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(54) Title: CONFIGURATION OF A COMMUNICATION DEVICE

FIG 1
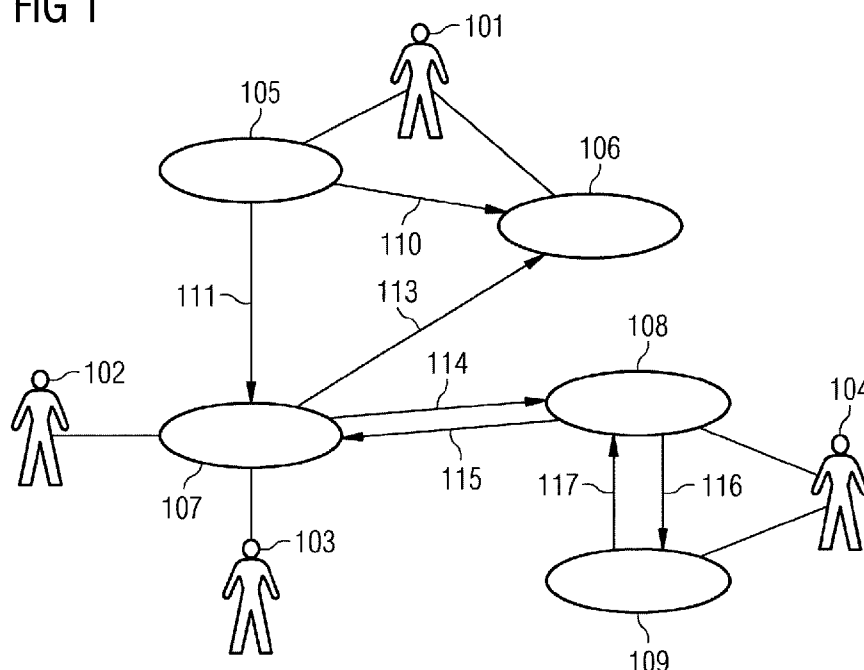
(57) Abstract: The present invention relates to methods and apparatus for enabling a communication device to be automatically and autonomously configured by a Network Operator (104) for deployment in a Network Operator's network. The communication device connects with a web server (106) to retrieve initial installation information. The communication device uses the installation information to identify and connect with a Network Operator (104) such that the Network Operator (104) can configure automatically and autonomously configure the communication device.

Configuration of a Communication Device

5   The present invention relates to the configuration of a
communication device and, in particular, to the automatic and
autonomous configuration of a Home Base Station.

Home Base Stations (HBS), which are also known as Femto Cells
10   or Residential Cells amongst other names, are communication
devices that are typically designed for use in residential or
business premises. The HBS is deployed in a user's home or
office in order to extend service coverage for mobile
communication, including voice and data communication, and is
15   therefore useful in areas where service coverage for mobile
communication is limited or unavailable. The HBS provides a
connection to a service provider's network typically via a
broadband connection so that when a user, for example, makes
a voice call from a mobile device such as a mobile phone, the
20   call is routed to the user's Network Operator and service
provider via the HBS over the broadband connection.

It is expected that in the future hundreds if not thousands
of the HBSs will be deployed in residential and business
25   premises thereby significantly increasing the size of each
Network Operator's network. The large number of HBSs
expected to be deployed would simply be too great for a
Network Operator to be able to support planned deployment of
the HBSs and provide resources, for example, man-power to
30   install each HBS.

Another problem with the expected volume of HBSs being
deployed in a network is that those HBSs will be deployed by
the user in locations that are not known in advance.

Therefore, each HBS deployment will be un-coordinated where automatic configuration and integration of the HBS to an Operator's network will become a requirement. This process of automated network deployment is known as Self Organising

5   Networks (SON).

However, the process of deploying and integrating each HBS into a Network Operator's network in an unplanned and uncoordinated manner has several problems which are discussed

10   below.

The HBS will typically be sold by retailers to the user. It is problematic for the user if each HBS manufactured is bound to a specific Network Operator as the user will not have the

15   freedom to choose a HBS that comprises the features which best suit the user's requirements. Therefore, it is preferable that each HBS manufactured is independent of and not bound to any particular Network Operator. However, if a HBS is not bound to any Network Operator then there is the

20   additional problem of how to configure each HBS to work in any one of a number of Network Operators' networks.

Furthermore, if each HBS is independent of any particular Network Operator then a further problem is how to install the

25   configuration information in the HBS in a secure and cost efficient manner without the need for any special technical tools, equipment or knowledge by the user or retailer.

Several different processes are known for installing

30   configuration information of a particular Network Operator into the HBS.

For example, once the user has purchased the HBS and provided their personal information and the Network Operator

subscription information to the retailer, the retailer
receives the configuration information for the HBS from the
Network Operator. The retailer, using a computer, may write
the configuration information onto a memory card, or SIM

5   card, which is then given to the user to insert into the HBS.
This method of entering the installation information into the
HBS is secure as the user has no direct control over entering
the actual configuration information into the HBS as the HBS
reads the configuration information directly from the memory

10   card or SIM card.

However, this method has the disadvantage is that each HBS
must be fitted with a memory card reader, or a SIM card
reader, which will increase the cost of manufacturing the HBS

15   thereby increasing the cost to the user of the HBS.
Furthermore, the cost in producing the memory cards, or the
SIM cards, will also increase the cost to the user of
purchasing the HBS.

20   Other known methods for entering the installation information
into the HBS include:

• the retailer, using a computer terminal, prints out a
    paper copy of the received configuration information
    which the retailer provides to the user;

25   • the retailer, using a computer terminal, sends an SMS,
    MMS or file to the user's mobile device, e.g. a mobile
    phone, containing the configuration information;

• the retailer, using a computer terminal, sends an e-mail
    to the user which contains the configuration

30   information.

In each of the above methods, the user on setting up the HBS
has to directly interact with the HBS to either enter the

installation information into the HBS manually or perform a
data transfer to the HBS from another device, for example,
the user's computer or mobile phone.

5   However, the above described methods for entering the
configuration information into the HBS have several
disadvantages. The methods require the user to directly
interact with the HBS in order to enter the configuration
information into the HBS. Therefore, the user requires the
10   necessary technical skills to connect to and enter the
required installation information correctly.

Moreover, in order to connect with the HBS the user will need
to interface in some manner with the HBS, for example, by
15   Bluetooth™, by infrared, by a LAN from the user's computer
and so on. This requirement would increase the cost of the
HBS as it would need to be manufactured with the additional
interfaces. This also requires the user to have the
necessary software and corresponding interface which the user
20   may not have and may not be willing to purchase.

Additionally, in most of the above methods the user is given
control of entering the configuration information into the
HBS. By giving the user this control over entering the
25   configuration information then there is an opportunity, or
the possibility, for fraud and/or abuse by some users who may
alter the configuration information provided by the Network
Operator.

30   As such, there exist several significant problems and
disadvantages with the known methods of entering the
configuration information into a HBS that is deployed at a
user's premises by the user.

5

According to a first aspect of the present invention there is
provided a method of operating a web server for configuring a
communication device in a network comprising the steps of
receiving at least one hardware parameter of the

5   communication device; storing the at least one hardware
parameter in a database; receiving installation information
for the communication device wherein the installation
information is used in configuring the communication device;
storing the installation information in the database;

10   receiving a request from the communication device for the
installation information; and transmitting the installation
information to the communication device.

Therefore, in the preferred embodiments the web sever stores

15   a parameter related to the communication device hardware
along with installation information that has been generated
for the communication by the Network Operator to which the
communication device will be subscribed. The web sever
receives a request from the communication device for the

20   installation information which the web server transmits to
the communication device. Thus, the communication device can
be configured without any direct interaction with the actual
communication device from the user or any other human agent.

25   Preferably, the web server receives the at least one hardware
parameter from either a manufacturer of the communication
device or a retailer of the communication device.

Preferably, the web server receives the installation

30   information from a retailer's terminal wherein the
installation information is generated by a Network Operator
server.

Preferably, the method further comprises the steps of receiving user information from a retailer's terminal, wherein the user information relates to a user who has purchased the communication device; and storing the user

5   information in the database.

Preferably, the method further comprises the step of linking the received at least one hardware parameter with the received installation information in the database.

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Preferably, the step of receiving the request from the communication device includes receiving a security token from the communication device; and authenticating the request from the communication device using the received security token.

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Preferably, the step of transmitting the installation information to the communication device further comprises the steps of retrieving the installation information from the database that is linked to the at least one hardware

20   parameter of the communication device; and transmitting the retrieved installation information to the communication device.

Accordingly, as the web server may be used in the process of

25   configuring hundreds or even thousands of communication devices where each communication device may be subscribed to any one of several available Network Operators then preferably the installation information is linked with the hardware parameters of the communication device, such as a

30   unique serial number, so that the specific installation information for a particular communication device can be retrieved. Alternatively, or additionally, the installation information may be linked to the user information, such as

the user's mobile phone number, which is also unique to the
user.

According to a second aspect of the present invention there
5   is provided a web server comprising an input for receiving at
least one hardware parameter of the communication device; a
storage space for storing the at least one hardware parameter
wherein the storage space is a database; an input for
receiving installation information for the communication
10   device; the storage space for storing the installation
information; an input for receiving a request from the
communication device for the installation information; and an
output for transmitting the installation information to the
communication device.

15

According to a third aspect of the present invention there is
provided web server comprising means for receiving at least
one hardware parameter of the communication device; means for
storing the at least one hardware parameter in a database;
20   means for receiving installation information for the
communication device; means for storing the installation
information in the database; means for receiving a request
from the communication device for the installation
information; and means for transmitting the installation
25   information to the communication device.

According to a fourth aspect of the present invention there
is provided a computer program product comprising software
code that when executed on a web server performs the method
30   of receiving at least one hardware parameter of the
communication device; storing the at least one hardware
parameter in a database; receiving installation information
for the communication device; storing the installation
information in the database; receiving a request from the

communication device for the installation information; and
transmitting the installation information to the
communication device.

5   Preferably, the computer program product is stored on a
computer-readable medium.

According to a fifth aspect of the present invention there is
provided a method of operating a communication device for
10   configuring the communication device in a network, comprising
the steps of pre-configuring the communication device with an
address of a web server; retrieving the pre-configured
address and connecting to the web server at the address;
receiving installation information from the web server; and
15   processing the received installation information.

Accordingly, the preferred embodiments of the present
invention have an advantage over the conventional systems in
that the communication device can automatically and
20   autonomously obtain and retrieve installation information
that is used in the process of configuring the communication
device into an operational state in a Network Operator's
network. Thus, the communication device can configure itself
without any direct interaction to the communication device
25   from the user or any other human agent, such as the retailer.

Preferably, the method further comprises the steps of pre-
configuring the communication device with a security token;
and transmitting the security token to the web server so that
30   the web server can authenticate the communication device as
part of the step of connecting to the web server.

Preferably, the method further comprises the steps of pre-
configuring the communication device with at least one

hardware parameter wherein the at least one hardware parameter is unique to the communication device; and transmitting the at least one hardware parameter that is unique to the communication device to the web server as part

5   of the step of connecting to the web server.

Preferably, the step of pre-configuring occurs during the manufacturing process and includes storing the pre-configured information in non-volatile memory in the communication

10   device.

Preferably, the address of the web server is defined as either a Uniform Resource Locator (URL) or an IP address.

15   Preferably, the received installation information comprises an address of a Network Operator server and the step of processing the received installation information further comprises the steps of storing the installation information in non-volatile memory in the communication device;

20   retrieving the address of a Network Operator server from the non-volatile memory; connecting to the Network Operator server; receiving configuration information from the Network Operator server; and processing the received configuration information.

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Preferably, the method further comprises the step of configuring the communication device in accordance with the received configuration information such that the communication device is operational within the Network

30   Operator's network.

Preferably, the address of the Network Operator server is defined as either a Uniform Resource Locator (URL) or an IP address.

10

Preferably, the step of connecting to the Network Operator server includes transmitting the hardware parameters of the communication device to the Network Operator server.

5

Preferably, the method further comprises the step of connecting the communication device to a network and to a power source.

10   Accordingly, in the preferred embodiments the communication device, once connected to a power source and to a network connection such as a broadband connection, automatically connects with a web server. The address of the web server is pre-configured into the communication device preferably

15   during the manufacturing process. In the preferred embodiments the communication device receives installation information from the web server which at least defines an address of the Network Operator's server. Typically, there are multiple Network Operators to which the user may

20   subscribe. An advantage of the preferred embodiments is that the communication device is not bound to any particular Network Operator at the point of sale to the user. Therefore, the communication device needs to be configured for use with the particular Network Operator to which the

25   user has purchased a subscription.

Once the communication device receives the installation information it processes the received information to retrieve the address of the Network Operator's server and connects to

30   the Network Operator's server either directly or via other communication units such as a gateway. The communication device then receives the configuration information from the Network Operator which the communication device processes in order to configure the communication device into an

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operational state and is deployed in the Network Operator's network.

Accordingly, the preferred embodiments of the present
5   invention enable a communication device, e.g. a Home Base Station, automatically and autonomously without any direct interaction with the communication device from the user or any other human agent such as the retailer.

10 According to a sixth aspect of the present invention there is provided a communication device comprising a storage space that is pre-configured with an address of a web server; the communication device is configured to retrieve the pre-configured address and is further configured to connect to
15 the web server at the address; an input for receiving installation information from the web server; and a processor for processing the received installation information.

According to a seventh aspect of the present invention there
20 is provided a communication device that comprises means for pre-configuring the communication device with an address of a web server; means for retrieving the preconfigured address and means for connecting to the web server at the address; means for receiving installation information from the web
25 server; and means for processing the received installation information.

Preferably, the communication device is a Home Base Station.

30 Preferably, there is provided a computer program product comprising software code that when executed on a communication device performs the method of pre-configuring the communication device with an address of a web server; retrieving the preconfigured address and connecting to the

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web server at the address; receiving installation information
from the web server; and processing the received installation
information.

5   Preferably, the computer program product is stored on a
computer-readable medium.

According to an eighth aspect of the present invention there
is provided a method of operating a terminal for configuring
10   a communication device in a network, comprising the steps of
receiving at least one hardware parameter of the
communication device; receiving user information of a user of
the communication device; transmitting the at least one
hardware parameter and the user information to a Network
15   Operator server; receiving installation information from the
Network Operator server wherein the installation information
is used in configuring the communication device; and
transmitting the installation information to a web server.

20   Therefore, in the preferred embodiments of the present
invention, a terminal, preferably the retailer's terminal,
receives hardware parameters along with user information and
transmits this information to the Network Operator to which
the user will subscribe the communication device for
25   services.

The Network Operator's server receives the information and
the installation information for the communication device is
generated by the Network Operator. As mentioned above, in
30   the preferred embodiments the installation information
includes an address of the Network Operator's server and
preferably also a security token so that the communication
device can be authenticated by the Network Operator's server

at the time that the communication device automatically
connects with the Network Operator's server.

The terminal then transmits the received installation
5   information to a web server which stores the installation
information in a database until the communication device
connects with the web server to retrieve the installation
information.

10   Preferably, the retailer's terminal is located at the
retailer's premises and the retailer obtains the hardware
parameter information and the user information at the point
of sale of the communication device to the user.

15   However, the terminal could also be, for example, a computer
that the user connects with over the Internet if the user is
purchasing the communication device online. In this case,
the user inputs the user information on the user's computer
which is then transmitted to the retailer's computer
20   terminal. The retailer obtains the hardware parameters from
the communication device that has been assigned to be sent to
the user.

Preferably, the user information includes the user's mobile
25   device number which is to be used in conjunction with the
communication device, the Network Operator to which the user
is subscribed, or is purchasing a subscription from, the
user's name and the user's address, or the address at which
the communication device is to be deployed.
30
Preferably, the hardware parameters of the communication
device are received by scanning a barcode attached to the
communication device, or attached to the packaging in which
the communication device is sold.

The hardware parameters preferably include the type of
communication device, a unique serial number of the
communication device and a MAC address.

5

Preferably, the step of transmitting the installation
information to the web server comprises the step of
connecting to the web server via a secure connection over a
network.

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Preferably, the step of transmitting the at least one
hardware parameter and the user information to the Network
Operator server comprises the step of connecting to the
Network Operator server via a secure connection over a

15   network.

Preferably, the at least one hardware parameter and/or the
user information are transmitted to the web server.

20   According to a ninth aspect of the present invention there is
provided a terminal comprising an input for receiving at
least one hardware parameter of the communication device; an
input for receiving user information of a user of the
communication device; an output for transmitting the at least

25   one hardware parameter and the user information to a Network
Operator server; an input for receiving installation
information from the Network Operator server; and an output
for transmitting the installation information to a web
server.

30

According to a tenth aspect of the present invention there is
provided a terminal that comprises means for receiving at
least one hardware parameter of the communication device;
means for receiving user information of a user of the

communication device; means for transmitting the at least one hardware parameter and the user information to a Network Operator server; means for receiving installation information from the Network Operator server; and means for transmitting

5   the installation information to a web server.

According to an eleventh aspect of the present invention there is provided a computer program product comprising software code that when executed on a terminal performs a

10   method of receiving at least one hardware parameter of the communication device; receiving user information of a user of the communication device; transmitting the at least one hardware parameter and the user information to a Network Operator server; receiving installation information from the

15   Network Operator server wherein the installation information is used in configuring the communication device; and transmitting the installation information to a web server.

Preferably, the computer program product is stored on a

20   computer-readable medium.

According to a twelfth aspect of the present invention there is provided a method for configuring a communication device in a network comprising the steps of pre-configuring the

25   communication device with an address of a web server; receiving at the web server at least one hardware parameter of the communication device; storing in a database on the web server the at least one hardware parameter; receiving at a terminal the at least one hardware parameter of the

30   communication device; receiving at the terminal user information of a user of the communication device; transmitting from the terminal the at least one hardware parameter and the user information to a Network Operator server; receiving at the terminal installation information

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from the Network Operator server wherein the installation
information is used in configuring the communication device;
transmitting from the terminal the installation information
to the web server; receiving at the web server the

5   installation information from the terminal; storing in the
database on the web server installation information for the
communication device; retrieving the pre-configured address
of the web server and connecting the communication device to
the web server; receiving at the web server a request from

10   the communication device for the installation information;
transmitting from the web server the installation information
to the communication device; receiving at the communication
device the installation information from the web server; and
processing in the communication device the received

15   installation information.

Accordingly, the preferred embodiments of the present
invention enable the communication device to be configured
for deployment in a particular Network Operator's network

20   without any direct intervention by the user, or any other
human agent such as the retailer. Therefore, as the
configuration of the communication device is performed
automatically and autonomously there is no requirement for
the user to have any special technical knowledge or special

25   equipment. As no special equipment, for example, a SIM card
and a SIM card reader is required then the communication
device can be manufactured and sold more economically.

Furthermore, as the user does not directly interact with the

30   communication device in terms of configuring the
communication device for deployment in a network then the
present invention also advantageously prevents any fraudulent
activity or misuse by the user to access a network that the
user is not allowed or subscribed to. Also, as the user does

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not directly interact with the communication device then the
configuration information will not be entered incorrectly
thereby preventing any damage or costly repair due to a human
error with the configuration process.

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Additionally, as each communication device is advantageously
independent of any one particular Network Operator at the
point of sale the user can select a communication device
based on price and the features offered rather than being

10   limited to only those communication devices that are linked
to or bound with a particular Network Operator.

According to the preferred embodiments of the present
invention the installation information is received from a

15   Network Operator's server. There are typically several
available Network Operators each offering various
subscription packages to the user. The Network Operators
will each have their own servers to manage subscriptions and
to generate the installation and/or configuration information

20   for the communication device so that the communication device
can be deployed in the particular chosen Network Operator's
network.

Each Network Operator will typically have several servers

25   that cooperate and communicate to perform the required tasks
of the Network Operator. However, the Network Operator may
only have one or two servers to perform the required tasks.
The combination of the Network Operator servers is typically
known collectively as the Network Operator's Network

30   Management System.

Preferably, one of the Network Operator's servers is a
Network Operator Subscription Management System which
receives the hardware parameters of the communication device

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and the user information from the retailer's terminal. The
Network Operator Subscription Management System preferably
performs any required validation and authentication of the
retailer's terminal and/or the communication device at the
5   time they attempt to connect with the Network Operator's
Subscription Management System. Preferably, the Network
Operator Subscription Management System forwards the hardware
parameters and user information to another of the Network
Operator's servers being a Radio Network (RNW) Configuration
10   Server.

Preferably, the RNW configuration server generates
installation information, being the information required by
the communication device in order to connect with the Network
15   Operator's Management System, and at a later time the
configuration information, being the information required by
the communication device to configure it into an operational
state in the Network Operator's network.

20   The installation information preferably only contains the
minimum information required to enable the communication
device to connect to the correct Mobile Network Operator.
This has the advantage that the Network Operator retains
control of the final configuration of the communication
25   device into an operational state for deployment in the
Network Operator's network. This is advantageous as most of
the radio parameters are dynamic and can be created only when
a communication device is connected to Operator's Network
Management System. Moreover, as the communication device
30   will use a licenced radio band then it is not allowed to
power-on its radio transmitter without operator control.
However, the RNW configuration server may generate some
static "pre-configuration" information at the same time as
generating the installation information.

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The installation information is preferably transmitted to the retailer's terminal via a secure web portal which in turn transmits it to the web server also via a secure web portal

5   to be stored in the web server's database ready to be downloaded to the communication device at the time the communication device connects with the web server.

Preferably the communication device is a Home Base Station

10 (HBS) and the preferred embodiments of the present invention provide an improved HBS installation process where the Network Operator provided installation information and configuration information is entered into the HBS after its physical installation at the premises where the HBS is to be

15 deployed and without any information being entered directly to the HBS by the user or a retailer.

Preferred embodiments of the present invention will now be described, by way of example only, and with reference to the

20 accompanying drawings, in which;

Figure 1 shows a use case diagram of the preferred embodiments of the present invention.

25 Figure 2 shows the signalling flow when the communication device is configured to operate in the network according to the preferred embodiments of the present invention.

Figure 3 shows a schematic drawing of the system in

30 accordance with the preferred embodiments of the present invention.

The communication device, preferably a Home Base Station (HBS) 301 which may also be referred to as a Femto Cell or a

Residential Cell, provides an extension to the service
coverage of a Network Operator so that a user can use their
mobile device, e.g. a mobile phone, to make, for example, a
voice call where traditionally no network service coverage or

5   very limited coverage was available.

If a user 102 requires a HBS 301 to extend the network
service coverage for their mobile terminal then the user 102
will have a subscription with a Network Operator 104 for

10   their mobile device, e.g. a mobile phone. Alternatively, at
the time of purchasing the HBS 301 the user 102 may also
purchase a subscription to a Network Operator 104 or may even
purchase a subscription to a Network Operator 104 at a later
date. However, when the user 102 physically installs the HBS

15   301 at their premises they will require a subscription to a
Network Operator 104 in order to complete the installation
and configuration process of the HBS 301 and provide service
coverage from the Network Operator 104 to which they are
subscribed.

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Figure 1 shows a use case diagram of the overall process and
the interactions between the various agents in the preferred
embodiments of the present invention.

25   Typically there are various Network Operators that offer
different subscriptions to their services for mobile
communication to the user 102. The user 102 will choose, or
have chosen, a subscription from a particular Network
Operator 104 that best suits the user's requirements and

30   expectations. An advantage of the present invention is that
each communication device, e.g. the HBS 301, is independent
of the individual Network Operators and so the user may also
choose the communication device that best suits the user's

requirements without needing to take into account which HBS
301 will work with certain Network Operators.

As each HBS 301 is independent of the individual Network
5   Operators then the HBS 301 will need to be informed of which
Network Operator 104 they are to connect to in order to
configure the HBS 301 for deployment in a particular Network
Operator's network. This is because each Network Operator
will have their own network management systems, network
10   planning systems, subscription management systems and RNW
configuration systems.

During the manufacturing and shipping process a minimal set
of identifiers and parameters are stored in a non-volatile
15   memory in the HBS 301. The identifiers and parameters
preferably include an address, preferably in the form of a
URL or an IP address, of a web server 303, the type of HBS
301 manufactured, a serial number, preferably unique to the
HBS 301, and a security token which will be used to
20   authenticate the HBS 301.

A web server 303 is connected to a network 307, such as the
Internet, and includes a database for storing several pieces
of information. The web server 106, 303 receives hardware
25   parameters of each manufactured HBS 301 and stores those
hardware parameters in the database. The web server 106, 303
receives 110 the hardware parameters from the manufacturer
101 via a terminal 304 during the manufacturing and shipping
process 105 of the HBS 301 or the web server 106, 303
30   receives 113 the hardware parameters from the retailer 103
via a terminal 302 during the process of a user purchasing
107 the HBS 301.

If the web server 106, 303 receives 110 the hardware
parameters during the manufacturing and shipping process 105
then the hardware parameters may be entered manually into the
database on the web server 106, 303 via a secure web portal
5   or, more preferably, the hardware parameters are entered
automatically into the database on the web server 106, 303
via an automatic update from a terminal 304 at the
manufacturer's premises over a network 307, such as the
Internet.
10

As a person skilled in the art will appreciate, several
methods could be used to automatically transmit and store in
a database located on a web server 106, 303 the hardware
information of each HBS 301 during the manufacturing and
15   shipping process 105 of each HBS 301.

If the web server 106, 303 receives 113 the hardware
parameters from the retailer 103 via a terminal 302 during
the purchasing process 107 then the hardware parameters are
20   obtained from the HBS 301 by the retailer 103, for example,
by scanning and reading a barcode attached to the HBS
packaging, and transmitting the hardware parameters to the
web server 106, 303 via, for example, a secure web portal.

25   The database located on the web server 106, 303 may store the
information deposited in the database permanently although it
is expected that the information will only be stored
temporarily until the HBS 301 has been fully configured and
is deployed in the network of the Network Operator 104 to
30   which the user 102 is subscribed.

The HBS 301 can connect to the web server 303 using the
address stored in the non-volatile memory of each HBS 301
during the manufacturing and shipping process 105. This

facilitates the automatic and autonomous retrieval of
installation information for the HBS 301 from the web server
303. This enables the preferred embodiments to have the
significant advantage that the installation information of
5   the Network Operator 104 can be applied to the "empty shell"
of the HBS 301 automatically without any person directly
interacting with the HBS 301.

In the preferred embodiments of the present invention it is
10   also advantageous to store in the non-volatile memory of the
HBS 301 a security token which can be used to authenticate
and validate the HBS 301 when it attempts to connect to the
web server 303 once it has been physically installed and
powered up.
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The user 102 purchases 107 the HBS 301 of their choice from a
retailer 103. The retailer 103 has a terminal 302 that is in
communication with the web server 303 via a network 307, such
as the Internet. In the preferred embodiments the interface
20   between the retailer's terminal 302 and the web server 303 is
via a secure web portal. The retailer's terminal 302 may be
located in the retailer's premises that the user 102 visits
to view and purchase an HBS 301 or the retailer's terminal
302 may be located on the Internet allowing a user 102 to
25   purchase the HBS 301 over the Internet, i.e. buy the HBS 301
online.

At the point of sale 107 to the user 102 of the HBS 301, the
user 102 provides various pieces of user information. The
30   information provided by the user 102 for the installation and
configuration process of the HBS 301 preferably includes the
address of the premises at which the HBS 301 will be located
once in operation, the identity of the Network Operator 104
to which the user 102 is, or will be, subscribed and a

subscription identity such as the user's mobile phone number.
The subscription to a Network Operator 104 may be the user's
existing subscription or the user may purchase a new
subscription at the time of purchasing the HBS 301.

5

The address of the premises at which the HBS 301 will be
located will be used to enable the Network Operator 104 to
configure and activate the HBS 301 in their network. The
location of the HBS 301 is important for the final

10   configuration process controlled by the Network Operator 104
as it enables the Network Operator 104 to determine the
nearest by HBS Gateway (connection point to the Network
Operator 104) and the neighbouring radio environment e.g. the
neighbouring macro cells and their radio parameters (assuming

15   the Network Operator 104 provides wireless services in the
area). The radio parameters in the HBS 301 must be adjusted
so that it does not cause interference to neighbouring macro
cells.

20   The retailer's terminal 302 connects via a network 307, such
as the Internet, to the Network Operator's Network Management
System 108, 305 via a secure interface such as a secure web
portal. The retailer 103 transmits 114, via the retailer's
terminal 302, the user information and the hardware

25   parameters of the HBS 301 to the Network Operator's Network
Management System 108, 305.

The Network Management System 108, 305 of the Network
Operator 104 to which the user 102 will be subscribed checks

30   and authenticates the user's subscription based on the
received user information and the received hardware
parameters of the HBS 301. The Network Management System
108, 305 verifies that the user 102 has a subscription with
the Network Operator 104 based on the received user name and

user mobile phone number. If the user 102 has an existing
subscription then the HBS service will be added as a new
service to the user's 102 existing subscription. However, if
the user 102 does not have an existing subscription the user
5   is added as a new subscriber to the Network Operator 104 and
the HBS service is added to the new subscription.

Once the user's subscription has been verified by the Network
Operator's Network Management System 108, 305 the hardware
10   parameters of the HBS and the relevant pieces of user
information such as the user's address and subscription
identity, e.g. the user's mobile phone number, are
transmitted 116 to the RNW Configuration System 109, 306. As
mentioned above, the location where the HBS 301 is to be
15   deployed is particularly important as it determines the
region where the HBS 301 will be installed, the nearest HBS
Gateway and the local radio environment.

The RNW Configuration System 109, 306 generates installation
20   information for the HBS 301 purchased by the user 102. In
the preferred embodiments the installation information
generated by the RNW Configuration System 109, 306 includes
the minimum information required to enable the HBS 301 to
connect with the Network Operator's Operation & Maintenance
25   Server or Auto Configuration Server which provides entry to
the Operator's overall Network Management System 108, 305,
either directly or via a local HBS Gateway, in order to
retrieve the complete configuration information that is used
configure the HBS 301 into an operational state in the
30   Network Operator's network. The installation information
therefore includes an address, preferably in the form of a
URL or an IP address, of the point of entry for the HBS 301
to enter the Network Management System 108, 305 and also

preferably includes a security token which will allow the HBS
301 to be authenticated.

5   The installation information is transmitted 117 from the RNW
       Configuration system 109, 306 to the Network Operator's
       Network Management System 108, 305. The Network Management
       System 108, 305 forwards 115 the installation information to
       the retailer's terminal 302 via a secure web portal that
       interfaces between the retailer's terminal 302 and the
10   Network Management System 108, 305. The web server 106, 303
       receives113 via a secure web portal the installation
       information from the retailer's terminal 302 and the
       installation information is stored in the web server
       database. The web server 106, 303 may also receive the
15   hardware parameters of the HBS 301 from the retailer's
       terminal 302.

       The web server 106, 303 links the installation information to
       at least the hardware parameters of the HBS 301 so that the
20   correct installation information can be retrieved for a
       particular HBS 301 when it connects to the web server 106,
       303 once the HBS 301 has been physically installed and
       powered up.

25   The retailer 103, via the retailer's terminal 302, may also
       transmit the user information to the web server 106, 303 to
       be stored in the database alongside the hardware parameters
       of the HBS 301 and the generated installation information.

30   The RNW Configuration System 109, 306 may, at the same time
       as generating the installation information, also generate
       static "pre-configuration" information to be stored in its
       database. The static pre-configuration information may
       include, for example, a HBS Identifier, a used radio

frequency, a list of neighbouring cells based on the address
of the location at which the HBS 301 will be deployed, etc.
This pre-configuration information can be considered an
initial record of the HBS 301 that will connect at a later

5   time to the Network Operator's Network Management System 108,
305 once the user has physically installed and powered up the
HBS 301 for the first time. However, due to the fact that
the complete configuration information includes dynamic
parameters then the RNW Configuration system 109, 306 will

10   not generate the complete configuration information until the
HBS 301 connects with the Network Management System 108, 305
to obtain this configuration information and perform the
configuration process.

15   In the preferred embodiments the automatic and autonomous
configuration of the HBS, once it has been physically
installed, follows the steps shown in Figure 2 which
illustrates the signalling flow of the process.

20   Once the user has purchased the HBS and the necessary
information has been generated then the user can physically
install the HBS at the premises at which the HBS is to be
deployed. The user connects the HBS to a power source and to
a network. Typically, the user will connect the HBS to the

25   network via a broadband connection.

In step 201, a HBS 211 is powered up and performs an internal
boot and self test process in order to initialise the
hardware and verify the HBS 211 is in a working condition.

30   The initialisation uses automatic configuration software that
has been stored in the non-volatile memory in the HBS 211.

In step 202, the HBS 211 establishes IP connectivity to the
network (Internet access) using the broadband connection

using DHCP (Dynamic Host Configuration Protocol) negotiation in order to obtain an IP address, DNS (Domain Name Server) address and other network parameters from a local ISP (Internet Service Provider) DCHP server 212.

In step 203, the HBS 211 detects that its state is "non-commissioned" so the HBS retrieves the address of the web server from its non-volatile memory where it was stored during the manufacturing process and resolves the web server's IP address from the local ISP's DNS server 213.

In step 204, the HBS 211 establishes a secure TCP (Transmission Control Protocol) connection to a web server 218 via, for example, a SSH (Secure Shell) or a IPSec (Internet Protocol Security) connection using the information stored in the non-volatile memory of the HBS 211 during the manufacturing process.

The process of connecting the HBS 211 to the web server 218 preferably includes means for authenticating and validating the HBS 211. During the manufacturing and shipping process of the HBS 211 it is preferable that a security token is stored in the non-volatile memory of the HBS 211. On attempting to connect to the web server 218 the HBS 211 is authenticated by the web server 218 using the security token.

In step 205, the HBS 211 transmits an installation information request message to the web server 218 using, for example, SOAP (Simple Object Access Protocol). The SOAP message contains the hardware parameters of the HBS 211 that were stored in the non-volatile memory of the HBS 211 during the manufacturing and shipping process.

29

In step 206, the web server 218 retrieves 219 from its
database at least the installation information that
corresponds to the received hardware parameters and transmits
206 the installation information to the HBS 211 in an

5   installation information reply message. The HBS 211 stores
the installation information in its non-volatile memory 220.
The web server 218 may also retrieve 219 and transmit 206 the
user information previously stored in the web server database
to the HBS 211 which will then also store the user

10   information in its non-volatile memory 220.

As described above, the installation information preferably
includes the minimal parameters necessary to enable the HBS
to connect with the Network Management System of the Network

15   Operator to which they are subscribed. Accordingly, the
installation information includes an address of the Network
Operator's Network Management System either in the form of a
URL or an IP address and preferably also a security token to
enable the Network Management System to authenticate and

20   validate the HBS that is attempting to connect with it.

Alternatively, the URL or IP address may instead define an
address of the nearest HBS Gateway in the region where the
HBS is physically installed. The HBS Gateway provides the

25   HBS with access to the Network Operator's Network Management
System.

Once the installation information has been downloaded and
stored in the HBS then the HBS is able to connect to the

30   Network Operator's Network Management System, either directly
or via the HBS Gateway, using the address defined in the
installation information. Preferably, the installation
information also contained a security token to enable the HBS
to be authenticated and validated by the Network Operator's

Network Management System at the time that the HBS connects
with the Network Operator's Network Management System.

In Figure 2 the installation information received from the
5   web server 218 includes a URL of the HBS Gateway local to the
HBS 211.

In step 207, the HBS 211 resolves an Operation and
Maintenance Server (OMS) IP address from the local ISP's DNS
10   Server 213 based on the URL received in the installation
information. The OMS is typically an Auto Configuration
Server (ACS) located within the HBS Gateway 214.
Alternatively, as mentioned above if the installation
information defined the IP address of the OMS (rather than a
15   URL of the OMS) then the HBS will not have to resolve the IP
address from the ISP's DSN Server.

In step 208, the HBS 211 establishes a secure connection with
the ACS at the HBS Gateway 214 via, for example, a TCP
20   connection using, for example, SSH, TLS (Transport Layer
Security) or IPSec based on the information retrieved from
the received installation information.

In step 209, the HBS 211 transmits 209 a Registration message
25   to the HBS Gateway which comprises the hardware parameters of
the HBS, relevant portions of the installation information,
the current software version and any further optional user
information. The HBS Gateway transmits 215 the relevant
information to the Network Operator's Network Management
30   System. Alternatively, as mentioned above, the HBS may
instead establish a secure connection directly with the
Network Operator's Network Management System instead of via a
local HBS Gateway. In this case, the HBS may transmit the

Registration message directly to the Network Management
System.

At this stage the HBS may be authenticated by the Network
5   Management System or the HBS Gateway before it is permitted
to continue with the configuration process.

In step 210, the Network Management System (or alternatively
the HBS Gateway) verifies that the HBS can be located in its
10   database 221. The current software version of the HBS is
also checked in order to determine whether a software upgrade
is required. The Network Management System, either directly
or via the HBS Gateway, transmits 217, 210 a Registration
Response message to the HBS which indicates whether the
15   registration is successful and in this case whether a
software upgrade is required. If a software upgrade is
required then this is initiated following standard and well-
known techniques for retrieving a software upgrade from
either the web server, the Network Management System or the
20   manufacturer's server.

However, if the registration is unsuccessful because the HBS
is not located in the database of the Network Management
System then the registration response message indicates that
25   the registration was rejected.

Once the registration is successful and the HBS has a
connection with the Network Management System then the
Network Operator can configure the HBS into an operational
30   state in their network.

The configuration process is a standard process that is well-
known in the art which comprises the steps of initiating Base
Transceiver Station (BTS) commissioning by sending the Start

BTS Commissioning message to the HBS using SOAP protocol.
The HBS starts a Radio Environment measurement procedure
which includes scanning the radio environment in the
frequency band that the HBS can support.

5

Upon completion of the Radio Environment measurement
procedures the HBS 301 creates an Environment Report that is
transmitted to the Network Management System 305. The RNW
Configuration server 306 generates initial RNW configuration
10   parameters based on the received user information, HBS
parameters and the radio environment measurements reports
from the HBS 301.

The RNW configuration information is generated at the time
15   that the HBS 301 connects with the Network Management System
305. The HBS 301 will initially connect with the Network
Operator's Operation & Maintenance Server or Auto
Configuration Server to enter the Operator's Network
Management System 305. As mentioned previously the RNW
20   Configuration server 306 may have already generated "pre-
configuration" static information which is stored only in the
Network Management System 305 and linked with the hardware
parameters of the HBS 301 but may also be linked with user
information such as their subscription reference. The static
25   pre-configuration information may be used by the RNW
Configuration server 306 when generating the RNW
configuration information.

This arrangement has the advantage of increasing the security
30   of the configuration process as the Network Operator 104
maintains control over the final configuration of the HBS 301
into an operational state in the Network Operator's network.

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In order for the relevant parts of the Network Management
System 305 to authenticate the HBS 301 and generate the
configuration information the HBS 301 preferably transmits
its hardware parameters such as the HBS Type and its unique

5   serial number as a key to access and retrieve related
information from the Network Management System 305, such as
the static "pre-configuration" information that may have been
previously generated. The Network Management System 305 and
the RNW Configuration server 306 use the hardware parameters

10   to identify any static pre-configuration information and to
generate the RNW configuration information for the HBS 301.
The Network Management System 305 may also use the user
information for additional security to verify consistency
with the user subscription.

15

The Network Management System 305 transmits the initial RNW
configuration information to the HBS 301 which it stores in
its non-volatile memory and uses the configuration
information to commission the HBS 301 into an operational

20   state. Once the HBS 301 has been commissioned it will be
forced to restart and reboot at which point the HBS 301 will
be operational in the Network Operator's network.

Accordingly, the preferred embodiments of the present

25   invention provide the means and methods for advantageously
enabling an automatic and autonomous configuration of Home
Base Stations. The manufactured Home Base Stations are not
bound to any Network Operator as the preferred embodiments of
the present invention enable any Home base Station to be

30   configured, without any direct human interaction with the
Home Base Station, for deployment in any Network Operator's
network.

The automatic and autonomous configuration of a communication device, such as a HBS, is achieved by storing an address of a web sever in the non-volatile memory of the HBS during its manufacturing process. Once the HBS is physically installed

5   it will connect to the web server and retrieve installation information that was generated and stored in the web server during the purchase process of the HBS from a retailer. The installation information was generated by the Network Operator based on information about the HBS and information

10 provided by the user. The installation information provides the HBS with the information required to connect to the Network Operator in order to receive configuration information and to perform the necessary configuration processes.

15

While preferred embodiments of the invention have been shown and described, it will be understood that such embodiments are described by way of example only. Numerous variations, changes and substitutions will occur to those skilled in the

20 art without departing from the scope of the present invention as defined by the appended claims. Accordingly, it is intended that the following claims cover all such variations or equivalents as fall within the spirit and the scope of the invention.

Claims:

1.   A method of operating a web server for configuring a
communication device in a network comprising the steps of:
5   receiving at least one hardware parameter of the
communication device;
           storing the at least one hardware parameter in a
database;
           receiving installation information for the communication
10   device wherein the installation information is used in
configuring the communication device;
           storing the installation information in the database;
           receiving a request from the communication device for
the installation information; and
15   transmitting the installation information to the
communication device.

2.   The method as claimed in claim 1 in which the web server
receives the at least one hardware parameter from either a
20   manufacturer of the communication device or a retailer of the
communication device.

3.   The method as claimed in any preceding claim in which
the web server receives the installation information from a
25   retailer's terminal wherein the installation information is
generated by a Network Operator server.

4.   The method as claimed in any one of the preceding
claims, in which the method further comprises the steps of:
30   receiving user information from a retailer's terminal,
wherein the user information relates to a user who has
purchased the communication device; and
               storing the user information in the database.

5.   The method as claimed in any one of the preceding claims, in which the method further comprises the step of linking the received at least one hardware parameter with the received installation information in the database.

5

6.   The method as claimed in any one of the preceding claims, in which: the step of receiving the request from the communication device includes receiving a security token from the communication device;   and the method further

10   comprises the step of:
        authenticating the request from the communication device using the received security token.

7.   The method as claimed in claim 5 or 6 in which the step

15   of transmitting the installation information to the communication device further comprises the steps of:
        retrieving the installation information from the database that is linked to the at least one hardware parameter of the communication device;   and

20   transmitting the retrieved installation information to the communication device.

8.   A web server comprising:
        an input for receiving at least one hardware

25   parameter of the communication device;
        a storage space for storing the at least one hardware parameter wherein the storage space is a database;
        an input for receiving installation information for the communication device;

30   the storage space for storing the installation information;
        an input for receiving a request from the communication device for the installation information; and

an output for transmitting the installation information to the communication device.

9.   A computer program product comprising software code that when executed on a web server performs the method of:

receiving at least one hardware parameter of the communication device;

storing the at least one hardware parameter in a database;

receiving installation information for the communication device;

storing the installation information in the database;

receiving a request from the communication device for the installation information; and

transmitting the installation information to the communication device.

10.   The computer program product as claimed in claim 9 in which the computer program product is stored on a computer-readable medium.

11.   A method of operating a communication device for configuring the communication device in a network, comprising the steps of:

pre-configuring the communication device with an address of a web server;

retrieving the pre-configured address and connecting to the web server at the address;

receiving installation information from the web server; and

processing the received installation information.

12.   The method as claimed in claim 11, further comprising the steps of:

pre-configuring the communication device with a security
token; and

transmitting the security token to the web server so
that the web server can authenticate the communication device
5   as part of the step of connecting to the web server.

13. The method as claimed in claim 11 or 12, further
comprising the steps of:

pre-configuring the communication device with at least
10   one hardware parameter wherein the at least one hardware
parameter is unique to the communication device; and

transmitting the at least one hardware parameter
that is unique to the communication device to the web server
as part of the step of connecting to the web server.
15

14. The method as claimed in any one of claims 11 to 13, in
which:

the step of pre-configuring occurs during the
manufacturing process and includes storing the pre-configured
20   information in non-volatile memory in the communication
device.

15. The method as claimed in any one of claims 11 to 14 in
which the address of the web server is defined as either a
25   Uniform Resource Locator (URL) or an IP address.

16. The method as claimed in any one of claims 11 to 15 in
which the installation information comprises an address of a
Network Operator server and the step of processing the
30   received installation information further comprises the steps
of:

storing the installation information in the non-volatile
memory of the communication device;

retrieving the address of a Network Operator server from
the non-volatile memory;

connecting to the Network Operator server;

receiving configuration information from the Network

5 Operator server; and

processing the received configuration information.

17. The method as claimed in claim 16 further comprising the
step of:

10   configuring the communication device in accordance with
the received configuration information such that the
communication device is operational within the Network
Operator's network.

15 18. The method as claimed in claim 16 or 17 in which the
address of the Network Operator server is defined as either a
Uniform Resource Locator (URL) or an IP address.

19. The method as claimed in any one of claims 16 to 18 in

20 which the step of connecting to the Network Operator server
includes transmitting the hardware parameters of the
communication device to the Network Operator server.

20. The method as claimed in any one of claims 11 to 19,

25 further comprising the step of:

connecting the communication device to a network and
to a power source.

21. A communication device comprising:

30   a storage space that is pre-configured with an
address of a web server;

the communication device is configured to retrieve the
pre-configured address and is further configured to connect
to the web server at the address;

an input for receiving installation information from the
web server; and

        a processor for processing the received installation
information.

5

22.   The communication device as claimed in claim 21 in which
the communication device is a Home Base Station.

23.   A method of operating a terminal for configuring a
10   communication device in a network, comprising the steps of:
        receiving at least one hardware parameter of the
communication device;
        receiving user information of a user of the
communication device;
15   transmitting the at least one hardware parameter and the
user information to a Network Operator server;
        receiving installation information from the Network
Operator server wherein the installation information is used
in configuring the communication device; and
20   transmitting the installation information to a web
server.

24.   The method as claimed in claim 23 in which the step of
receiving the at least one hardware parameter of the
25   communication device comprises scanning a barcode attached to
the communication device.

25.   The method as claimed in claim 23 or 24 in which the
step of transmitting the installation information to the web
30   server comprises the step of connecting to the web server via
a secure connection over a network.

26.   The method as claimed in any one of claims 23 to 25 in
which the step of transmitting the at least one hardware

parameter and the user information to the Network Operator
server comprises the step of connecting to the Network
Operator server via a secure connection over a network.

5   27. The method as claimed in any one of claims 23 to 26
further comprising the step of:
        transmitting either or both of the at least one hardware
parameter and the user information to the web server.

10   28. A terminal comprising:
        an input for receiving at least one hardware parameter
of the communication device;
        an input for receiving user information of a user of the
communication device;
15   an output for transmitting the at least one hardware
parameter and the user information to a Network Operator
server;
        an input for receiving installation information from the
Network Operator server; and
20   an output for transmitting the installation information
to a web server.

29. A computer program product comprising software code that
when executed on a terminal performs a method of:
25   receiving at least one hardware parameter of the
communication device;
        receiving user information of a user of the
communication device;
        transmitting the at least one hardware parameter and the
30   user information to a Network Operator server;
        receiving installation information from the Network
Operator server wherein the installation information is used
in configuring the communication device; and

transmitting the installation information to a web server.

30.   The computer program product as claimed in claim 29 in
5   which the computer program product is stored on a computer-readable medium.

31.   A method for configuring a communication device in a network comprising the steps of:
10   pre-configuring the communication device with an address of a web server;
          receiving at the web server at least one hardware parameter of the communication device;
          storing in a database on the web server the at least
15   one hardware parameter;
          receiving at a terminal the at least one hardware parameter of the communication device;
          receiving at the terminal user information of a user of the communication device;
20   transmitting from the terminal the at least one hardware parameter and the user information to a Network Operator server;
          receiving at the terminal installation information from the Network Operator server wherein the installation
25   information is used in configuring the communication device;
          transmitting from the terminal the installation information to the web server;
          receiving at the web server the installation information from the terminal;
30   storing in the database on the web server installation information for the communication device;
          retrieving the pre-configured address of the web server and connecting the communication device to the web server;

receiving at the web server a request from the communication device for the installation information;

transmitting from the web server the installation information to the communication device;

5   receiving at the communication device the installation information from the web server; and

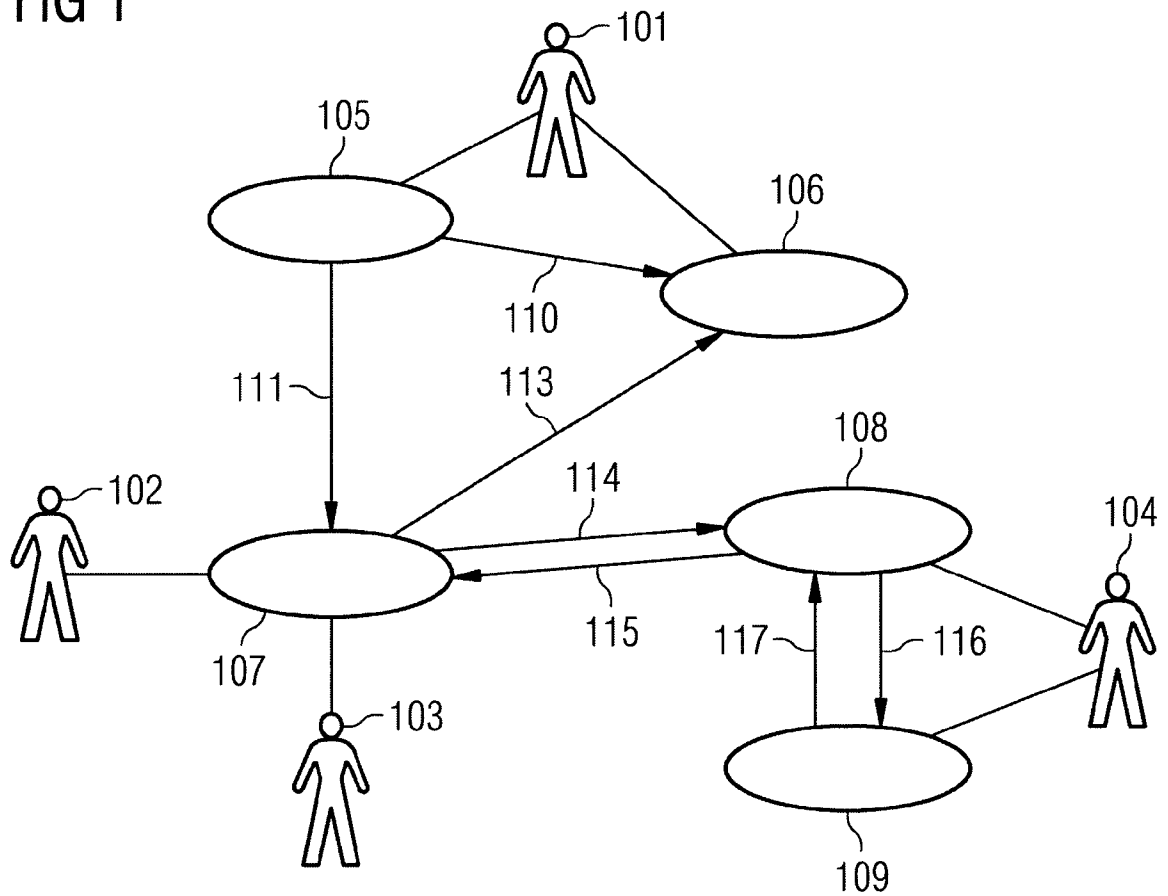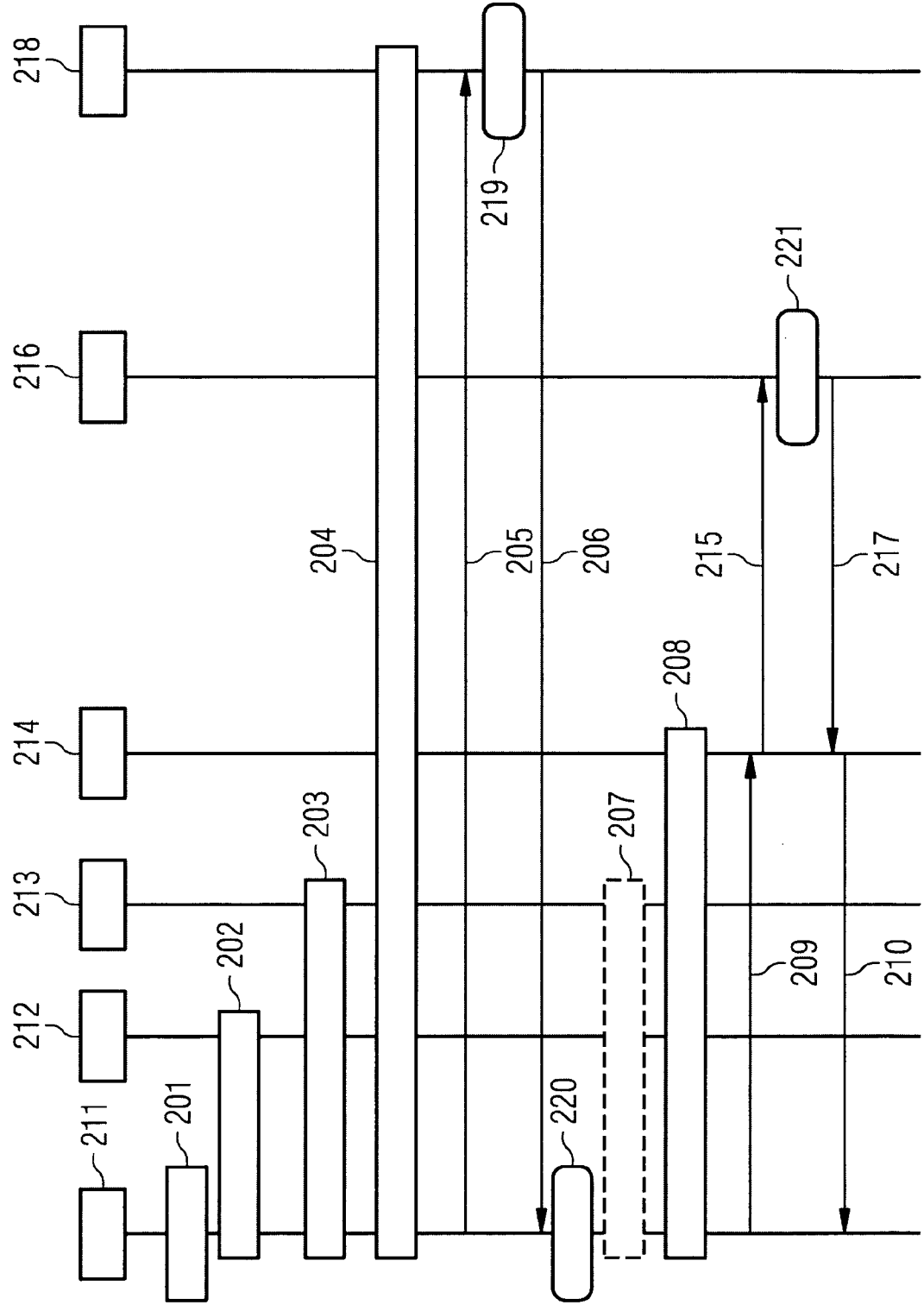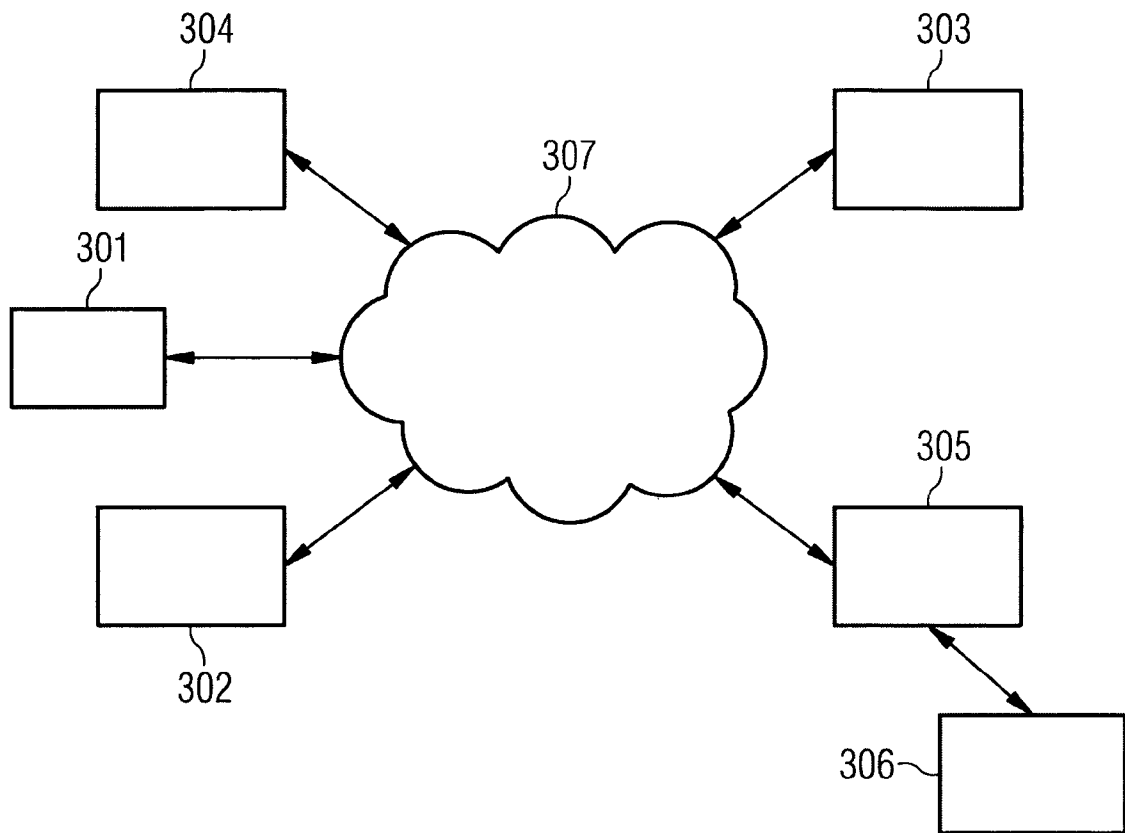processing in the communication device the received installation information.

FIG 1

2/3

FIG 2

FIG 3

INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04L29/08   H04L12/24

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 practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2007/268516 A1 (BUGWADIA JAMSHEED [US] ET AL) 22 November 2007 (2007-11-22) paragraphs [0011], [0024], [0025], [0028], [0030], [0050], [0052], [0057], [0078], [0100] -----	1-31

☐ Further documents are listed in the continuation of Box C.   ☒ 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 document 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
30 September 2009	14/10/2009

| Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016 | Authorized officer Manea, Anda |

Form PCT/ISA/210 (second sheet) (April 2005)

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US 2007268516 A1	22-11-2007	CA	2654379 A1	29-11-2007
		EP	2033082 A2	11-03-2009
		WO	2007136863 A2	29-11-2007