via the WLAN radio access point WLAN AP), authenticates itself in respect of the home network HPLMN (for example at the authentication network unit AAA PDG) in accordance with the 3GPP standard and thereafter to sets up a connection to execute a communication to the home network HPLMN, in order to use specific subscription services there for example. A cellular mobile radio network, a WLAN network, an IP network, an I-WLAN network etc. can be used as a communication network or access network. The mobile station could, because of a network configuration or also at periodic or even no-periodic intervals, send such a request relating to at least one communication network to be used for the communication to the further network unit WLAN DB and thus have the opportunity of always selecting the optimum communication network for communication.

Figure 2 shows a mobile station MS for executing the inventive method with a receive unit E, a transmit unit S and a

processing unit V.

The claims defining the invention are as follows:

1. A method for selection of a communication network and for connection of a mobile station into a communication network in
5 the coverage area of which it is located,
wherein
a mobile station is temporarily connected to a network unit of a first communication network, the mobile station sends a request relating to at least one second communication network
10 to be used for communication via the network unit to a further network unit,
the further network unit, after checking the request, sends at least one response message containing at least one item of information to the mobile station and the mobile station
15 connects into a communication network depending on the at least one item of information received.
2. The method as claimed in claim 1,
wherein the network unit adds at least one item of
20 information data to the request from the mobile station.
3. The method as claimed in claim 2,
wherein an item of information data is a country code and/or the network code of the communication network into which
25 the mobile station is temporarily connected and/or is an item of position information relating to the current location of the mobile station.
4. The method as claimed in any one of the previous claims,
30 wherein the mobile station adds data relating to the bandwidth needed by the mobile station and/or the security requirements for the communication network to the request.

5. The method as claimed in any one of the previous claims,
wherein the SSID number, the network code and/or the
country code of the communication network to be used is used in
the response message as information relating to the at least one
5 second communication network to be used for communication.

6. The method as claimed in any one of the previous claims,
wherein the network unit is a proxy server and/or a
network unit of an I-WLAN network.

10

7. The method as claimed in any one of the previous claims,
wherein the further network unit is a register unit, a
memory unit and/or a database.

15

8. The method as claimed in claim 7,
wherein the further network unit is a network unit of an
IP network and/or of a WLAN network.

20

9. The method as claimed in claim 7,
wherein the further network unit is a network unit of the
home network of the mobile station.

10. The method as claimed in any one of the previous claims,
wherein the HTTP protocol, the HTTPS protocol, the SIP
25 protocol and/or the H.323 protocol are used as the signaling
protocol.

11. The method as claimed in claim 1,
wherein the mobile station, as a result of a change to
30 the network configuration, sends to the further network unit a
request relating to the communication network to be used for a
communication.

12. The method as claimed in claim 1,
wherein at periodic intervals the mobile station sends a
request to the further network unit relating to the
communication network to be used for a communication.

5

13. The method as claimed in any one of the previous claims,
wherein a mobile radio terminal, a mobile computer, a
computer and/or a mobile organizer can be used as the mobile
station.

10

14. The method as claimed in any one of the previous claims,
wherein a WLAN network, an IP network and/or a cellular mobile
radio network can be used as the communication network.

15 15. A mobile station for selection of a communication network
and for connecting into the communication network in the
coverage area of which said mobile station is located,
with a receive unit and a transmit unit to execute the
communication,

20 with a processing unit for temporary connection to a
network unit of a first communication network, for sending a
request relating to at least one second communication network to
be used for a communication via the network unit to a further
network unit and for connecting into a communication network,
25 depending on at least one item of information sent by the at
least one further network unit to the mobile station in a
response message.

16. A system for selection of a communication network and for
30 connecting into the communication network in the coverage area
of which a mobile station is located,

- with a mobile station for temporary connection to a
network unit of a first communication network and for
sending a request relating to at least one second

- communication network to be used for a communication via the network unit to a further network unit,
- with the further network unit for checking the request and for sending at least one item of information contained in a response message to the mobile station,
- with the mobile station for connecting into a communication network depending on the at least one item of information received.

10 17. A method for selection of a communication network and for connection of a mobile station into a communication network in the coverage area of which it is located, said method being substantially as described herein with reference to the accompanying drawings.

15 18. A mobile station substantially as described herein with reference to the accompanying drawings.

20 19. A system for selection of a communication network and for connecting into the communication network in the coverage area of which a mobile station is located, said system being substantially as described herein with reference to the accompanying drawings.

25 DATED this twenty-eighth Day of April, 2009
Nokia Siemens Networks GmbH & Co. KG
 Patent Attorneys for the Applicant
 SPRUSON & FERGUSON

FIG 1

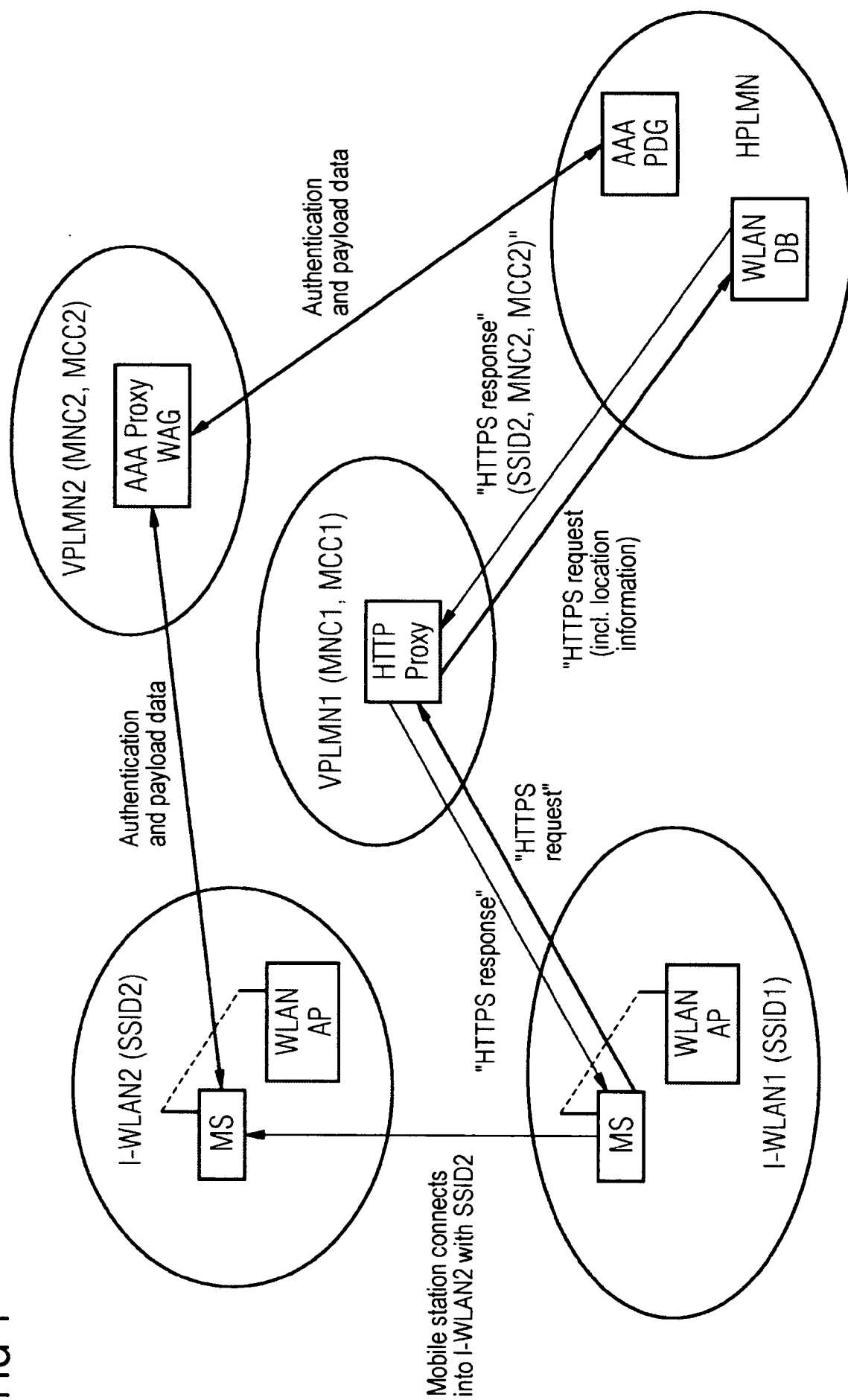


FIG 2

