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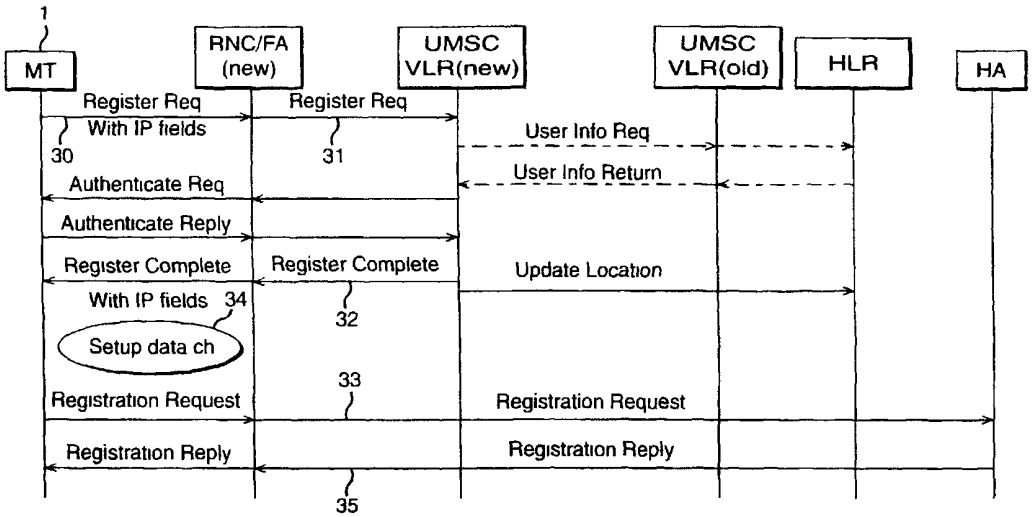
(54) Title: USER REGISTRATION AND LOCATION MANAGEMENT FOR MOBILE TELECOMMUNICATIONS SYSTEMS



(57) Abstract: A method of use of a UMTS telecommunications network, comprising utilising UMTS signalling to indicate changes in an IP sub-network. To register a Mobile Terminal (MT) or to update its location within the network, signalling relevant to the IP domain is transmitted with UMTS signalling in an integrated approach. This reduces the number of signalling messages that are required and minimises delays.

WO 01/31859 A1

USER REGISTRATION AND LOCATION MANAGEMENT FOR MOBILE TELECOMMUNICATIONS SYSTEMS

Background of the Invention

This invention relates to user registration and location management for mobile telecommunications systems. In particular, it relates to Universal Mobile Telecommunications Service (UMTS) systems, when used to provide connectivity between an IP (Internet Protocol) capable end-device and an IP-based network.

When a UMTS user switches on his mobile terminal (MT), the user needs to be registered with the UMTS network. Similarly, when the user moves around the area covered by the network, location management procedures need to take place in order to allow the user to be provided with services.

The initial registration process normally involves requesting for registration on the network, authentication of the user by the network, registration of the user and informing the home location register (HLR) of the users current whereabouts. This takes place at the UMTS level.

At the IP (Internet Protocol) level, there are three scenarios to consider when the user switches on an IP capable terminal. These are:

(1) the user has a static home IP address,

(2) the user requires a dynamic home IP address from the UMTS operator, and

(3) the user requires a dynamic home IP address from a body outside the UMTS domain.

In any case, a mobile IP registration with the home agent (HA) and

perhaps the foreign agent (FA) needs to take place before the user can successfully engage in a data transaction using the Internet Protocol.

The current solution for the registration of data (IP) users in UMTS with mobile IP relies on the use of two, subsequent, registrations, the first at the UMTS level and the second at the IP level. This is shown in Figure 1.

The user of a mobile terminal switches on his mobile terminal MT1 and requires registration with the UMTS network. He sends a message 2 requesting registration which passes through a radio network controller (RNC) 3 (which may also be the foreign agent (FA) for the IP protocol) to a switching centre with a visiting location register (VLR) 4. This in turn requests user information from any previous visiting location register 5 which the user may have last received service from, or from the user's home location register (HLR) 6. This sends back information concerning the user to the new VLR 4 and then an authentication request 7 and reply 8 are sent to and received from the mobile terminal 1. After this authentication, registration of the mobile terminal is complete and a register complete message 9 is sent to the terminal. Also, a message 10 is sent to the HLR informing the HLR of the new location of the terminal.

If IP registration is also required, then a further IP registration step also has to take place with conventional systems.

Once UMTS registration is complete, the mobile terminal 1 sets up a UMTS data channel 11. The mobile terminal 1 sends an FA router solicitation message 12 to the new RNC/FA 3 and this in turn sends an FA advertisement 13 back to the mobile terminal over the data channel. The mobile terminal then sends a registration request which passes through the RNC/FA 3 and onwards to the home agent 14. This then sends back a registration reply 15 to the mobile terminal and IP registration is complete. The foreign agent FA in IP is analogous

to the VLR (visiting location register) in the UMTS domain.

Accordingly, two independent registration processes are necessary, first the UMTS registration and then the IP registration.

When a UMTS user moves around the area covered by the network, location management procedures need to take place in order to allow the user to be provided with services. Location management under a single radio network controller (RNC) does not affect the IP level. However, inter-RNC location updates have to involve IP level mobility as well as UMTS mobility. This is because it is assumed that mobile IP foreign agents (FA's) and RNC's are co-located.

Conventionally, an analogous process to the conventional method of registration has been done. Firstly UMTS location update is done and then, independently, a subsequent IP location update is done. This is shown in Figure 2.

The location update procedures are similar in principle to the registration updates of Figure 1, except that the location update 16 is required for both IP and UMTS, rather than register updates. Apart from this, the procedures involve similar steps, mutatis mutandis.

In both the user registration and location management scenarios, the complete separation of the two procedures for UMTS and IP bring inefficiencies in the usage of the air-interface, and delays to the overall registration or location update procedure.

The present invention arose in an attempt to reduce these inefficiencies and to reduce the time taken for the overall registration procedure or for the

overall location update procedure.

Brief Summary of the Invention

According to the present invention in a first aspect there is provided a method of use of a UMTS telecommunications network, comprising utilising UMTS signalling to indicate changes in an IP sub-network.

According to the present invention in a second aspect there is provided a method for a mobile terminal associated with a UMTS telecommunications network to register its position and/or update its location with regard to UMTS and IP registration, comprising integrating UMTS and IP procedures.

Mobile-IP specifications allow for link-layer mechanisms to be used to discover a foreign agent (FA) or to detect a change in the sub-network. In a preferred embodiment of the invention, accordingly, the UMTS level mobility-management (link-layer) is used for FA discovery.

More specifically, the method may comprise using UMTS 'register request' and 'register complete' messages for detecting FA information.

Preferably, additional fields of information are sent with the 'register req' message and with the 'register complete' message.

The fields which may be sent with the 'register req' message are: (1) type of home address, (2) type of COA (care of address), (3) home IP address, (4) home agents address, and (5) last used COA.

The additional field for the 'register complete' messages may be (1) home address, (2) COA type and (3) COA.

In further embodiments relating to location management, the UMTS 'location update' and 'location update complete' messages may be used.

Preferably, extra fields of information are provided in one or both of these messages. The fields which may be attached to the 'location update' message are: (1) home address, (2) COA type and (3) COA.

The extra fields which may be attached to the 'location update complete' message may comprise any of (1) type and (2) COA.

Description of the Drawings

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 shows UMTS and IP registration procedures according to the prior art;

Figure 2 shows UMTS and IP location update procedures according to the prior art;

Figure 3 shows an integrated registration procedure according to the present invention; and

Figure 4 shows an integrated location update procedure according to the present invention.

Detailed Description of Preferred Embodiments of the Invention

Referring to Figure 3, in embodiments of the invention, the UMTS level mobility-management (link-layer) may be used for FA discovery. Accordingly, the UMTS 'register req' and 'register complete' messages are used for discovering the FA care-of-address (COA) or obtaining a co-located COA for a mobile terminal. Thus, in the Figure, when a mobile terminal 1 requires to

register with a network, it sends out a modified register request message 30 with the addition of various IP related fields.

These fields are:

(1) type of home address

(2) type of COA

(3) home IP address (optional)

(4) home agents address (optional)

(5) last used COA (optional)

Note that if the mobile terminal 1 is not IP capable, then the additional fields are not used.

More particularly, the fields are the following:

(1) Type: this field identifies to the network if the mobile terminal 1 has a static address or requires a dynamic address from the UMTS operator, or requires a dynamic address from an entity outside the UMTS domain.

(2) Type of COA: this identifies if the mobile terminal is to use a co-located COA or a FA, the address in the COA field depends upon this setting.

(3) Home address: if the mobile is configured with a static home address, this field identifies that address. If the mobile does not have a statically configured home address, this field is omitted.

(4) Home agent: if the mobile has been configured statically with its home agent address, this field identifies it. Otherwise, this field is omitted.

(5) Last used COA: this field contains the mobile's last used COA, if any. Otherwise this field is omitted.

The 'register req', with attached IP fields is functionally similar to the FA router solicitation 12 of Figure 1.

The 'register complete' message is, from the IP perspective, the FA advertisement. The additional IP fields in the 'register complete' message are:

(1) home address: home address of the user

(2) type: the type of COA used at present, co-located or foreign agent (FA)

(3) COA: the COA.

If the user does not have a static address and the UMTS network could not obtain a home address for the user, then the user will be required to use IP level mechanisms to obtain one. The UMTS network will, however, issue the user with the address of the FA or the co-located COA.

Subsequent to the register complete message 32, the mobile then uses a UMTS data channel to send a mobile-IP registration message 33 to the FA (or direct to the HA in case of a co-located COA). This procedure takes place at the IP level, where a data channel 34 is set up over the UMTS radio interface for carrying IP control messages. The HA (or FA) then transmits a registration reply message 35.

Figure 4 shows an embodiment of the invention representing an integrated procedure for location management with mobile IP and UMTS. The procedure differs from that of the prior art in that the mobile terminal 40, in its 'location update request' transmission 41 also includes one or more extra fields. The fields are:

(1) home address: home address of the user

(2) type: the type of COA used at present, co-located or foreign agent (FA)

(3) COA: the COA.

An authentication routine then follows and, once the UMTS level location update is successfully completed, the RNC/FA checks whether a new COA needs to be issued. They can do this because of the information that was presented by the mobile terminal 40 in the 'location update request' message 41. If a new COA needs to be issued, it is attached to a "location update complete" message 42. The extra fields of information required within this message are (1) type and (2) COA. This message is used by the mobile terminal 40 at the IP level, as detection for mobile IP. A data channel is set up and the mobile terminal decides what it needs and whether it needs to do anything in relation to registering with a new FA and HA and this takes place at a registration request step 44. The mobile terminal registers either with a new RNC/FA 46 and with the home agent (HA) 47. If route optimisation is enabled, then the new FA will re-register the user at the old FA.

Embodiments of the invention accordingly allow a reduction in signalling messages that have to be transmitted across the air interface, during registration or during an inter-RNC location update, and minimise the delay required to complete such location updates. In effect, therefore, valuable network resources are saved and overhead is reduced.

Embodiments of the invention in general utilise UMTS signalling for detecting changes in the IP sub-network and integration of IP level signalling and UMTS level signalling. The invention may have wider use than the two specific scenarios described (user registration and location management) and may be applied to other scenarios where IP signalling is required.

Mobile IP information is sent during UMTS signalling for the reasons described above.

CLAIMS

1. A method of use of a UMTS telecommunications network, comprising utilising UMTS signalling to indicate changes in an IP sub-network.

2. A method for a mobile terminal associated with a UMTS telecommunications network to register its position and/or update its location with regard to UMTS and IP registration, comprising integrating UMTS and IP procedures.

3. A method as claimed in Claim 2, comprising a method for a mobile terminal to register its position with regard to UMTS and IP registration, the method comprising using UMTS 'register request' and/or 'register complete' messages for detecting IP information.

4. A method as claimed in Claim 3, wherein fields of information relevant to the IP domain are sent with the 'register req' message.

5. A method as claimed in Claim 4, wherein the fields (in case the mobile terminal is IP capable) are: (1) type of home address, (2) type of care of address (COA), and, optionally, any of the following: (3) home IP address, (4) home agents (HA) address and (5) last used COA.

6. A method as claimed in Claim 5, wherein additional fields of information are sent with the 'register complete' message.

7. A method as claimed in Claim 6, wherein the fields comprise (in case the mobile terminal is IP capable) (1) home address, (2) COA type and (3) COA.

8. A method as claimed in any preceding claim, comprising a method for a

mobile terminal to update its location, wherein the method comprises using UMTS 'location update' and/or 'location update complete' messages to detect IP information.

9. A method as claimed in Claim 8, wherein additional fields of information relevant to the IP domain are sent with the 'location update' message.,

10. A method as claimed in Claim 9, wherein the additional fields comprise (in case the mobile terminal is IP capable) (1) home address, (2) COA type and (3) COA.

11. A method as claimed in any of Claims 8 to 10, wherein additional fields are sent with the 'location update complete' message.

12. A method as claimed in Claim 11, wherein the additional fields comprise (in case the mobile terminal is IP capable) (1) type and (2) COA.

13. A method of using a UMTS communication network, substantially as hereinbefore described with reference to, and as illustrated by, Figures 3 and 4 of the accompanying drawings.

FIG. 1(PRIOR ART)

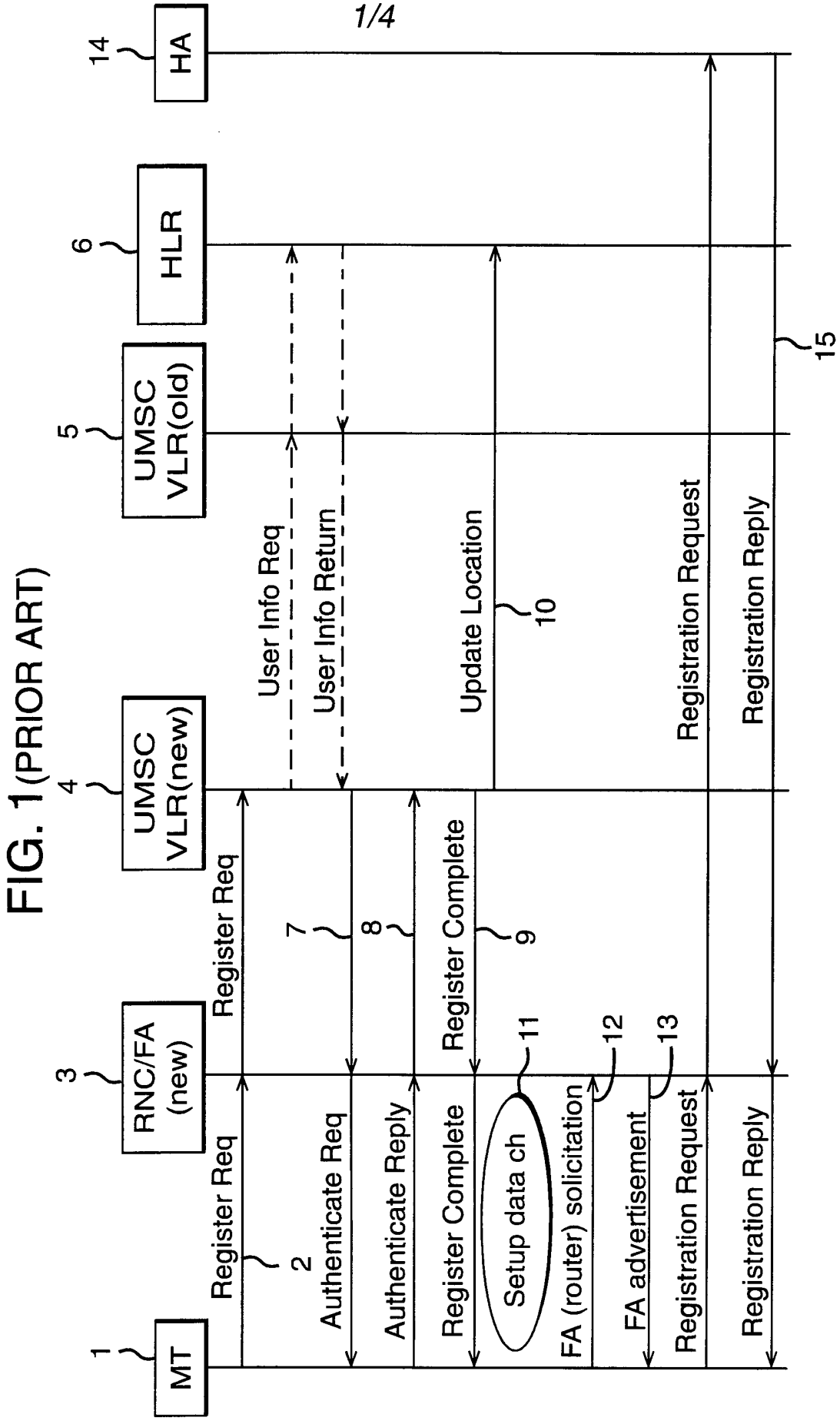


FIG. 2(PRIOR ART)

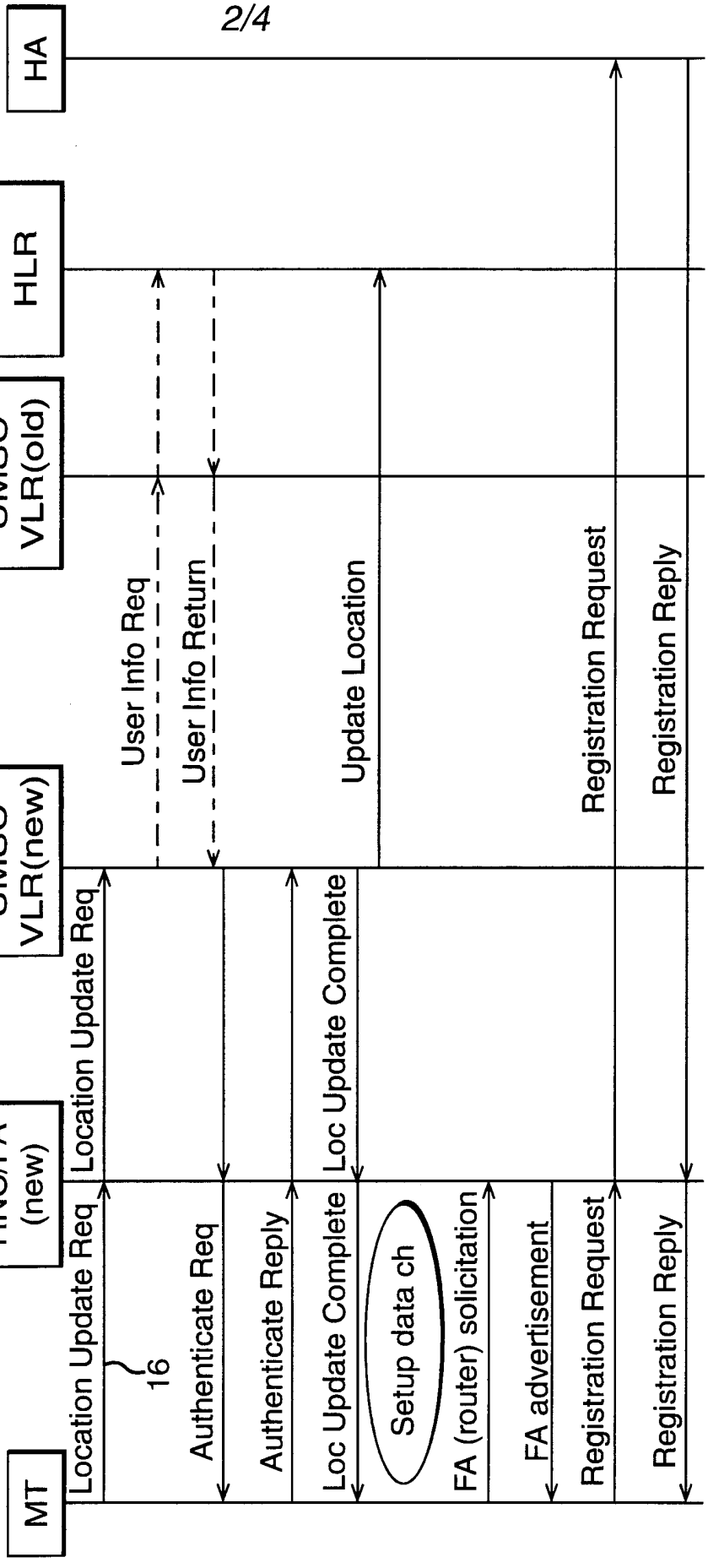
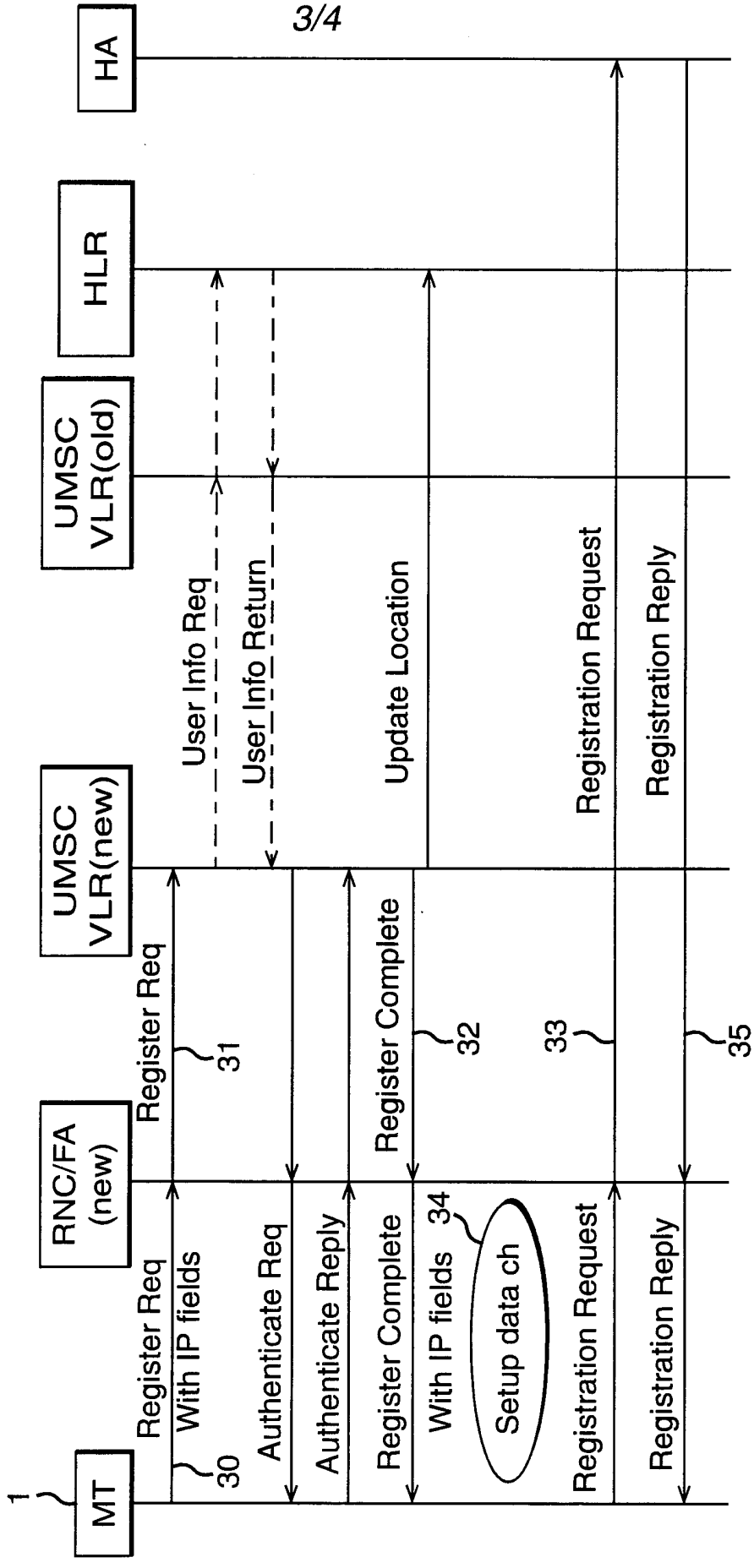


FIG. 3


MT
RNC/FA (new)
UMSC VLR(new)
UMSC VLR(old)
HLR
HA
1
Register Req
With IP fields
30
Register Req
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User Info Req
User Info Return
Update Location
Authenticate Req
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Register Complete
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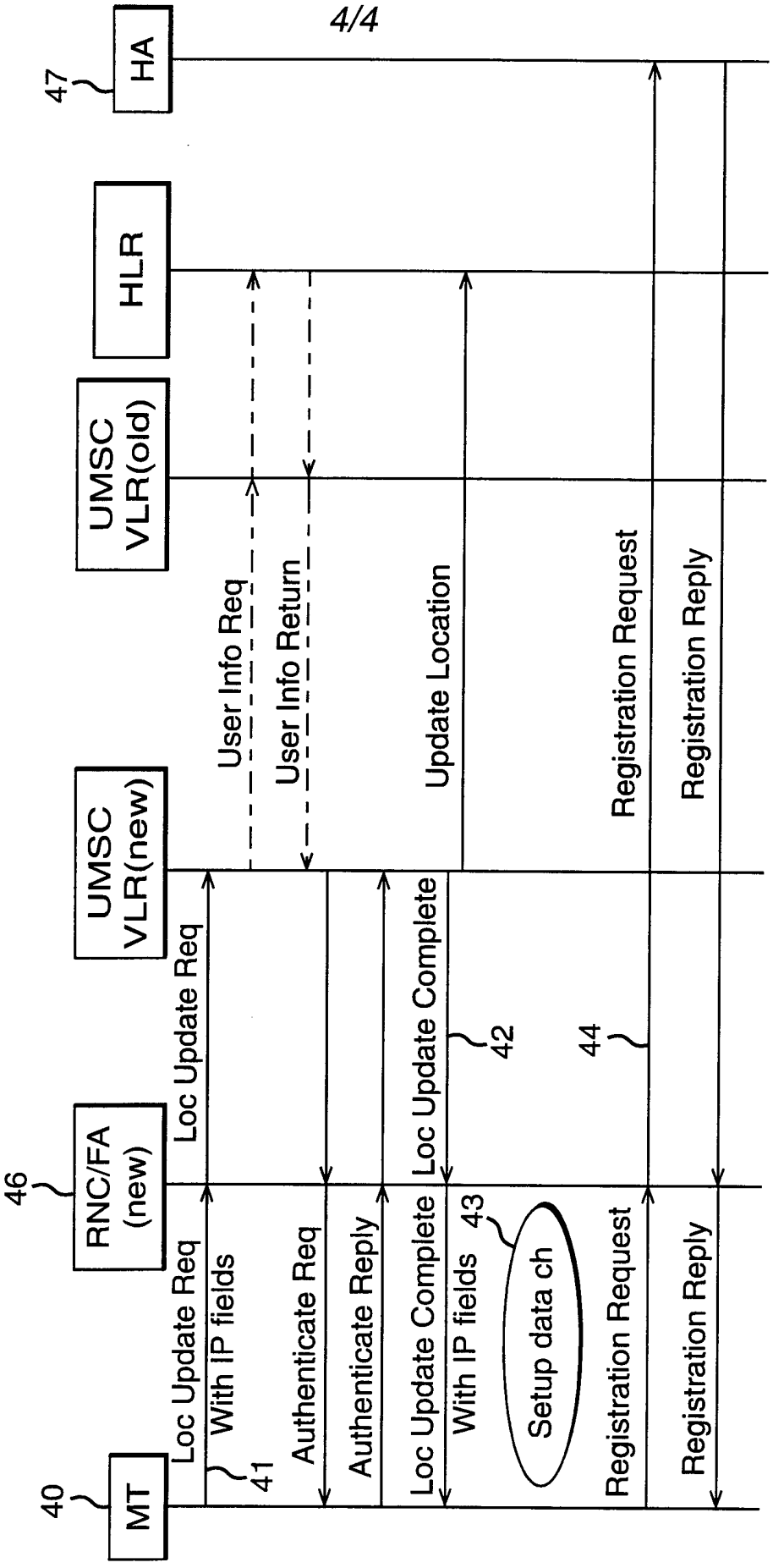
33
Registration Request
Registration Reply
Registration Reply
35

FIG. 4


40
MT
46
RNC/FA (new)
UMSC VLR(new)
UMSC VLR(old)
HLR
47
HA
Loc Update Req
With IP fields
41
Loc Update Req
Authenticate Req
Authenticate Reply
User Info Req
User Info Return
Update Location
Loc Update Complete
42
Loc Update Complete
With IP fields
43
Setup data ch
44
Registration Request
Registration Request
Registration Reply
Registration Reply

INTERNATIONAL SEARCH REPORT

Interna al Application No
PCT/EP 00/05705

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04L12/56 H04L29/06

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04L H04Q

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

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

EPO-Internal, WPI Data, PAJ, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CLAPTON A J ET AL: "UMTS - THE MOBILE PART OF BROADBAND COMMUNICATIONS FOR THE NEXT CENTURY" BT TECHNOLOGY JOURNAL,GB,BT LABORATORIES, vol. 16, no. 2, 1 April 1998 (1998-04-01), pages 120-131, XP000750524 ISSN: 1358-3948 page 127, column 1, line 9 - line 13 page 130, column 1, line 23 - line 39 --- -/--	1,2

[X] Further documents are listed in the continuation of box C.

[ ] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search	Date of mailing of the international search report
1 November 2000	14/11/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Tous Fajardo, J

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Internal Application No
PCT/EP 00/05705

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	ACHARYA A ET AL: "MOBILITY SUPPORT FOR IP OVER WIRELESS ATM" IEEE COMMUNICATIONS MAGAZINE,US,IEEE SERVICE CENTER. PISCATAWAY, N.J, vol. 36, no. 4, 1 April 1998 (1998-04-01), pages 84-88, XP000752575 ISSN: 0163-6804 page 86, column 2, line 36 -page 87, column 1, line 12 ---	1
A	MITTS H ET AL: "A SIMPLE AND EFFICIENT ROUTING PROTOCOL FOR THE UMTS ACCESS NETWORK" JOURNAL OF SPECIAL TOPICS IN MOBILE NETWORKS AND APPLICATIONS,BALTZER SCIENCE PUBLISHERS, AMSTERDAM,NL, vol. 1, 1996, pages 167-181, XP000750011 ISSN: 1383-469X page 169, column 1, line 32 -page 170, column 1, line 28 -----	1,2

1