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(54) Title: APPARATUS, METHOD AND COMPUTER PROGRAM PRODUCT FOR ADJUSTING HANDOVER PARAMETERS

(57) Abstract: It is presented a method for adjusting handover parameters of a processed base station in relation to neighbouring base stations, neighbouring the processed base station. The method being executed in a handover parameter determiner and comprises: obtaining (20) a list of neighbouring base stations of the mobile communication network; determining (22), for each of the neighbouring base stations in the list, a capability to send handover issue report messages; and adjusting (24) the handover parameters based on the determined capabilities for each of the neighbouring base stations in the list.

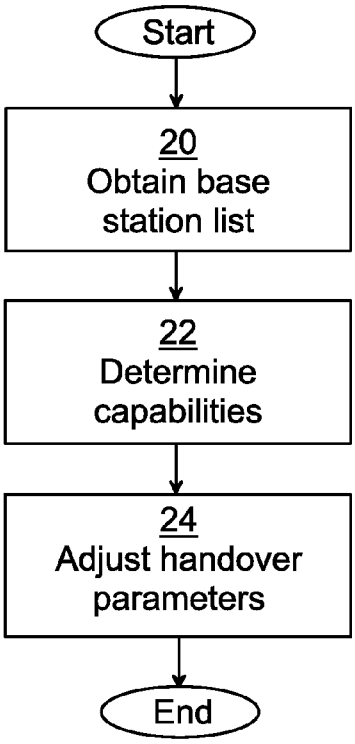


Fig. 4A

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APPARATUS, METHOD AND COMPUTER PROGRAM PRODUCT FOR ADJUSTING HANDOVER PARAMETERS

TECHNICAL FIELD

The invention relates to a handover determiner and more particularly to a handover determiner for adjusting handover parameter of a base station.

BACKGROUND

When a mobile communication terminal moves geographically between cells of different base stations, the connection with the mobile communication terminal is transferred between the base stations. This is known as handover and has been implemented in most mobile communication networks.

Whether to perform a handover often depends on signal levels of two base stations as measured by the mobile communication terminal. However, handover problems do sometimes occur when handing over from a source base station to a target base station, e.g. by the mobile communication terminal losing the radio link to the target base station or establishing a connection with a third base station. Knowledge of such events assists in controlling whether a handover is to be triggered or not.

However, in heterogeneous environments with base stations of different configurations, the various types of base stations handle these events differently which can easily create a chaotic situation where different base stations handle the handover issues differently. This can lead to incorrect conclusions when expected handover issue messages are not received, either due to the issue not

occurring or the base station not having the capability to send such handover issue messages.

SUMMARY

An object of the invention is to improve handover determination, especially in a heterogeneous environment with respect to base station configurations.

A first aspect is a handover parameter determiner for adjusting handover parameters of a processed base station in relation to neighbouring base stations, neighbouring the processed base station. The handover parameter determiner comprises: a list obtainer arranged to obtain, for a particular base station, a list of neighbouring base stations; a capability determiner arranged to determine, for each of the neighbouring base stations in the list, a capability to send handover issue report messages; and a handover parameter adjuster arranged to adjust the handover parameters based on the determined capabilities for each of the neighbouring base stations in the list.

By using the knowledge of the capabilities of the neighbouring base station to send handover issue report messages, the handover parameters can be calculated with better precision. This is due to the reason that an absence of a particular handover issue report message should be interpreted differently if it is due to no issues, compared to if it is due to a lack of ability to send such a message. This supports a heterogeneous environment where there are base stations of different types. The capabilities can be collected separately for each type of handover issue report message.

The handover parameter adjuster may be arranged to consider an absence of handover issue report messages from a neighbouring base station differently depending on whether the neighbouring base station is determined to be capable to send handover issue report messages.

A second aspect is a base station comprising a handover parameter determiner according to the first aspect, wherein the base station is the processed base station of the handover parameter determiner. In this way, each base station is capable of determining handover parameters using information of the capabilities of its neighbouring base stations.

A third aspect is a server comprising a handover parameter determiner according to the first aspect, wherein the handover parameter determiner is arranged to adjust handover parameters for a plurality of respective processed base stations of a mobile communication network. This provides a server which can be used to determine handover parameters for each base station, in relation to its respective neighbours.

A fourth aspect is a method for adjusting handover parameters of a processed base station in relation to neighbouring base stations, neighbouring the processed base station. The method being executed in a handover parameter determiner and comprises: obtaining a list of neighbouring base stations of the mobile communication network; determining, for each of the neighbouring base stations in the list, a capability to send handover issue report messages; and adjusting the handover parameters based on the determined capabilities for each of the neighbouring base stations in the list.

The step of adjusting the handover parameters may involve considering an absence of handover issue report messages from a neighbouring base station differently depending on whether the neighbouring base station is determined to be capable to send handover issue report messages.

The handover issue report messages may include radio link failure indication messages, indicating that a mobile communication terminal has lost connection to a base station and subsequently reconnected to another base station. The radio link failure indication message can be a message in accordance with the LTE standard.

The handover issue report messages may include handover report messages, indicating a failed handover. The handover report message can be a message in accordance with the LTE standard.

The step of adjusting handover parameters may comprise considering an absence of handover issue report messages after a handover differently based on the capabilities of the involved neighbouring base station.

The step of determining may comprise initially considering each of the neighbouring base stations in the list to be incapable of sending handover issue report messages, and when a handover issue report message is received from a reporting base station, determining the reporting base station to be capable of sending handover issue report messages. This is a convenient way to automatically maintain a list of capabilities without explicitly requesting capabilities.

The step of determining may comprise, for each of the neighbouring base stations in the list: sending a

capability request to the base station in question, requesting the base station in question to send a capability response comprising indication of a capability to send handover issue report message.

The step of determining may comprise: determining the capabilities of a base station in question by receiving a capability response message and reading the content of the capability response message.

The capability request may be comprised in an X2 SETUP REQUEST message in compliance with 3GPP TS 36.423 V9.2.0 or later and capability response may be comprised in an X2 SETUP RESPONSE message in compliance with 3GPP TS 36.423 V9.2.0 or later.

The list of neighbouring base stations may comprise all the neighbouring base stations.

The step of adjusting may comprise adjusting a handover margin, indicating how much better a signal from a target base station should be compared to a currently connected base station for a mobile communication terminal to commence handover.

The step of adjusting may comprise adjusting a time to trigger parameter, indicating for how long a signal from a target base station should be better than a connected base station for a mobile communication terminal to commence handover.

A fifth aspect is a computer program for adjusting handover parameters of a processed base station in relation to neighbouring base stations, neighbouring the processed base station. The computer program comprises

computer program code which, when run on a handover parameter determiner, causes the handover parameter determiner to: obtain a list of neighbouring base stations of the mobile communication network; determine, for each of the neighbouring base stations in the list, a capability to send handover issue report messages; and adjust the handover parameters based on the determined capabilities for each of the neighbouring base stations in the list.

A sixth aspect is a computer program product comprising a computer program according to the fifth aspect and a computer readable means on which the computer program is stored.

It is to be noted that any feature of the first, second, third, fourth, fifth and sixth aspects may, where appropriate, be applied to any other of these aspects.

Generally, all terms used in the application are to be interpreted according to their ordinary meaning in the technical field, unless explicitly defined otherwise herein. All references to "a/an/the element, apparatus, component, means, step, etc." are to be interpreted openly as referring to at least one instance of the element, apparatus, component, means, step, etc., unless explicitly stated otherwise. The steps of any method disclosed herein do not have to be performed in the exact order disclosed, unless explicitly stated.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is now described, by way of example, with reference to the accompanying drawings, in which:

Fig 1 is a schematic diagram illustrating an environment where embodiments presented herein can be applied;

Figs 2A-B are schematic diagrams illustrating that the handover parameter determiner can be implemented in a base station or server of Fig 1;

Figs 3A-B are sequence diagrams illustrating handover issue report messages between base stations of Fig 1;

Figs 4A-C are flow charts illustrating methods performed in the handover parameter determiner of Figs 2A-B;

Fig 5 is a schematic diagram showing some components of the base station of Fig 1;

Fig 6 is a schematic diagram showing some components of the server of Fig 1;

Fig 7 is a schematic diagram showing functional modules of the handover parameter determiner of Figs 2A-B;

Fig 8 shows one example of a computer program product comprising computer readable means; and

Fig 9 is a flow chart illustrating a capability query between a handover determiner and a base station.

DETAILED DESCRIPTION

The invention will now be described more fully hereinafter with reference to the accompanying drawings, in which certain embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided by way of example so that this

disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout the description.

Fig 1 is a schematic diagram illustrating an environment where embodiments presented herein can be applied. In a mobile communication network 9 there are three base stations 1a-1c shown. The mobile communication network 9 can comply with Long Term Evolution, LTE, standard of 3rd Generation Partnership Project, 3GPP or any other applicable standard such as W-CDMA (Wideband Code Division Multiple Access), GSM (Wideband Code Division Multiple Access), etc. Hereinafter, references are on occasion made to messages according to LTE for completeness sake, but it is to be noted that this does not restrict the embodiments, which can be applied to any suitable standard.

The base stations can be extended node Bs (eNBs) in an LTE system or equivalent nodes in other types of systems. While three base stations are shown here, the mobile communication network 9 can comprise any number of suitable base stations. A first base station 1a is responsible for three cells 3a-3c and a second base station 1b is responsible for three cells 4a-c. A third base station 1c is also responsible for three cells (not shown). While the number of cells of each base station here is illustrated as being three, it is to be noted that the number of cells of each base station can be any suitable number including one, two or more than three. The base stations 1a-c have a communication channel 6 between them. The communication link can for example be an X2 link in accordance with the LTE standards, using

X2AP (X2 application protocol). A server 7 can be provided being in contact with each one of the base stations 1a-c.

The cell 4a of the second base station 1b has a reciprocal neighbour relationship 5a, 5b respectively with cells 3b, 3c of the first base station 1a. Moreover, the cell 4b of the second base station 1b has a reciprocal neighbour relationship 5c with the cell 3c of the first base station 1a. This implies that the first base station 1a and the second base station 1b are neighbouring base stations. It is sufficient that there is single neighbour relationship between the cells of two base stations for the base stations to be considered neighbouring base stations.

It is to be noted that the cells are here shown spaced apart slightly for illustrational purposes. In reality, the cells can border each other properly or overlap.

One or more mobile communication terminals 2 are shown, where each mobile communication terminal 2 is mobile between the cells of the base stations of the mobile communication network 9 to achieve connectivity with the mobile communication network 9.

When a mobile communication terminal 2 moves geographically, the connection with the mobile communication terminal is transferred between cells, typically between neighbouring cells. When the transfer occurs between two base stations, it is called a handover. Since, in practice, there is often an overlap between cells, there is a zone where the handover can be performed.

For each base station 1a-c, there are several handover parameters that are set to reduce the risk of handover issues such as too early handover or too late handover. The handover parameters apply for each neighbouring base station and can differ within the same base station with respect to different neighbouring base stations.

One handover parameter is "handover margin", which indicates by how much (e.g. in decibels), a signal for a new base station needs to be better for the handover to occur. The signal measurement can e.g. be signal strength or signal to noise ratio. The handover margin should not be too low, as this can create an effect of oscillating handovers back and forth between two base stations due to temporary variations in radio conditions. At the same time, the handover margin should not be too high, as this could result in a dropped connection.

Another handover parameter is time to trigger, which indicates for how long the signal to noise ratio of the new base station needs to be better than the handover margin for the handover to occur. The measurements of signal to noise ratio are performed in the mobile communication terminal 2. The time to trigger should not be too short, as this could also create an effect of oscillating handovers back and forth between two base stations due to temporary variations in radio conditions. At the same time, the time to trigger should not be too long, as this could also result in a dropped connection.

The handover parameters are set, at least partly, in a handover parameter determiner based on statistics collected from handover issue report messages indicating failed handovers or handovers to wrong base stations. The

handover issue report messages can include radio link failure indication messages and/or handover report messages, which will be explained in more detail with reference to Figs 3A and 3B below.

Figs 2A-B are schematic diagrams illustrating that the handover parameter determiner 8 can be implemented in a base station or server of Fig 1. The handover parameter determiner 8 is a functional module. The module can be implemented using hardware and/or software such as a computer program executing in the base station 2 or the server 7. In Fig 2A, the handover parameter determiner 8 is shown as being part of a base station 1 and in Fig 2B, the handover parameter determiner 8 is shown as being part of the server 7. By being include in the server 7, the handover parameter determiner 8 can be used to determine handover parameters for several or all base stations of the mobile communication network 9.

Figs 3A-B are sequence diagrams illustrating handover issue report messages between base stations of Fig 1. References here will also be made to Figs 1 and 2A-B.

In Fig 3A, a handover has previously been determined to be effected. The handover 10 is performed to transfer the mobile communication terminal 2 from the first base station 1a to the second base station 1b. However, for some reason, the mobile communication terminal 2 loses 11a-b the connection to the second base station 1b.

The mobile communication terminal 2 subsequently establishes 12 a connection with the first base station 1a. During this, the mobile communication terminal 2 informs the first base station 1a that the mobile

communication terminal 2 comes from a failed link with the second base station 1b. As a result of this, the first base station 1a sends a radio link failure message 13 to the second base station 1b. The radio link failure message 13 is a message to indicate that a mobile communication terminal has lost connection to a base station and subsequently reconnected to another base station. The second base station 1b responds to the first base station 1a with a handover report message 14. The handover report message 14 indicates the failed handover.

The situation of Fig 3B is similar to the situation of Fig 3A with the difference being that there are three base stations involved.

As before, a handover has previously been determined to be effected. This handover 10 is performed to transfer the mobile communication terminal 2 from the first base station 1a to the second base station 1b. Again, the mobile communication terminal 2 loses 11a-b the connection to the second base station 1b.

Here however, the mobile communication terminal 2 subsequently establishes 12 a connection with the third base station 1c. During this, the mobile communication terminal 2 informs the third base station 1c that the mobile communication terminal 2 comes from a failed link with the second base station 1b. It is therefore here the third base station 1c that sends the radio link failure message 13 to the second base station 1b. The second base station 1b then informs the original base station, being the first base station 1a of the failed handover using the handover report message 14.

By collecting these handover issue report messages (the radio link failure message 13 and the handover report message 14) over time, the first base station 1a can thus adjust the handover parameters to avoid handover failures in the future, as will be explained in more detail below.

One problem occurs when some base stations support these handover issue report messages and some do not. Lacking radio link failure messages from one base station could have two potential causes. The first cause is that no mobile communication terminal tries to re-establish connection in any of the cells of the base station. The second cause is that the base station does not support the sending of this message.

These different causes can require different actions in the determination of handover parameters. For example: Without any radio link failure message, no "too late handover" events will be detected. This indicates that the handover margin could be increased for the corresponding relation. But if the radio link failure message is not supported, a number of "too late HO" events could have taken place without the knowledge thereof, whereby the handover margin in this case should not be decreased.

Analogously, lacking handover report messages from one base station could either be caused by the absence of "too early handover" or "handover to wrong cell" events occurring in the cells of the base station, or by the situation that the base station does not support sending of this message. Again, these cases should be treated differently when determining handover parameters.

Thus, without the knowledge of if a neighbour base station supports the handover issue report messages, the handover parameter determination will not work properly.

Figs 4A-C are flow charts illustrating methods performed in the handover parameter determiner of Figs 2A-B.

In an initial obtain base station list step 20, a list of neighbouring base stations of the mobile communication network is obtained.

In a determine capabilities step 22, the handover parameter determiner determines, for each of the neighbouring base stations in the list, whether it is capable of sending handover issue report messages. Optionally, a record is kept of which types of messages are supported, such as radio link failure and handover report.

In an adjust handover parameter step 24, the handover parameters are adjusted based on the determined capabilities for each of the neighbouring base stations in the list.

Statistics per relation is collected by the base station. Counters for handover too early, handover too late and handover to the wrong cell are collected. When handover to the wrong cell happens, statistics are only affected for cases where the intended cell (the right cell) is also a neighbour to the source cell, are the statistics affected. For handovers to the wrong cell, event counters for both the actual cell (the cell with which communication ended up being established with) and the intended cell (the intended handover cell) shall be collected.

This step can compare the measured rate with the target rate for the following five events: handover oscillation, handover too early, handover too late, handover to wrong cell (actual cell), and handover to wrong cell (intended cell). These events are counted per relation, i.e. neighbouring base station..

Each event counter can be compared with a configurable target rate. The difference (the error) is multiplied with a configurable weight. The resulting values for all events are accumulated into a relation level handover inhibition factor. In this accumulation, the resulting values for too late handover and handover to wrong cell (intended cell) are negated prior to accumulation.

This relation level handover inhibition factor represents a desired increase or, if negative, decrease of handover margin and time to trigger parameters that is needed to balance the statistics.

The handover margin parameter can be adjusted to ensure it complies with allowed values and/or relative adjustment, e.g. in whole or half dB steps. Likewise, the time to trigger parameter can be kept within allowed values and/or relative adjustments.

While the steps are here shown sequentially, determine capabilities step 22 and the adjust handover parameters step 24 can be performed in parallel and can be repeated at certain intervals or occur as new information becomes available.

Fig 4B shows sub-steps of the determine capabilities step 22 according to one embodiment. In an assume incapable step 26, it is here assumed initially that every

neighbouring base station does not have the capability of sending the handover issue report messages.

Subsequently, in a determine capable when message is received step 27, when a handover issue report message is received from a neighbouring base station, such a base station is clearly able to send such messages and the capability of that base station is updated accordingly. This can be performed independently for the capability to send radio link failure messages and handover report messages.

Also here, while the steps are shown sequentially, the assume incapable step can be performed initially, and the determine capable when message is received step 27 is performed when any such handover issue report message is received from a neighbouring base station.

Fig 4C shows sub-steps of the determine capabilities step 22 according to one embodiment. In a send capability request step 28, the base station being active to maintain its capability list of neighbouring base stations sends a capability request to each one of the neighbouring base stations. Optionally, the capability request can be included as an addition to an X2 SETUP REQUEST message in compliance with 3GPP TS 36.423 V9.2.0 or later, thereby using an existing communication protocol to great extent.

In a receive capability response step 29, the base station being active to maintain its capability list receives a capability response from a subset or all of the neighbouring bases stations. The capability of each base station is updated accordingly. Optionally, the

capability response can be included in an X2 SETUP RESPONSE message in compliance with 3GPP TS 36.423 V9.2.0 or later. The capability response message can include two flags, indicating the capability to send radio link failure messages and handover report messages, respectively.

The embodiments illustrated in Figs 4B and 4C can be combined by, in Fig 4C, adding the determine capable when message is received step 27, after the receive capability response step. In this way, if a capability response message is not received from a particular neighbouring base station, that base station is assumed to not have any capability to send handover issue report messages. However, but this is adjusted if a handover issue report message is later received from that neighbouring base station.

Fig 5 is a schematic diagram showing some components of a base station 1 such as any one of the base stations 1a-c of Fig 1. A controller 50 is provided using any suitable central processing unit (CPU), microcontroller, digital signal processor (DSP), application specific integrated circuit etc., capable of executing software instructions stored in a computer program product 54, e.g. in the form of a memory. The computer program product 54 can be a memory or any combination of read and write memory (RAM) and read only memory (ROM). The memory also comprises persistent storage, which, for example, can be any single one or combination of magnetic memory, optical memory, or solid state memory or even remotely mounted memory.

The base station 1 also comprises an I/O interface 57 for communicating with other elements of the mobile

communication network such as other base stations or the server 7.

The base station 1 also comprises one or more transceivers 55 and a corresponding number of antennas 52 for radio communication with mobile communication terminals.

Fig 6 is a schematic diagram showing some components of the server 7 of Fig 1. A controller 90 is provided using any suitable central processing unit (CPU), microcontroller, digital signal processor (DSP), capable of executing software instructions stored in a computer program product 94, e.g. in the form of a memory. The computer program product 94 can be a memory or any combination of read and write memory (RAM) and read only memory (ROM). The memory also comprises persistent storage, which, for example, can be any single one or combination of magnetic memory, optical memory, or solid state memory or even remotely mounted memory.

The server 7 also comprises an I/O interface 92 for communicating with other elements of the mobile communication network such as the base stations.

Fig 7 is a schematic diagram showing functional modules of the handover parameter determiner of Figs 2A-B. The modules can be implemented using hardware and/or software such as a computer program executing in the base station 2 or the server 7. All modules depend on an execution environment (not shown) which utilises the components shown in Fig 5 and 6 respectively. The modules correspond to steps of the method illustrated in Figs 4A-C.

A list obtainer 60 is arranged to obtain, for a particular processed base station, a list of neighbouring base stations. This module performs step 20 of Fig 4A.

A capability determiner 62 is arranged to determine, for each of the neighbouring base stations in the list, a capability to send handover issue report messages. This module corresponds to step 22 of Fig 4A, and thus optionally also the sub-steps shown in either or both of Figs 4B-C.

A handover parameter adjuster 64 is arranged to adjust the handover parameters based on the determined capabilities for each of the neighbouring base stations in the list.

Fig 8 shows one example of a computer program product 70 comprising computer readable means. On this computer readable means a computer program 71 can be stored, which computer program can cause a controller to execute a method according to embodiments described herein. In this example, the computer program product is an optical disc, such as a CD (compact disc) or a DVD (digital versatile disc) or a Blu-Ray disc. As explained above, the computer program product could also be embodied as a memory of a device, such as memory 54 of the base station 2 or memory 94 of the server 7. While the computer program 71 is here schematically shown as a track on the depicted optical disk, the computer program can be stored in any way which is suitable for the computer program product.

Fig 9 is a sequence diagram illustrating a capability query between a handover determiner 8 and a base station 1b. This corresponds to the sub-steps of Fig 4C.

First, the handover parameter determiner 8 sends a capability request 80 to the base station. This corresponds to sub-step 28 of Fig 4C.

Secondly, the base station 1 sends a capability response 81 to the handover parameter determiner 8. This corresponds to sub-step 29 of Fig 4C.

The invention has mainly been described above with reference to a few embodiments. However, as is readily appreciated by a person skilled in the art, other embodiments than the ones disclosed above are equally possible within the scope of the invention, as defined by the appended patent claims.

CLAIMS

1. A handover parameter determiner for adjusting handover parameters of a processed base station in relation to neighbouring base stations, neighbouring the processed base station, the handover parameter determiner comprising:

a list obtainer arranged to obtain, for a particular base station, a list of neighbouring base stations;

a capability determiner arranged to determine, for each of the neighbouring base stations in the list, a capability to send handover issue report messages; and

a handover parameter adjuster arranged to adjust the handover parameters based on the determined capabilities for each of the neighbouring base stations in the list.

2. A base station comprising a handover parameter determiner according to claim 1, wherein the base station is the processed base station of the handover parameter determiner.

3. A server comprising a handover parameter determiner according to claim 1, wherein the handover parameter determiner is arranged to adjust handover parameters for a plurality of respective processed base stations of a mobile communication network.

4. A method for adjusting handover parameters of a processed base station in relation to neighbouring base stations, neighbouring the processed base station, the method being executed in a handover parameter determiner and comprising:

obtaining a list of neighbouring base stations of the mobile communication network;

determining, for each of the neighbouring base stations in the list, a capability to send handover issue report messages; and

adjusting the handover parameters based on the determined capabilities for each of the neighbouring base stations in the list.

5. The method according to claim 4, wherein the step of adjusting the handover parameters involves considering an absence of handover issue report messages from a neighbouring base station differently depending on whether the neighbouring base station is determined to be capable to send handover issue report messages.

6. The method according to claim 4 or 5, wherein the handover issue report messages includes radio link failure indication messages, indicating that a mobile communication terminal has lost connection to a base station and subsequently reconnected to another base station.

7. The method according to any one of claims 4 to 6, wherein the handover issue report messages includes handover report messages, indicating a failed handover.

8. The method according to any one of claims 4 to 7, wherein the step of adjusting handover parameters comprises considering an absence of handover issue report messages after a handover differently based on the capabilities of the involved neighbouring base station.

9. The method according to any one of claims 4 to 8, wherein the step of determining comprises initially considering each of the neighbouring base stations in the list to be incapable of sending handover issue report

messages, and when a handover issue report message is received from a reporting base station, determining the reporting base station to be capable of sending handover issue report messages.

10. The method according to any one of claims 4 to 9, wherein the step of determining comprises, for each of the neighbouring base stations in the list:

sending a capability request to the base station in question, requesting the base station in question to send a capability response comprising indication of a capability to send handover issue report message.

11. The method according to claim 10, wherein the step of determining comprises: determining the capabilities of a base station in question by receiving a capability response message and reading the content of the capability response message.

12. The method according to claim 11, wherein the capability request is comprised in an X2 SETUP REQUEST message in compliance with 3GPP TS 36.423 V9.2.0 or later and capability response is comprised in an X2 SETUP RESPONSE message in compliance with 3GPP TS 36.423 V9.2.0 or later.

13. The method according to any one of claims 4 to 11, wherein the list of neighbouring base stations comprises all the neighbouring base stations.

14. The method according to any one of claims 4 to 13, wherein the step of adjusting comprises adjusting a handover margin, indicating how much better a signal from a target base station should be compared to a currently

connected base station for a mobile communication terminal to commence handover.

15. The method according to any one of claims 4 to 14, wherein the step of adjusting comprises adjusting a time to trigger parameter, indicating for how long a signal from a target base station should be better than a connected base station for a mobile communication terminal to commence handover.

16. A computer program for adjusting handover parameters of a processed base station in relation to neighbouring base stations, neighbouring the processed base station, the computer program comprising computer program code which, when run on a handover parameter determiner, causes the handover parameter determiner to:

obtain a list of neighbouring base stations of the mobile communication network;

determine, for each of the neighbouring base stations in the list, a capability to send handover issue report messages; and

adjust the handover parameters based on the determined capabilities for each of the neighbouring base stations in the list.

17. A computer program product comprising a computer program according to claim 16 and a computer readable means on which the computer program is stored.

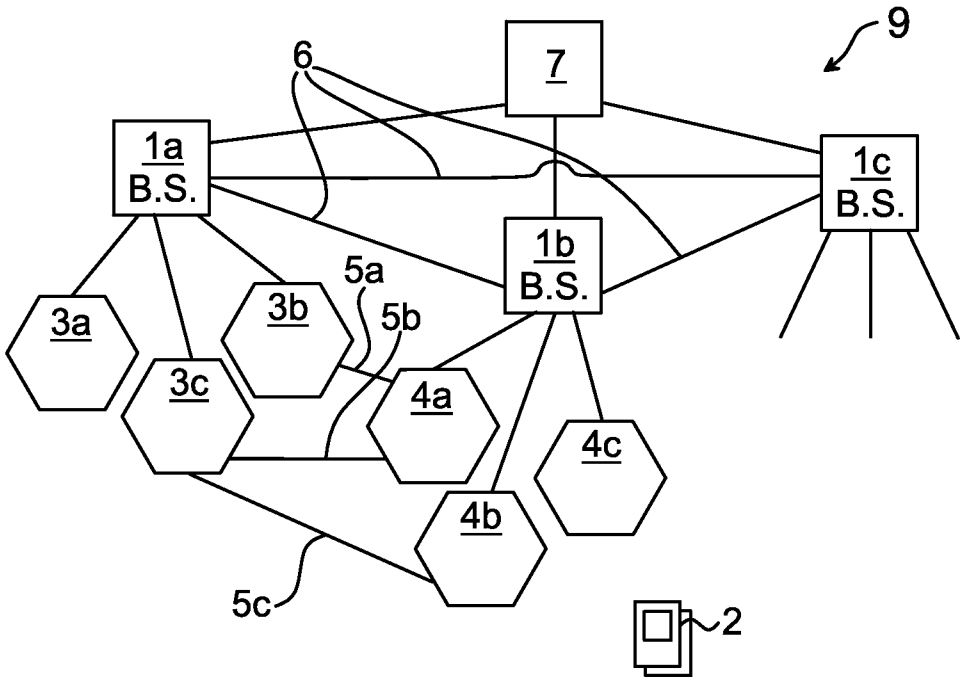


Fig. 1

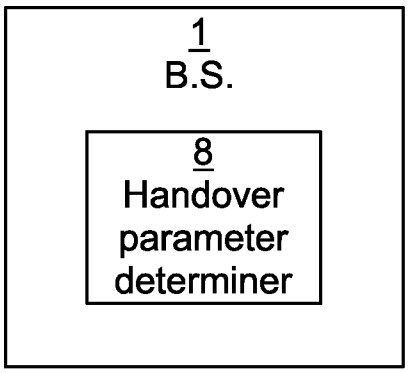


Fig. 2A

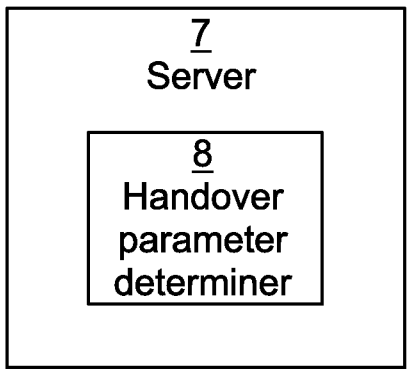


Fig. 2B

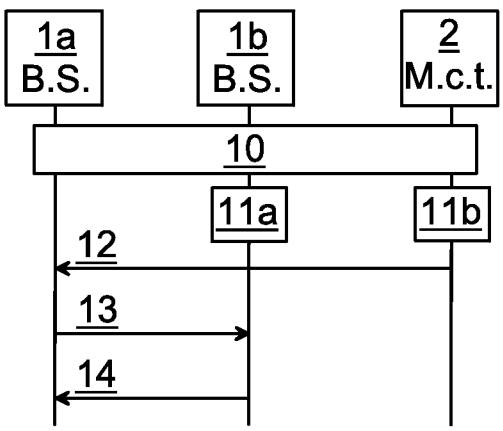


Fig. 3A

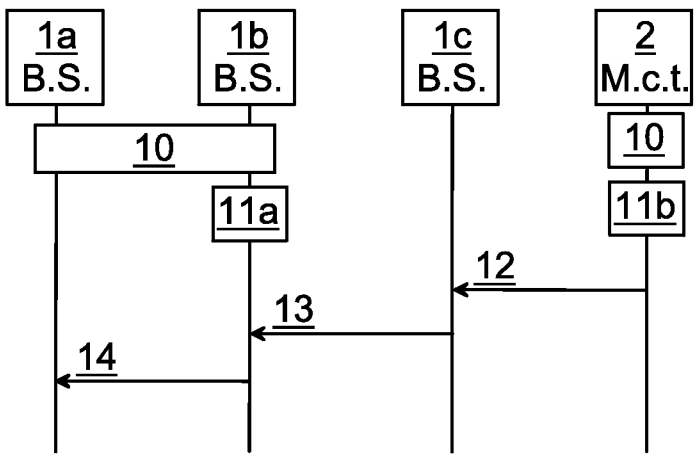


Fig. 3B

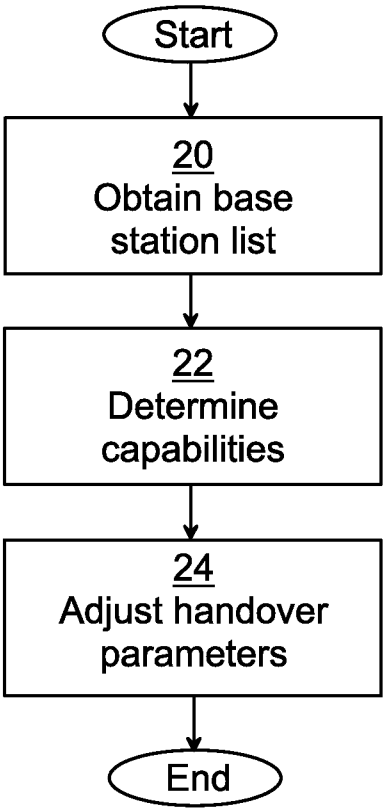


Fig. 4A

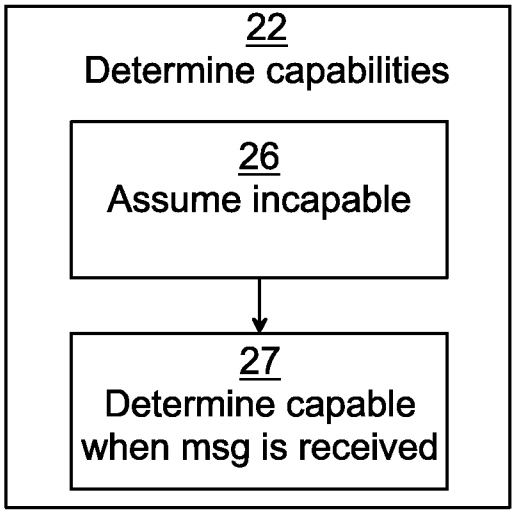


Fig. 4B

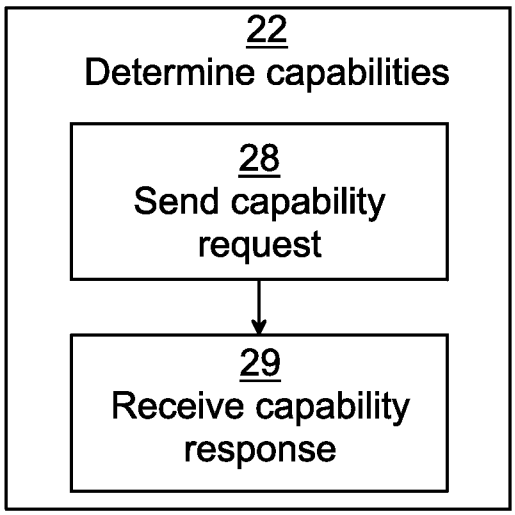


Fig. 4C

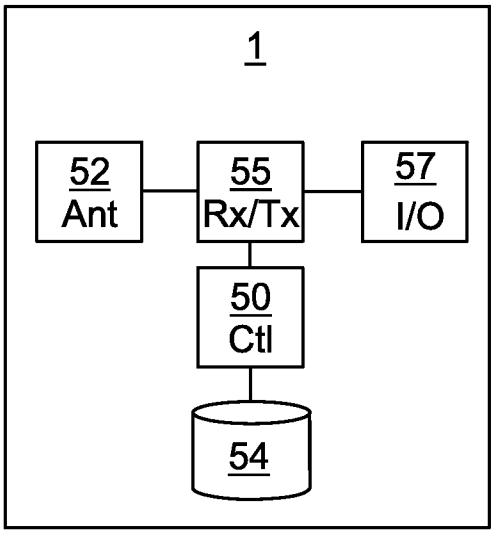


Fig. 5

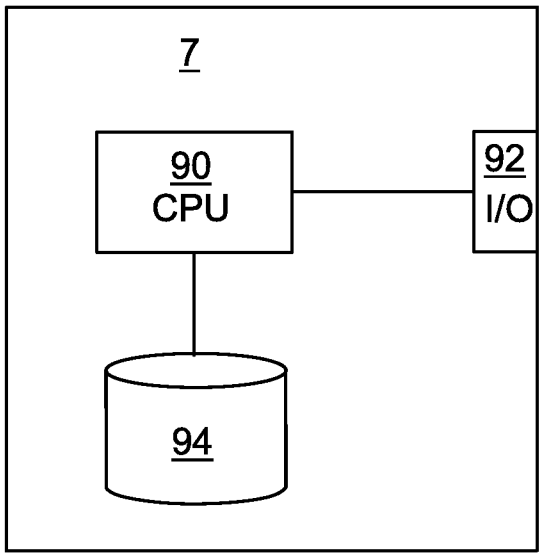


Fig. 6

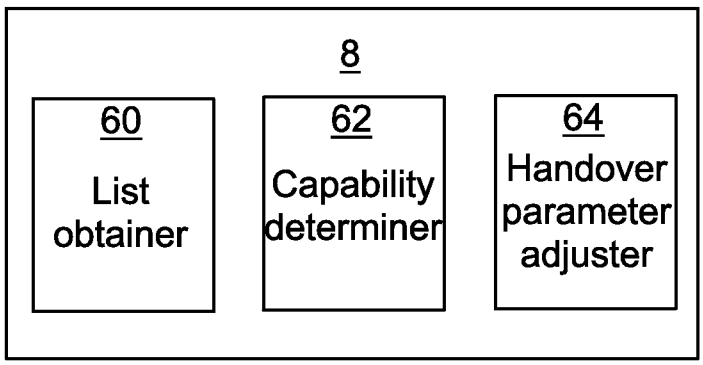


Fig. 7

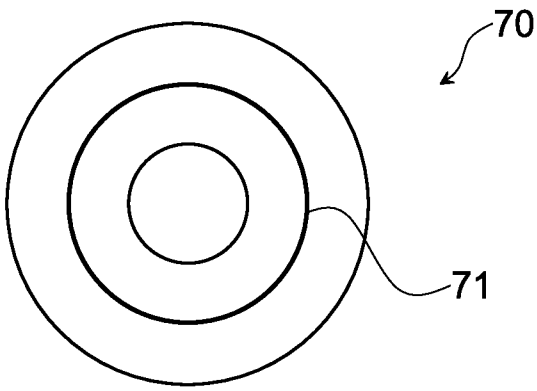


Fig. 8

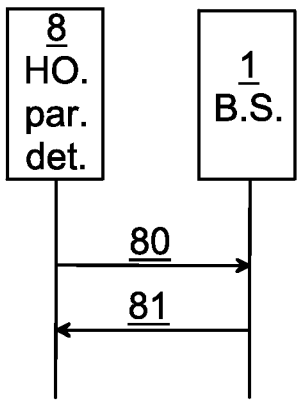


Fig. 9

INTERNATIONAL SEARCH REPORT

International application No
PCT/SE2011/050447

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04W36/00
ADD. H04W36/08 H04W92/20

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)
H04W

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2010/057123 A2 (QUALCOMM INC [US]; AGASHE PARAG A [US]; TENNY NATHAN E [US]) 20 May 2010 (2010-05-20) abstract paragraph [0009] - paragraph [0010] paragraph [0023] - paragraph [0036] paragraph [0079] figures 1-5, 7,8	1-17

-/--

[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 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
10 November 2011	17/11/2011

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

INTERNATIONAL SEARCH REPORT

International application No
PCT/SE2011/050447

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	NOKIA SIEMENS NETWORKS: "Planned RAN Work Item on Self-Organizing Networks", 3GPP DRAFT; S5-090029, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, no. Sophia Antipolis, France; 20090107, 7 January 2009 (2009-01-07), XP050335484, [retrieved on 2009-01-07] chapter 1 chapter 2.1	1-17
A	RAN3 (MOTOROLA ET AL: "Introduction of MRO procedures in stage 2", 3GPP DRAFT; 36300_CR0179_(REL-9)_R2-097533_R3-093370, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. RAN WG2, no. Jeju; 20091109, 19 November 2009 (2009-11-19), XP050420619, [retrieved on 2009-11-19] the whole document	1-17
A	HUAWEI: "Solutions for the Mobility Robustness use case", 3GPP DRAFT; R3-081165 SOLUTIONS FOR THE MOBILITY ROBUSTNESS USE CASE, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. RAN WG3, no. Kansas City, USA; 20080430, 30 April 2008 (2008-04-30), XP050164358, [retrieved on 2008-04-30] the whole document	1-17

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/SE2011/050447

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2010057123 A2	20-05-2010	CA 2742503 A1	20-05-2010
		CN 102217354 A	12-10-2011
		EP 2359626 A2	24-08-2011
		TW 201032613 A	01-09-2010
		US 2010124918 A1	20-05-2010