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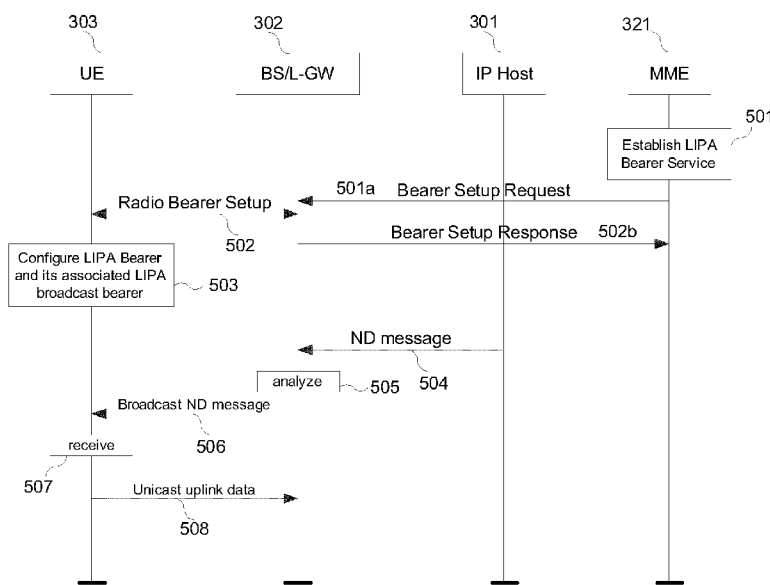
Fig. 5

(57) Abstract: A method for providing a bearer service in a communications system is disclosed. The method comprises establishing (502) a radio bearer service between a network apparatus (302) and a user terminal (303), for transmitting messages over an air interface, such that a point-to-point radio bearer is to be used for transmitting unicast messages and its associated shared point-to-multipoint broadcast radio bearer in downlink is to be used for transmitting one or more of broadcast and multicast messages from a local IP network via the network apparatus (302) to user terminals (303). Messages (506) received from the point-to-point radio bearer and its associated point-to-multipoint broadcast radio bearer in downlink are combinable in the user terminal (303) to a single connection emulating one or more of a broadcast and multicast capable media respectively over the air interface.

BEARER SERVICE IN COMMUNICATIONS

FIELD OF THE INVENTION

The exemplary and non-limiting embodiments of this invention
relate generally wireless communications networks, and more
5   particularly to providing a bearer service.

BACKGROUND ART

The following description of background art may include
insights, discoveries, understandings or disclosures, or
associations together with dis-closures not known to the
10   relevant art prior to the present invention but provided by
the invention. Some such contributions of the invention may
be specifically pointed out below, whereas other such
contributions of the invention will be apparent from their
context.

15   LIPA (local IP access) enables a UMTS or LTE device to access
a local IP network that a femtocell is connected to. When a
user has a femtocell at home or in the office, mobile devices
may use LIPA to access devices that are connected to the
local network over the femtocell. To get access to devices on
20   a local network to which a femtocell is connected to, the
mobile device uses a special APN. APN tells SGSN (UMTS) or
MME (LTE) that the mobile device wants to get a connection to
the local network and not to the network operator's core
network. Optionally, a LIPA flag is defined that is sent by
25   the mobile device during PDP context establishment (UMTS) or
default bearer activation (LTE) for the same purpose. For
simultaneous access to the local network and the internet,
the mobile may have two PDP contexts (UMTS) or two default
bearers (LTE): one that terminates in the local network and
30   one that goes through the core network to GGSN/P-GW. In case
internet connectivity is available through the local network,
LIPA allows UE to reach the internet this way. Once the LIPA
PDP context/default bearer is established, data flows
directly to L-GW and from there into the local network
35   without traversing the radio access network or the core
network of the network operator. Control of the LIPA PDP

context/default bearer may remain with SGSN/MME in the core
network. In other words, authentication, authorization and
security procedures remain with the network operator.
Incoming packets from the local network are forwarded to a
5   mobile device that is in an UMTS idle/cell or URA_PCH state
or LTE idle state respectively. In these states, the mobile
device is paged first and has to re-establish an RRC (radio
resource control) connection before the data can be
forwarded.

10 SUMMARY

The following presents a simplified summary of the invention
in order to provide a basic understanding of some aspects of
the invention. This summary is not an extensive overview of
the invention. It is not intended to identify key/critical
15 elements of the invention or to delineate the scope of the
invention. Its sole purpose is to present some concepts of
the invention in a simplified form as a prelude to the more
detailed description that is presented later.

Various aspects of the invention comprise a method,
20 apparatuses, a computer program product, and a computer-
readable storage medium as defined in the independent claims.
Further embodiments of the invention are disclosed in the
dependent claims.

An aspect of the invention relates to a method for providing
25 a bearer service in a communications system, the method
comprising establishing, a radio bearer service between a
network apparatus and a user terminal, for transmitting
messages over an air interface, wherein a point-to-point
radio bearer is to be used for transmitting unicast messages
30 and its associated shared point-to-multipoint broadcast radio
bearer in downlink is to be used for transmitting one or more
of broadcast and multicast messages from a local IP network
via the network apparatus to user terminals, such that
messages received from a point-to-point radio bearer and its
35 associated point-to-multipoint broadcast radio bearer in

downlink are combinable in the user terminal to a single
connection emulating one or more of a broadcast and multicast
capable media respectively over the air interface.

A further aspect of the invention relates to an apparatus
5   comprising a communication control circuitry configured to
establish a radio bearer service between the apparatus and a
user terminal, for transmitting messages over an air
interface, wherein a point-to-point radio bearer is to be
used for transmitting unicast messages and its associated
10   shared point-to-multipoint broadcast radio bearer in downlink
is to be used for transmitting one or more of broadcast and
multicast messages from a local IP network via the apparatus
to user terminals, such that messages received from a point-
to-point radio bearer and its associated point-to-multipoint
15   broadcast radio bearer in downlink are combinable in the user
terminal to a single connection emulating one or more of a
broadcast and multicast capable media respectively over the
air interface.

A still further aspect of the invention relates to an
20   apparatus comprising at least one processor, and at least one
memory including a computer program code, wherein the at
least one memory and the computer program code are configured
to, with the at least one processor, cause the apparatus to
establish a radio bearer service between the apparatus and a
25   user terminal, for transmitting messages over an air
interface, wherein a point-to-point radio bearer is to be
used for transmitting unicast messages and its associated
shared point-to-multipoint broadcast radio bearer in downlink
is to be used for transmitting one or more of broadcast and
30   multicast messages from a local IP network via the apparatus
to user terminals, such that messages received from a point-
to-point radio bearer and its associated point-to-multipoint
broadcast radio bearer in downlink are combinable in the user
terminal to a single connection emulating one or more of a
35   broadcast and multicast capable media respectively over the
air interface.

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A still further aspect of the invention relates to a user equipment comprising a communication control circuitry configured to receive receive messages transmitted over an air interface, wherein a point-to-point radio bearer is used
5 for transmitting unicast messages and its associated shared point-to-multipoint broadcast radio bearer in downlink is used for transmitting one or more of broadcast and multicast messages from a local IP network via a network apparatus to the user terminal, and combine the messages received from the
10 point-to-point radio bearer and its associated point-to-multipoint broadcast radio bearer in downlink, to a single connection emulating one or more of a broadcast and multicast capable media respectively over the air interface.

A still further aspect of the invention relates to a computer
15 program comprising program code means adapted to perform any one of the method steps according to an embodiment of the invention when the program is run on a computer.

A still further aspect of the invention relates to a computer readable storage medium comprising computer readable code for
20 executing a computer process according to an embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS
In the following the invention will be described in greater detail by means of exemplary embodiments with reference to
25 the attached drawings, in which

Figure 1 illustrates LIPA bearers according to an exemplary embodiment;

Figure 2 illustrates LIPA data flows according to an exemplary embodiment;

30 Figure 3 shows a simplified block diagram illustrating exemplary system architecture;

Figure 4 shows a simplified block diagram illustrating exemplary apparatuses;

Figure 5 shows a messaging diagram illustrating signalling according to an exemplary embodiment;

Figure 6 shows a schematic diagram of a flow chart according to an exemplary embodiment;

5   Figure 7 shows a schematic diagram of a flow chart according to an exemplary embodiment.

DETAILED DESCRIPTION OF SOME EMBODIMENTS

An exemplary embodiment relates to future networks enabling and supporting a local breakout functionality (local IP
10   access, LIPA), such as LTE etc. An exemplary embodiment may involve eNBs, UEs and/or local gateways (L-GW).

An ethernet bearer and shared prefix model may be introduced using point-to-point (PtP) radio bearers. These, however, do not include e.g. a broadcast bearer when needed for DL
15   neighbour discovery (ND) delivery/point-to-multipoint in detail.

The way of utilizing radio broadcast to realize IP multicast/broadcast according to an exemplary embodiment may have some resemblance to e.g. MBMS (multimedia broadcast
20   multicast service) procedures as well as multicasting/broadcasting ND messages and/or protocol messages using MBMS like radio broadcast channel. In an exemplary embodiment, the multicast/broadcast channel which is used only for the protocol messages that needs
25   multicasting, may be combined with a regular user specific unicast user plane channel in UE, so that UE's IP stack sees them as one logical IP interface. UE (IP host generally) seems not to be able to handle a situation where ND messages and other IP traffic are received from different interfaces.
30   E.g. in a fixed network there may be no problem with IP host connected, as it seems that the messages including ND messages use the same interface without any confusion. A problem with the mobile terminals seems to come from how they handle bearers. Without the combining function the terminal
35   just may not associate the broadcast/multicast bearer which pushes ND messages towards it, to a regular user plane bearer heading to the corresponding network. UE IP stack is supposed

to understand that these two logical connections belong to the same IPv6 link.

An exemplary embodiment involves creating a new local IP access (LIPA) broadcast radio bearer service to carry
5   multicast IP messages efficiently over radio interface (i.e. basically to emulate a kind of ethernet-type broadcasting e.g. for handling IPv6 link-local multicast messaging for UEs sharing the same LIPA base station). In other words, a way how the multicast packets are transported between a local
10 network and UE attached to the local network. It enables neighbour discovery to function, and therefore enables typical home network address assignment procedures to work also on a LIPA bearer. An exemplary embodiment involves combining a multicast/broadcast channel which is used only
15 for the protocol messages that need multicasting, with the regular user specific unicast user plane channel in UE, so that UE's IP stack sees them as one logical IP interface.

An exemplary embodiment helps to provide kind of WLAN type access network services over a femto cell. If there is a
20 large number of LIPA UEs served by one eNB, radio resources may be saved by using broadcast bearer to send multicast messages only once instead of repeating them on dedicated bearers (point-to-multipoint vs. point-to-point).

A 3GPP bearer model implicitly defines the used IP link
25 model. 3GPP accesses have two models:

–   an "old" point-to-point link model used since GPRS; the link is between UE and PGW/GGSN,

–   a "new" point-to-point link model used with PMIPv6; the link is between UE and SGW but the IPv6 prefix/IPv4 address
30 is still topologically anchored to the PGW.

Since GPRS-times, 3GPP compliant host OSs have abstracted the PDP connection as a dial-up "PPP-like" interface.

Modern host OSs may wish to abstract "everything" as an IEEE 802 (ethernet) type interface. This may lead to false
35 assumptions on both end-host and network side regarding link model and addressing. As a result there may be no working

combinations regarding addressing, and a need for a bearer
model with true ethernet addressing is recognised.

A neighbour discovery (ND) protocol for IPv6 is a fundamental
network layer protocol for IPv6, by which IPv6 hosts uses
5   for, address configuration, L2 address resolution (AR) of
other nodes, duplicate address detection (DUD), router
discovery etc. The ND protocol is used inside an IPv6 link
(subnet), and assumes the multicast capable transport. Some
ND messages may be sent (multicast) to specific multicast
10   groups, part of them to an All_Nodes multicast group, which
means in practice broadcasting to each host in the link.

The 3GPP IPv6 link model is based on dedicated prefixes per
UE. Exactly one dedicated prefix is assigned for each UE,
which means that there are no other hosts in a same IPv6 link
15   (subnet). The prefix is advertised to UE as a prefix that
cannot be used for on-link determination ("non-on-link
prefix") so that UE knows that it is the only host in the
link and sends each packet to a default router (P-GW, GGSN).
Since UE is the only host in the link, most of the ND
20   procedures may be omitted and no ND multicasting is needed.

With introduction of LIPA (local IP access) 3GPP UEs (and
BSs) may be connected to a third-party-administered local
area network. If the local mobile GW (L-GW) is a layer-2
device like in the case of an ethernet bearer, UEs logically
25   belong to the network of the access router(s) of the local
network.

The address configuration management of the third party
network is beyond the control of a mobile operator, thus for
the flexibility sake the 3GPP subsystem should adapt to the
30   usual IP addressing and link models used in the wired LANs.
The shared IPv6 prefix link model is commonly used in LAN
interfaces, meaning that each host including mobile ones
share the same IPv6 prefix and belong to the same IPv6 link,
which in turn necessitates that ND protocol messages are to
35   be transported between hosts and routers.

The ND protocol assumes a multicast-capable link. The 3GPP
access link based on default and dedicated bearers is not, as
such, multicast capable; instead the 3GPP access link is
formed of point-to-point links (bearers) either between UE
5   and P-GW/GGSN (3GPP variant) or UE and S-GW (IETF variant).
The multicast link may be emulated by replicating multicast
packets to point-to-point links (bearers) and sending
replicated packets individually to each bearer, but this
increases overhead and wastes radio resources and transport
10   resources and should thus be avoided.

The current 3GPP IPv6 link model relies on dedicated IPv6
prefixes for UE, which means that only PDN GW belongs to the
same IPV6 link together with UE, which makes on-link
determination unnecessary, thus avoiding ND protocol
15   multicast. However, by means of the LIPA feature, 3GPP UE may
be attached to a third party administrator's network whose IP
addressing policies are beyond a mobile network operator's
control and quite often (probably) use shared IPv6 prefixes.

An exemplary embodiment proposes that a point-to-multipoint
20   broadcast bearer service is used for transporting ND messages
(or other messages) with a multicast destination address over
the air interface (see Figure 1 illustrating LIPA bearers
with two UEs using a LIPA connection to a local network). In
an exemplary embodiment, when initiating a direct access to
25   the local network (LIPA service), i.e. when a two-way (uplink
and downlink) LIPA dedicated bearer is established, UE starts
reception of the downlink LIPA broadcast bearer service which
is dedicated for the ND protocol message multicasting.

In an exemplary embodiment, the LIPA broadcast bearer service
30   is established for a LIPA base station for transporting ND
protocol messages, or some other protocol messages requiring
multicasting, towards UEs. A filter function in the BS
internal local GW identifies, based on a criteria such as a
protocol (e.g. ARP, ICMP or some other protocol), and/or a
35   destination address, etc., messages that are to be multicast
and forwards them to the LIPA broadcast bearer (see Figure 2

illustrating LIPA data flows with a LIPA connection to a
local network using on-link prefixes). Other user plane
traffic to UE from the local network interface (see SGi in
Figure 2) or from another UE is forwarded to a regular

5   unicast LIPA downlink bearer. BS keeps track on the LIPA UEs
attached to BS, and in the case that there is none, BS may
stop transmitting on the LIPA broadcast channel in order to
save radio resources. BS may also, if beneficial, for
example, in radio resource-wise, decide to use the regular

10 LIPA downlink bearer for ND protocol message delivery. The
filter function in L-GW may also comprise multicast listener
discovery (MLD) snooping for IPv6 or IGMP snooping for IPv4
functionality. Multicast snooping makes it possible to filter
off multicast messages targeted to multicast groups to which

15 none of the camped UEs are belonging.

In an exemplary embodiment, when the LIPA bearer is
established, UE receives a configuration message for
configuring a LIPA bearer service and its associated LIPA
broadcast bearer service, giving the necessary information

20 for UE to start the reception of the LIPA broadcast service.
Based on this configuration message, the downlink flows from
the unicast LIPA downlink bearer and the LIPA multicast
bearer are combined together in a multiplexer function of UE
so that UE's IP stack sees them as a single logical ingress

25 interface (see a MUX function in Figure 2).

The LIPA broadcast bearer is common for the LIPA UEs
connected to a local IP network and carries data that does
not interest every UE. It is up to the UE's IP stack to
recognise multicast packets that concern it.

30 In an exemplary embodiment, the ND protocol messages from UE
to another host in LAN are sent to the uplink LIPA unicast
bearer as other user plane uplink traffic.

In an exemplary embodiment, L-GW may either be a standalone
node, or a collocated function in BS. In the case of

35 standalone L-GW, the LIPA multicast traffic may be delivered

from L-GW to LIPA base stations by using IP multicasting and transmitted over the air interface by using a coordinated transmission scheme similar to that of a multi-cell MBMS.

Thus, the enhanced bearer model for local IP access according
5   to an exemplary embodiment involves delivering multicast (ND) protocol messages from a local IP network to UEs by using a point-to-multipoint (broadcast) radio bearer service which is combined to a regular bearer in UE so that UE sees them as one logical downlink interface. With LIPA, the delivery of ND
10   messaging becomes topical if L2-modelled local GWs are used or an ethernet like link model is used in a local GW. Many ND messages are sent to multicast IP addresses. Multicasting over the point-to-point 3GPP radio bearers introduces overhead and is waste of radio capacity.

15   Exemplary embodiments of the present invention will now be de-scribed more fully hereinafter with reference to the accompanying drawings, in which some, but not all embodiments of the invention are shown. Indeed, the invention may be embodied in many different forms and should not be construed
20   as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. Although the specification may refer to "an", "one", or "some" embodiment(s) in several locations, this does not necessarily mean that each such
25   reference is to the same embodiment(s), or that the feature only applies to a single embodiment. Single features of different embodiments may also be combined to provide other embodiments. Like reference numerals refer to like elements throughout.

30   The present invention is applicable to any user terminal, network element, server, corresponding component, and/or to any communication system or any combination of different communication systems that support a bearer service. The communication system may be a fixed communication system or a
35   wireless communication system or a communication system utilizing both fixed networks and wireless networks. The

protocols used, the specifications of communication systems, servers and user terminals, especially in wireless communication, develop rapidly. Such development may require extra changes to an embodiment. Therefore, all words and
5   expressions should be interpreted broadly and they are intended to illustrate, not to restrict, the embodiment.

In the following, different embodiments will be described using, as an example of a system architecture whereto the embodiments may be applied, without restricting the
10 embodiment to such an architecture, however.

With reference to Figure 3, let us examine an example of a radio system to which embodiments of the invention can be applied. In this example, the radio system is based on LTE network elements. However, the invention described in these
15 examples is not limited to the LTE radio systems but can also be implemented in other radio systems, such as UMTS (universal mobile telecommunications system), GSM, EDGE, WCDMA, bluetooth network, WLAN or other fixed, mobile or wireless network. In an embodiment, the presented solution
20 may be applied between elements belonging to different but compatible systems such as LTE and UMTS.

A general architecture of a communication system is illustrated in Figure 3. Figure 3 is a simplified system architecture only showing some elements and functional
25 entities, all being logical units whose implementation may differ from what is shown. The connections shown in Figure 3 are logical connections; the actual physical connections may be different. It is apparent to a person skilled in the art that the systems also comprise other functions and
30 structures. It should be appreciated that the functions, structures, elements, and protocols used in or for fixed or wireless communication are irrelevant to the actual invention. Therefore, they need not be discussed in more detail here.

The exemplary radio system of Figure 3 comprises a local
network node 301, e.g. an IP host connected to a local
network 310. The network node 301 may include e.g. an
application server, PC, and/or a printer. The local network

5   node 301 may be operationally connected (directly or
indirectly) to a radio network node 302 including a local
gateway function, via a connection 304. The local network
node 301 and the radio network node 302 are operationally
connected (directly or indirectly) to the same local IP

10   network 310. The radio network node may include e.g. a base
station (BS, node-B, eNB), access point (AP), radio network
controller (RNC), or any other network element or a
combination of network elements. In Figure 3, the radio
network node 302 that may also be called a base station (BS)

15   and/or eNB/RNC (enhanced node-B/radio network controller) of
the radio system hosts the functions for radio resource
management in a public land mobile network. The radio network
node 302 may also be connected to a core network 320 and one
or more core network elements such as a mobility management

20   entity MME 321, via a connection 322. Figure 3 shows one or
more user equipment 303 located in the service area of the
radio network node 302. The user equipment refers to a
portable computing device, and it may also be referred to as
a user terminal. Such computing devices include wireless

25   mobile communication devices operating with or without a
subscriber identification module (SIM) in hardware or in
software, including, but not limited to, the following types
of devices: mobile phone, smart-phone, personal digital
assistant (PDA), handset, laptop computer. In the example

30   situation of Figure 3, the user equipment 303 is capable of
connecting to the radio network node 302 via a connection
305.

Figure 3 only illustrates a simplified example. In practice,
the net-work may include more network elements and user

35   terminals. The networks of two or more operators may overlap,
the sizes and form of the cells may vary from what is
depicted in Figure 3, etc. The communication system may also

be able to communicate with other networks, such as a public switched telephone network. The embodiments are not, however, restricted to the network given above as an example, but a person skilled in the art may apply the solution to other

5   communication networks provided with the necessary properties. For example, the connections between different network elements may be realized with internet protocol (IP) connections.

Figure 4 illustrates examples of apparatuses according to

10 embodiments of the invention. Figure 4 shows a user equipment 303 located in the area of the radio network node 302. The user equipment is configured to be in connection with the radio network node 302. The user equipment or UE 303 comprises a controller 401 operationally connected to a

15 memory 202 and a transceiver 403. The controller 401 controls the operation of the user equipment 303. The memory 402 is configured to store software and data. The transceiver 403 is configured to set up and maintain a wireless connection to the radio network node 302. The transceiver is operationally

20 connected to a set of antenna ports 404 connected to an antenna arrangement 405. The antenna arrangement 405 may comprise a set of antennas. The number of antennas may be one to four, for example. The number of antennas is not limited to any particular number. The user equipment 303 may also

25 comprise various other components, such as a user interface, camera, and media player. They are not displayed in the figure due to simplicity. The radio network node 302 comprises a controller 406 operationally connected to an interface 407, and a transceiver 408. The controller 406

30 controls the operation of the radio network node 302. The transceiver 408 is configured to set up and maintain a wireless connection to the user equipment 303 within the service area of the radio network node 302. The transceiver 408 is operationally connected to an antenna arrangement 409.

35 The antenna arrangement 409 may comprise a set of antennas. The number of antennas may be two to four, for example. The number of antennas is not limited to any particular number.

The radio network node may be operationally connected (directly or indirectly) to another network element 301 of the communication system, such as an IP host, e.g. an application server, PC and/or a printer. The network element

5   301 may comprise a controller 410 operationally connected to an interface 412, and a memory 411. The controller 410 controls the operation of the network node 301. The memory 411 is configured to store software and data. The radio network node may also be operationally connected (directly or

10   indirectly) to a further network element 321 of the communication system, such as a mobility management entity (MME), an MSC server (MSS), a mobile switching centre (MSC), a radio resource management (RRM) node, a gateway GPRS support node, an operations, administrations and maintenance

15   (OAM) node, a home location register (HLR), a visitor location register (VLR), a serving GPRS support node, a base station controller (BSC), a gateway, and/or a server. The network element 321 may comprise a controller 413 operationally connected to an interface 415, and a memory

20   414. The controller 413 controls the operation of the network node 321. The memory 414 is configured to store software and data. The embodiments are not, however, restricted to the network given above as an example, but a person skilled in the art may apply the solution to other communication

25   networks provided with the necessary properties. For example, the connections between different network elements may be realized with internet protocol (IP) connections.

The memory may include volatile and/or non-volatile memory and typically stores content, data, or the like. For example,

30   the memory may store computer program code such as software applications (for example for the detector unit and/or for the adjuster unit) or operating systems, information, data, content, or the like for the processor to perform steps associated with operation of the apparatus in accordance with

35   embodiments. The memory may be, for example, random access memory (RAM), a hard drive, or other fixed data memory or

storage device. Further, the memory, or part of it, may be
removable memory detachably connected to the apparatus.

The techniques described herein may be implemented by various
means so that an apparatus implementing one or more functions
5   of a corresponding mobile entity described with an embodiment
comprises not only prior art means, but also means for
implementing the one or more functions of a corresponding
apparatus described with an embodiment and it may comprise
separate means for each separate function, or means may be
10   configured to perform two or more functions. For example,
these techniques may be implemented in hardware (one or more
apparatuses), firmware (one or more apparatuses), software
(one or more modules), or combinations thereof. For a firm-
ware or software, implementation can be through modules (e.g.
15   procedures, functions, and so on) that perform the functions
described herein. The software codes may be stored in any
suitable, processor/computer-readable data storage medium(s)
or memory unit(s) or article(s) of manufacture and executed
by one or more processors/computers. The data storage medium
20   or the memory unit may be implemented within the
processor/computer or external to the processor/computer, in
which case it can be communicatively coupled to the
processor/computer via various means as is known in the art.

User equipment may refer to any user communication device. A
25   term "user equipment" as used herein may refer to any device
having a communication capability, such as a wireless mobile
terminal, a PDA, tablet, a smart phone, a personal computer
(PC), a laptop computer, a desktop computer, etc. For
example, the wireless communication terminal may be an UMTS
30   or GSM/EDGE smart mobile terminal having wireless modem.
Thus, the application capabilities of the device according to
various embodiments of the invention may include native
applications available in the terminal, or subsequently
installed applications by the user or operator or other
35   entity. The network apparatus 302 may be implemented in any
network element, such as a server.

16

Figure 4 is a block diagram of an apparatus according to an embodiment of the invention. Although the apparatus has been depicted as one entity, different modules and memory may be implemented in one or more physical or logical entities.

5   The functionality of the network apparatus 302 is described in more detail below with Figures 5 and 6. It should be appreciated that the apparatus 302 may comprise other units used in or for distributed computing and/or data federation. However, they are irrelevant to the actual invention and,
10   therefore, they need not to be discussed in more detail here.

The apparatus may also be a user terminal which is a piece of equipment or a device that associates, or is arranged to associate, the user terminal and its user with a subscription and allows a user to interact with a communications system.
15   The user terminal presents information to the user and allows the user to input information. In other words, the user terminal may be any terminal capable of receiving information from and/or transmitting in-formation to the network, connectable to the network wirelessly or via a fixed
20   connection. Examples of the user terminal include a personal computer, a game console, a laptop (a notebook), a personal digital assistant, a mobile station (mobile phone), and a line telephone.

The apparatus 301, 302, 303, 321 may generally include a
25   processor, controller, control unit or the like connected to a memory and to various interfaces of the apparatus. Generally the processor is a central processing unit, but the processor may be an additional operation processor. The processor may comprise a computer processor, application-
30   specific integrated circuit (ASIC), field-programmable gate array (FPGA), and/or other hardware components that have been programmed in such a way to carry out one or more functions of an embodiment.

The techniques described herein may be implemented by various
35   means so that an apparatus implementing one or more functions

of a corresponding mobile entity described with an embodiment
comprises not only prior art means, but also means for
implementing the one or more functions of a corresponding
apparatus described with an embodiment and it may comprise
5   separate means for each separate function, or means may be
configured to perform two or more functions. For example,
these techniques may be implemented in hardware (one or more
apparatuses), firmware (one or more apparatuses), software
(one or more modules), or combinations thereof. For a firm-
10   ware or software, implementation may be through modules (e.g.
procedures, functions, and so on) that perform the functions
described herein. The software codes may be stored in any
suitable, processor/computer-readable data storage medium(s)
or memory unit(s) or article(s) of manufacture and executed
15   by one or more processors/computers. The data storage medium
or the memory unit may be implemented within the
processor/computer or external to the processor/computer, in
which case it may be communicatively coupled to the
processor/computer via various means as is known in the art.

20   The signalling chart of Figure 5 illustrates the required
signalling. In the example of Figure 5, a network element 321
which may comprise e.g. a core network node such as a
mobility management entity 321, decides, in item 501, to
establish a LIPA bearer service via a network apparatus such
25   as a base station BS and/or a local gateway L-GW 302, by
sending a bearer setup request message 501a to the apparatus
302, wherein the apparatus302 performs a radio bearer setup
procedure 502 for configuring a LIPA bearer service and its
associated LIPA broadcast bearer service for transmitting
30   messages over the air interface 305, such that a point-to-
multipoint broadcast bearer service may be used for
transmitting neighbour discovery ND messages (or other
messages) with a multicast destination address from the
apparatus 302 to user terminals 303. Thus the radio bearer
35   setup procedure 502 concerns both the LIPA bearer (unicast)
and the established LIPA broadcast bearer (multicast)
service, informing the user terminal 303 that the user

terminal 303 may start reception of the LIPA broadcast bearer
service. In response to the radio bearer setup procedure 502,
a bearer setup response message 502b may be transmitted from
the apparatus 302 to the network element 321. In item 503,

5   the user terminal 303 configures the radio bearers according
to the parameters received in the radio bearer setup
procedure 502 from the apparatus 302. A network node 301 such
as an IP host, may transmit an ND message 504 or another
message 504 that is to be multicast to the user terminals

10   303. In response to receiving the message 504 in the
apparatus 302, the apparatus 302 analyses, in item 505,
whether the message 504 is to be multicast, wherein if the
apparatus 302 identifies that the message is to be multicast,
the apparatus 302 forwards 506 the identified message via the

15   established LIPA broadcast bearer service to the user
terminals 303 connected to the apparatus 302. In item 507,
the user terminal 303 receives the multicast message 506 via
the established LIPA broadcast bearer service. In a message
508, the user terminal 303 may send ND protocol messages to

20   another host in the local IP network 310 via an uplink LIPA
unicast bearer service.

Figure 6 is a flow chart illustrating an exemplary
embodiment. The network apparatus 302 which may comprise e.g.
a network element (network node) such as a base station BS

25   and/or a local gateway L-GW, receives, in item 601, a bearer
setup request message from a core network element 321,
regarding establishment of a LIPA bearer service. In item
602, the apparatus 302 performs a radio bearer setup
procedure for configuring a LIPA bearer service and its

30   associated LIPA broadcast bearer service for transmitting
messages over the air interface 305, such that a point-to-
multipoint broadcast bearer service may be used for
transmitting neighbour discovery ND messages (or other
messages) with a multicast destination address from the

35   apparatus 302 to user terminals 303. In response to the
bearer setup procedure, a bearer setup response message may
be transmitted, in item 603, from the apparatus 302 to the

network element 321. The bearer setup procedure 602 concerns
both the LIPA bearer (unicast) and the established LIPA
broadcast bearer (multicast) service, informing the user
terminal(s) 303 that the user terminal(s) 303 may start

5   reception of the LIPA broadcast bearer service. A network
element 301 such as an IP host, may transmit an ND message
(or another message) that is to be multicast to the user
terminals 303. In response to receiving, in item 604, the ND
message (or other message) that is to be multicast, the

10   apparatus 302 is configured to analyse, in item 605, whether
the ND message (or other message) is to be multicast, wherein
if the apparatus 302 identifies 605 that the message is to be
multicast, the apparatus 302 is configured to forward 606 the
identified message via the established LIPA broadcast bearer

15   service to the user terminals 303 connected to the apparatus
302. However, if it is discovered that the message is not to
be multicast or if, for example, it is beneficial in terms of
the radio resource usage, a downlink LIPA unicast bearer
service may be used 607 for transmission of the ND message or

20   other message to the user terminal. In item 608, the
apparatus may receive (and forward) ND protocol messages
transmitted from the user terminal 303 via an uplink LIPA
unicast bearer service, the messages being directed to
another host in the local IP network.

25   Figure 7 is a flow chart illustrating an exemplary
embodiment. The user equipment 303 which may comprise e.g. a
user terminal such as a mobile station or a laptop, performs,
in item 701, with a network apparatus 302, a radio bearer
setup procedure regarding a LIPA bearer (unicast) service and

30   a LIPA broadcast bearer (multicast) service. In item 702, the
user terminal 303 configures the radio bearers according to
the parameters received from the apparatus 302 in the radio
bearer setup procedure, wherein the user terminal 303 may
start reception of the LIPA broadcast bearer service. In item

35   703, the user equipment 303 may receive, from the network
apparatus 302, a multicast message (e.g. an ND message) via
the established LIPA broadcast bearer service. In item 704,

the user equipment 303 may send (e.g. via the network
apparatus 302) unicast data (e.g. a neighbour discovery
protocol message) to another host in a local IP network via
an uplink LIPA unicast bearer service.

5   Thus, according to an exemplary embodiment, there is provided
a method for providing a bearer service in a communications
system, the method comprising establishing, a radio bearer
service between a network apparatus and a user terminal, for
transmitting messages over an air interface, wherein a point-
10   to-point radio bearer is to be used for transmitting unicast
messages and its associated shared point-to-multipoint
broadcast radio bearer in downlink is to be used for
transmitting one or more of broadcast and multicast messages
from a local IP network via the network apparatus to user
15   terminals, such that messages received from a point-to-point
radio bearer and its associated point-to-multipoint broadcast
radio bearer in downlink are combinable in the user terminal
to a single connection emulating one or more of a broadcast
and multicast capable media respectively over the air
20   interface.

According to another exemplary embodiment, there is provided
a method for establishing a LIPA broadcast bearer service for
transmitting neighbour discovery messages or other protocol
messages requiring multicasting, to user terminals.

25   According to yet another exemplary embodiment, there is
provided a method for identifying a message that is to be
multicast; and forwarding the identified message by utilizing
the established broadcast bearer service to user terminals
connected to the network apparatus.

30   According to yet another exemplary embodiment, there is
provided a method for identifying a message that is to be
multicast, based on one or more of a communications protocol
and a destination address, and forwarding user plane data
traffic that is not to be multicast, from a local network
35   interface or from a further user terminal, via a downlink
unicast bearer service to the user terminal.

According to yet another exemplary embodiment, said communications protocol comprises one or more of ARP and ICMP.

5   According to yet another exemplary embodiment, there is provided a method for keeping track on LIPA user terminals attached to the network apparatus, wherein if there are no LIPA user terminals attached to the network apparatus, the method comprises stopping transmission via a LIPA broadcast bearer service.

10 According to yet another exemplary embodiment, there is provided a method for stopping transmission via a LIPA broadcast bearer service, if beneficial in terms of the radio resource usage, wherein a downlink LIPA unicast bearer service is to be used for transmission of the neighbour
15 discovery messages.

According to yet another exemplary embodiment, the network apparatus comprises a standalone local gateway, wherein LIPA multicast data traffic is delivered from an MBMS gateway to LIPA base stations by using IP multicasting.

20 According to yet another exemplary embodiment, the network apparatus comprises a LIPA base station.

According to yet another exemplary embodiment, there is provided an apparatus comprising a communication control circuitry configured to establish a radio bearer service
25 between the apparatus and a user terminal, for transmitting messages over an air interface, wherein a point-to-point radio bearer is to be used for transmitting unicast messages and its associated shared point-to-multipoint broadcast radio bearer in downlink is to be used for transmitting one or more
30 of broadcast and multicast messages from a local IP network via the apparatus to user terminals, such that messages received from a point-to-point radio bearer and its associated point-to-multipoint broadcast radio bearer in downlink are combinable in the user terminal to a single

connection emulating one or more of a broadcast and multicast capable media respectively over the air interface.

According to yet another exemplary embodiment, there is provided an apparatus comprising a communication control
5   circuitry configured to establish a LIPA broadcast bearer service for transmitting neighbour discovery messages or other protocol messages requiring multicasting, towards user terminals.

According to yet another exemplary embodiment, there is
10   provided an apparatus comprising a communication control circuitry configured to identify a message that is to be multicast; and forward the identified message by utilizing the established broadcast bearer service to user terminals connected to the apparatus.

15   According to yet another exemplary embodiment, there is provided an apparatus comprising a communication control circuitry configured to carry out the identifying based on one or more of a communications protocol and a destination address; and forward user plane data traffic that is not to
20   be multicast, from a local network interface or from a further user terminal, via a downlink unicast bearer service to the user terminal.

According to yet another exemplary embodiment, there is provided an apparatus comprising a communication control
25   circuitry configured to keep track on LIPA user terminals attached to the apparatus; and stop transmission via the LIPA broadcast bearer service, if there are no LIPA user terminals attached to the apparatus.

According to yet another exemplary embodiment, there is
30   provided an apparatus comprising a communication control circuitry configured to stop transmission via the LIPA broadcast bearer service, if beneficial in terms of the radio resource usage, wherein a downlink LIPA unicast bearer service is to be used for transmission of the neighbour
35   discovery messages.

According to yet another exemplary embodiment, there is
provided an apparatus comprising a filter function for
filtering off multicast messages targeted to multicast groups
to which none of the user terminals connected to the

5   apparatus are belonging, the filter function including one or
more of a multicast listener discovery MLD snooping for an
IPv6 functionality and an IGMP snooping for an IPv4
functionality.

According to yet another exemplary embodiment, the apparatus

10   comprises a standalone local gateway, wherein the
communication control circuitry is further configured to
deliver LIPA multicast data traffic from an MBMS gateway to
LIPA base stations by using IP multicasting.

According to yet another exemplary embodiment, there is

15   provided an apparatus comprising at least one processor; and
at least one memory including a computer program code,
wherein the at least one memory and the computer program code
are configured to, with the at least one processor, cause the
apparatus to establish a radio bearer service between the

20   apparatus and a user terminal, for transmitting messages over
an air interface, wherein a point-to-point radio bearer is to
be used for transmitting unicast messages and its associated
shared point-to-multipoint broadcast radio bearer in downlink
is to be used for transmitting one or more of broadcast and

25   multicast messages from a local IP network via the apparatus
to user terminals, such that messages received from a point-
to-point radio bearer and its associated point-to-multipoint
broadcast radio bearer in downlink are combinable in the user
terminal to a single connection emulating one or more of a

30   broadcast and multicast capable media respectively over the
air interface.

According to yet another exemplary embodiment, there is
provided a user equipment comprising a communication control
circuitry configured to receive messages transmitted over an

35   air interface, wherein a point-to-point radio bearer is used
for transmitting unicast messages and its associated shared

point-to-multipoint broadcast radio bearer in downlink is
used for transmitting one or more of broadcast and multicast
messages from a local IP network via a network apparatus to
the user terminal; and combine the messages received from the
5   point-to-point radio bearer and its associated point-to-
multipoint broadcast radio bearer in downlink, to a single
connection emulating one or more of a broadcast and multicast
capable media respectively over the air interface.

According to yet another exemplary embodiment, there is
10   provided a user equipment comprising a communication control
circuitry configured to combine, by means of a multiplexer
functionality, downlink data traffic transmitted via a
downlink LIPA unicast bearer service and downlink data
traffic transmitted via the LIPA broadcast bearer service, so
15   that an IP stack of the user equipment sees the downlink LIPA
unicast bearer service and the LIPA broadcast bearer service
as one logical ingress interface.

According to yet another exemplary embodiment, there is
provided a user equipment comprising a communication control
20   circuitry configured to send neighbour discovery protocol
messages to another host in a local area network via an
uplink LIPA unicast bearer service.

According to yet another exemplary embodiment, the LIPA
broadcast bearer service is common for LIPA-capable user
25   terminals, wherein the user equipment comprises a
communication control circuitry configured to recognise
multicast packets that concern the user equipment.

According to yet another exemplary embodiment, there is
provided a computer program comprising program code means
30   adapted to perform any one of the method steps when the
program is run on a computer.

According to yet another exemplary embodiment, there is
provided a computer readable storage medium comprising
computer readable code for executing a computer process
35   according to any one of the method steps.

It will be obvious to a person skilled in the art that, as
the technology advances, the inventive concept can be
implemented in various ways. The invention and its
embodiments are not limited to the examples described above
5   but may vary within the scope of the claims.

List of abbreviations

3GPP bearer   dedicated point-to-point connection for
UE

10 AR   address resolution

ARP   address resolution protocol

eNB   evolved node-B

DUD   duplicate address detection

EPS   evolved packet system

15 GGSN   gateway GPRS support node

GPRS   general packet radio service

HeNB   home eNB

ICMP   internet control message protocol

IPv6   internet protocol version 6

20 ISP   internet service provider

L1   layer-1 (physical layer)

Link   interface at link layer (layer-2)

L-GW   local gateway

LIPA   local IP access

25 MAPCON   multi access PDN connectivity

MBMS   multimedia broadcast multicast service

	ND	neighbour discovery
	NIC	network interface connection at physical
	layer	
5	OPIIS	operator policies for IP interface
	selection	
	OS	operating system
	PDN	packet data network
	PMIPv6	proxy mobile IPv6
	PPP	point-to-point protocol
10	PtP	point-to-point
	UE	user equipment
	UL	uplink
	DL	downlink
	IP	internet protocol
15	LTE	long term evolution
	UMTS	universal mobile telecommunications
	system	
	APN	access point name
	SGSN	serving GPRS support node
20	MME	mobility management entity
	PDP	packet data protocol
	P-GW	paging gateway
	RRC	radio resource control
	MUX	multiplexer
25	PC	personal computer

CLAIMS

1. A method for providing a bearer service in a
communications system, the method comprising

establishing (502), a radio bearer service between a network
5   apparatus (302) and a user terminal (303), for transmitting
messages over an air interface (305), wherein a point-to-
point radio bearer is to be used for transmitting unicast
messages and its associated shared point-to-multipoint
broadcast radio bearer in downlink is to be used for
10   transmitting one or more of broadcast and multicast messages
from a local IP network (310) via the network apparatus (302)
to user terminals (303), such that messages (506) received
from a point-to-point radio bearer and its associated point-
to-multipoint broadcast radio bearer in downlink are
15   combinable in the user terminal (303) to a single connection
emulating one or more of a broadcast and multicast capable
media respectively over the air interface (305).

2. A method according to claim 1, **characterized** in that
it comprises establishing a LIPA broadcast bearer service for
20   transmitting neighbour discovery messages or other protocol
messages requiring multicasting, to user terminals (303).

3. A method according to claim 1 or 2, **characterized** in
that it comprises

identifying (505, 605) a message (504) that is to be
25   multicast; and

forwarding (506, 606) the identified message by utilizing the
established broadcast bearer service to user terminals (303)
connected to the network apparatus (302).

4. A method according to claim 3, **characterized** in that
30   the identifying (505, 605) is carried based on one or more of
a communications protocol and a destination address, wherein
the method comprises forwarding (607) user plane data traffic
that is not to be multicast, from a local network interface

or from a further user terminal, via a downlink unicast
bearer service to the user terminal (303).

5. A method according to claim 4, **characterized** by in
that said communications protocol comprises one or more of
5   ARP and ICMP.

6. A method according to any of claims 1 to 5,
characterized in that it comprises keeping track on
LIPA user terminals (303) attached to the network apparatus
(302), wherein if there are no LIPA user terminals attached
10   to the network apparatus (302), the method comprises stopping
transmission via a LIPA broadcast bearer service.

7. A method according to any of claims 1 to 6,
characterized in that the method comprises stopping
transmission via a LIPA broadcast bearer service, if
15   beneficial in terms of the radio resource usage, wherein a
downlink LIPA unicast bearer service is to be used for
transmission of the neighbour discovery messages.

8. A method according to any of claims 1 to 7,
characterized in that the network apparatus (302)
20   comprises a standalone local gateway (L-GW), wherein LIPA
multicast data traffic is delivered from an MBMS gateway to
LIPA base stations by using IP multicasting.

9. A method according to any of claims 1 to 8,
characterized in that the network apparatus (302)
25   comprises a LIPA base station (BS).

10. An apparatus comprising a communication control circuitry
configured to

establish a radio bearer service between the apparatus (302)
and a user terminal (303), for transmitting messages over an
30   air interface (305), wherein a point-to-point radio bearer is
to be used for transmitting unicast messages and its
associated shared point-to-multipoint broadcast radio bearer
in downlink is to be used for transmitting one or more of
broadcast and multicast messages from a local IP network

(310) via the apparatus (302) to user terminals (303), such
that messages received from a point-to-point radio bearer and
its associated point-to-multipoint broadcast radio bearer in
downlink are combinable in the user terminal (303) to a

5   single connection emulating one or more of a broadcast and
multicast capable media respectively over the air interface
(305).

11. An apparatus according to claim 10, **characterized**
in that the communication control circuitry is further

10   configured to

establish a LIPA broadcast bearer service for transmitting
neighbour discovery messages or other protocol messages
requiring multicasting, towards user terminals (303).

12. An apparatus according to claim 10 or 11,

15   **characterized** in that the communication control
circuitry is further configured to

identify a message that is to be multicast; and

forward the identified message by utilizing the established
broadcast bearer service to user terminals (303) connected to

20   the apparatus (302).

13. An apparatus according to claim 12, **characterized**
in that the communication control circuitry is further
configured to

carry out the identifying based on one or more of a

25   communications protocol and a destination address; and

forward user plane data traffic that is not to be multicast,
from a local network interface or from a further user
terminal, via a downlink unicast bearer service to the user
terminal (303).

30   14. An apparatus according to claim 13, **characterized**
in that said communications protocol comprises one or more of
ARP and ICMP.

15. An apparatus according to any of claims 10 to 14, **characterized** in that the communication control circuitry is further configured to

keep track on LIPA user terminals (303) attached to the
5   apparatus (302); and

stop transmission via the LIPA broadcast bearer service, if there are no LIPA user terminals attached to the apparatus (302).

16. An apparatus according to any of claims 10 to 15,
10   **characterized** in that the communication control circuitry is further configured to stop transmission via the LIPA broadcast bearer service, if beneficial in terms of the radio resource usage, wherein a downlink LIPA unicast bearer service is to be used for transmission of the neighbour
15   discovery messages.

17. An apparatus according to any of claims 10 to 16, **characterized** in that the apparatus (302) comprises a filter function for filtering off multicast messages targeted to multicast groups to which none of the user terminals (303)
20   connected to the apparatus (302) are belonging, the filter function including one or more of a multicast listener discovery MLD snooping for an IPv6 functionality and an IGMP snooping for an IPv4 functionality.

18. An apparatus according to any of claims 10 to 17,
25   **characterized** in that the apparatus (302) comprises a standalone local gateway (L-GW), wherein the communication control circuitry is further configured to deliver LIPA multicast data traffic from an MBMS gateway to LIPA base stations (302) by using IP multicasting.

30   19. An apparatus according to any of claims 10 to 18, **characterized** in that the apparatus (302) comprises a LIPA base station (BS).

20. An apparatus comprising

at least one processor; and

at least one memory including a computer program code, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the

5 apparatus (302) to

establish a radio bearer service between the apparatus (302) and a user terminal (303), for transmitting messages over an air interface (305), wherein a point-to-point radio bearer is to be used for transmitting unicast messages and its

10 associated shared point-to-multipoint broadcast radio bearer in downlink is to be used for transmitting one or more of broadcast and multicast messages from a local IP network (310) via the apparatus (302) to user terminals (303), such that messages received from a point-to-point radio bearer and

15 its associated point-to-multipoint broadcast radio bearer in downlink are combinable in the user terminal (303) to a single connection emulating one or more of a broadcast and multicast capable media respectively over the air interface (305).

20 21. A user equipment comprising a communication control circuitry configured to

receive messages transmitted over an air interface (305), wherein a point-to-point radio bearer is used for transmitting unicast messages and its associated shared

25 point-to-multipoint broadcast radio bearer in downlink is used for transmitting one or more of broadcast and multicast messages from a local IP network (310) via a network apparatus (302) to the user terminal (303); and

combine the messages received from the point-to-point radio

30 bearer and its associated point-to-multipoint broadcast radio bearer in downlink, to a single connection emulating one or more of a broadcast and multicast capable media respectively over the air interface (305).

22. A user equipment according to claim 21, **characterized** in that it comprises a communication control circuitry configured to combine, by means of a multiplexer functionality, downlink data traffic transmitted

5   via a downlink LIPA unicast bearer service and downlink data traffic transmitted via the LIPA broadcast bearer service, so that an IP stack of the user equipment sees the downlink LIPA unicast bearer service and the LIPA broadcast bearer service as one logical ingress interface.

10 23. A user equipment according to claim 21 or 22, **characterized** in that it comprises a communication control circuitry configured to send neighbour discovery protocol messages to another host in a local area network via an uplink LIPA unicast bearer service.

15 24. A user equipment according to claim 21, 22 or 23, **characterized** in that the LIPA broadcast bearer service is common for LIPA-capable user terminals (303), wherein the user equipment (303) comprises a communication control circuitry configured to recognise multicast packets that

20 concern the user equipment (303).

25. A computer program comprising program code means adapted to perform any one of steps of claims 1 to 9 when the program is run on a computer.

26. A computer readable storage medium comprising computer

25 readable code for executing a computer process according to any one of claims 1 to 9.
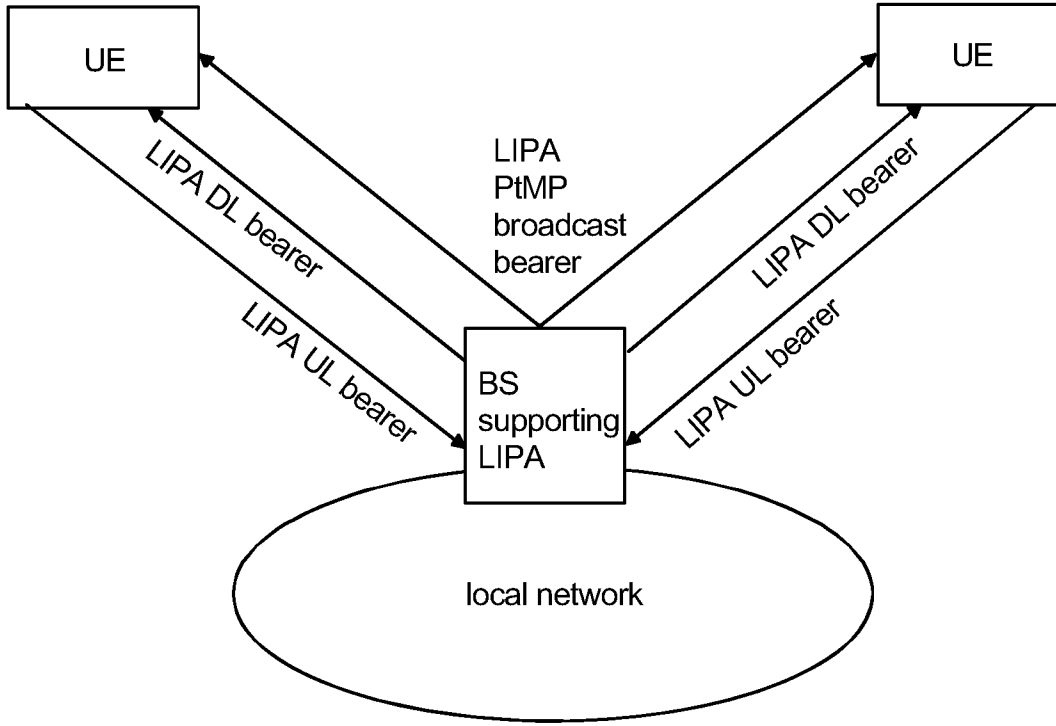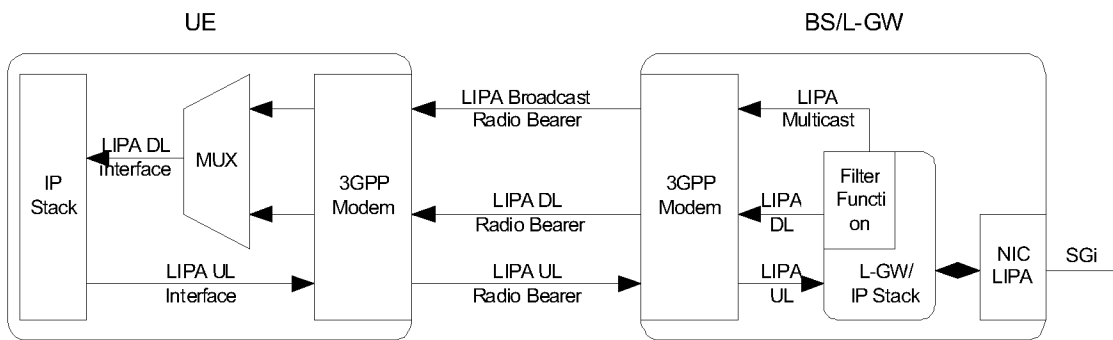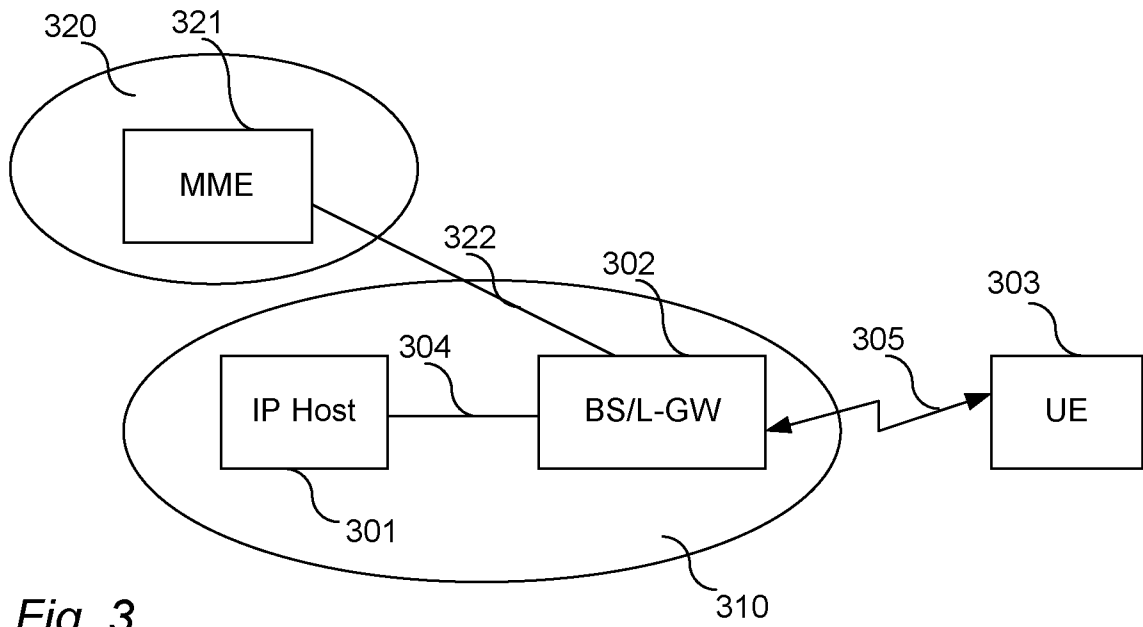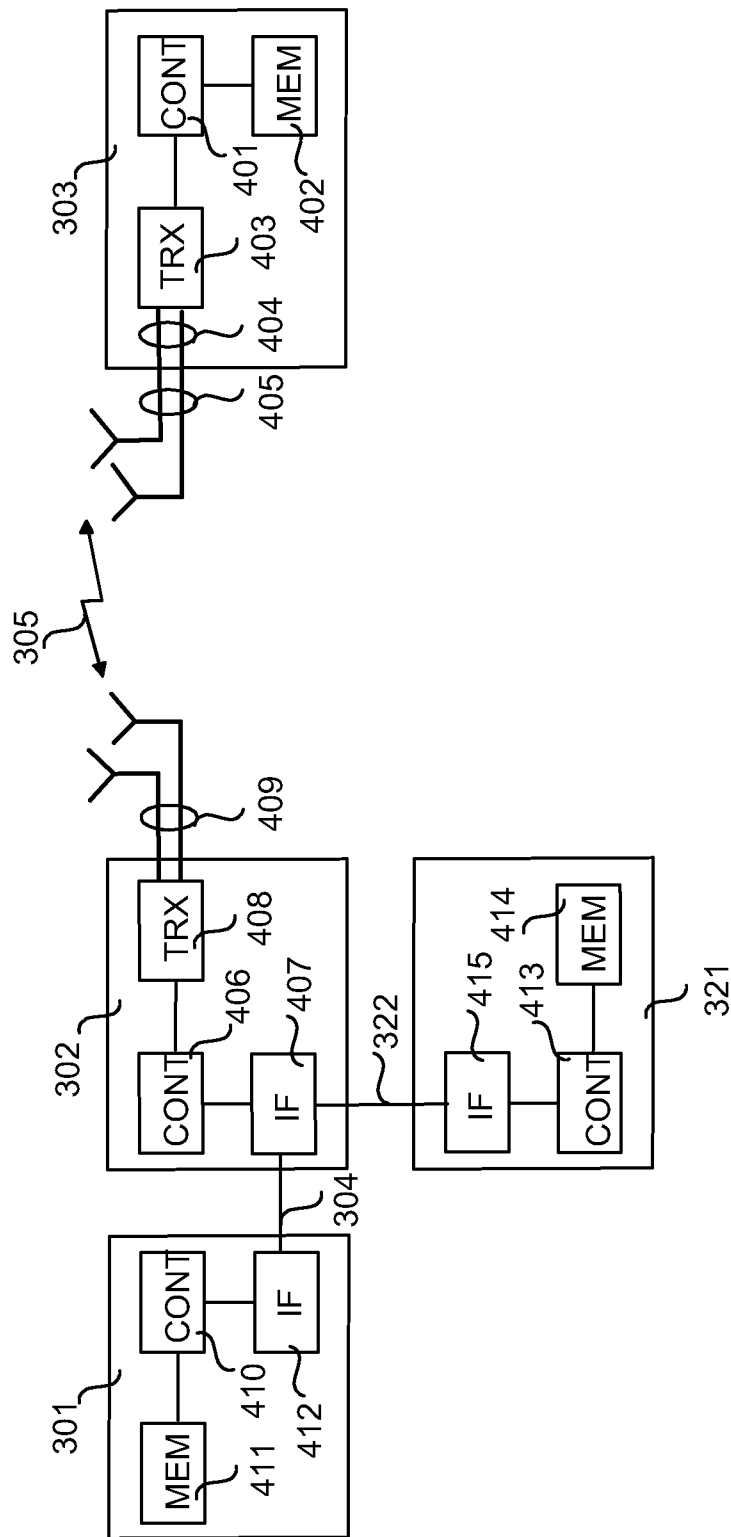
Fig. 1

Fig. 2

Fig. 3

Fig. 4
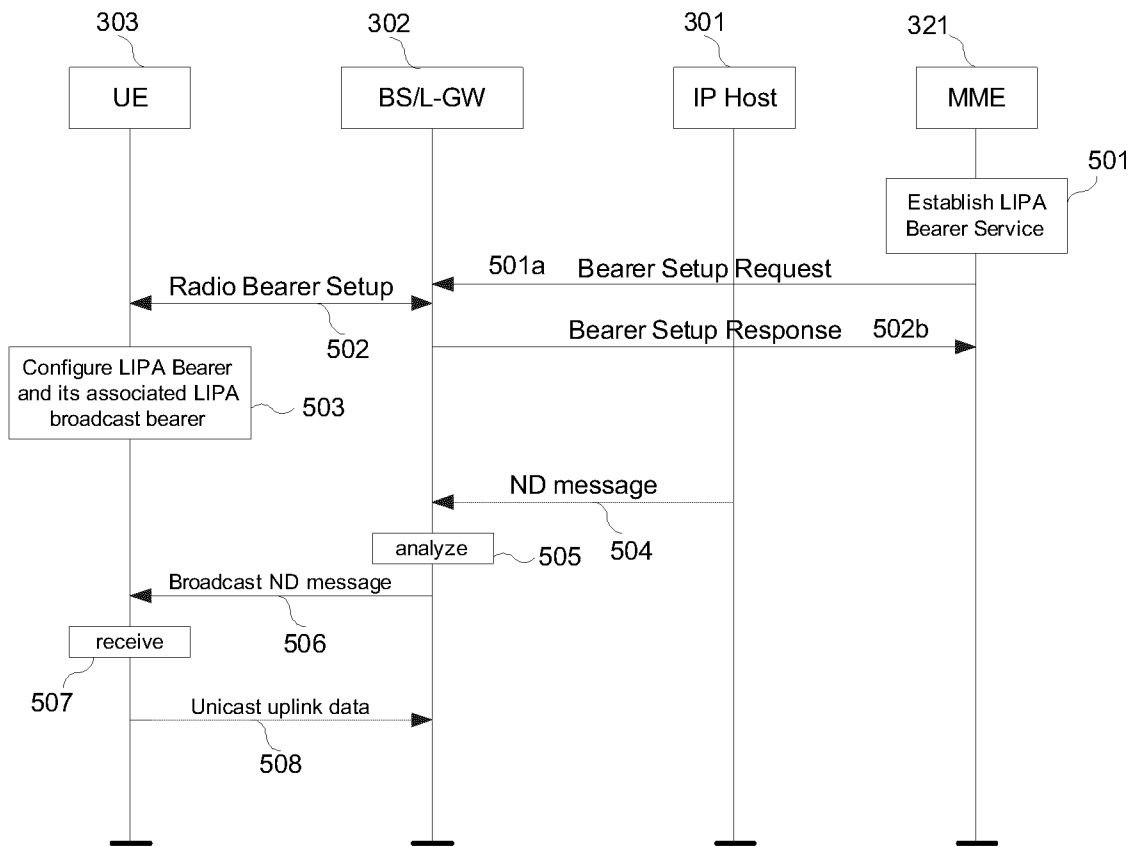
Fig. 5
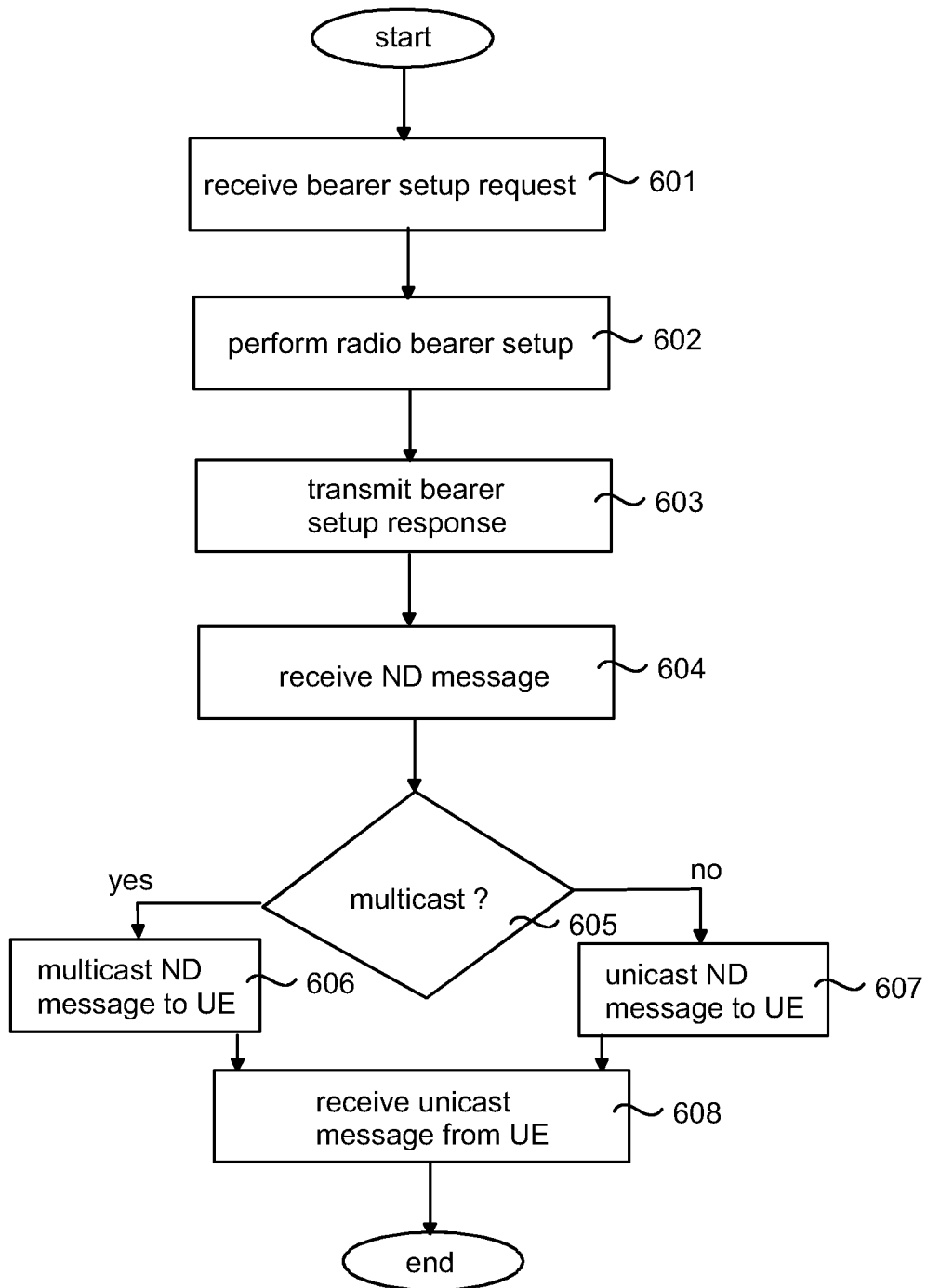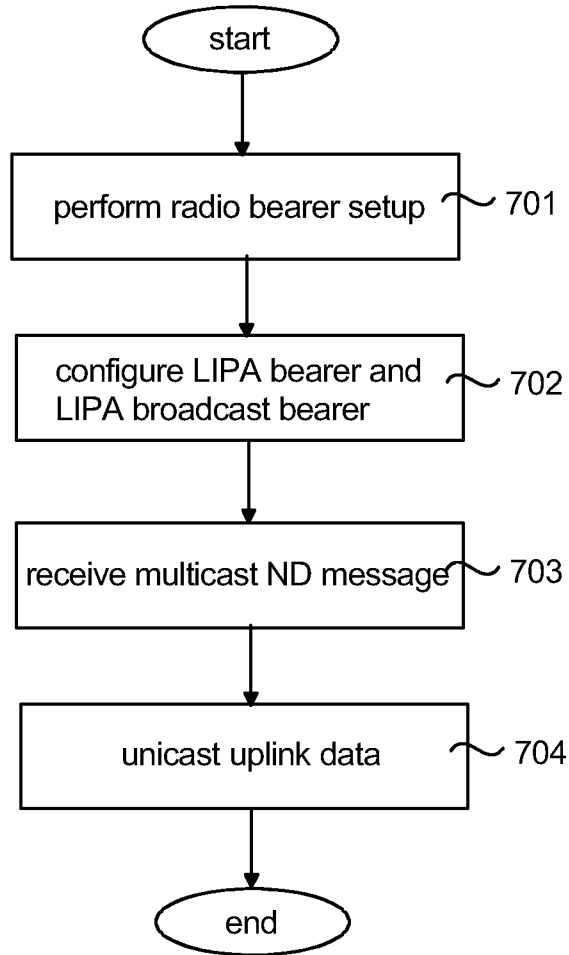
5/6

Fig. 6

```
                          ┌─────────────┐
                          │    start    │
                          └─────────────┘
                                 │
                                 ▼
                    ┌──────────────────────────┐
                    │ perform radio bearer setup│ ⌁ 701
                    └──────────────────────────┘
                                 │
                                 ▼
                    ┌──────────────────────────┐
                    │ configure LIPA bearer and │ ⌁ 702
                    │ LIPA broadcast bearer     │
                    └──────────────────────────┘
                                 │
                                 ▼
                    ┌──────────────────────────┐
                    │ receive multicast ND message│ ⌁ 703
                    └──────────────────────────┘
                                 │
                                 ▼
                    ┌──────────────────────────┐
                    │     unicast uplink data    │ ⌁ 704
                    └──────────────────────────┘
                                 │
                                 ▼
                          ┌─────────────┐
                          │     end     │
                          └─────────────┘
```

Fig. 7

INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

INV. H04L12/18
ADD.

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

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2011/235563 A1 (TINNAKORNSRISUPHAP PEERAPOL [US] ET AL) 29 September 2011 (2011-09-29) abstract paragraph [0009] - paragraph [0011] -----	1-26
A	MOTOROLA: "Enabling UPnP/DLNA multicast traffic with LIPA Solution 1", 3GPP DRAFT; S2-102569 LIPA DLNA PROXY V2, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. SA WG2, no. Kyoto; 20100510, 4 May 2010 (2010-05-04), XP050434700, [retrieved on 2010-05-04] paragraph [0002] - paragraph [0003] ----- -/--	1-26

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

* Special categories of cited documents :

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

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
4 July 2012	11/07/2012

Name and mailing address of the ISA/	Authorized officer
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