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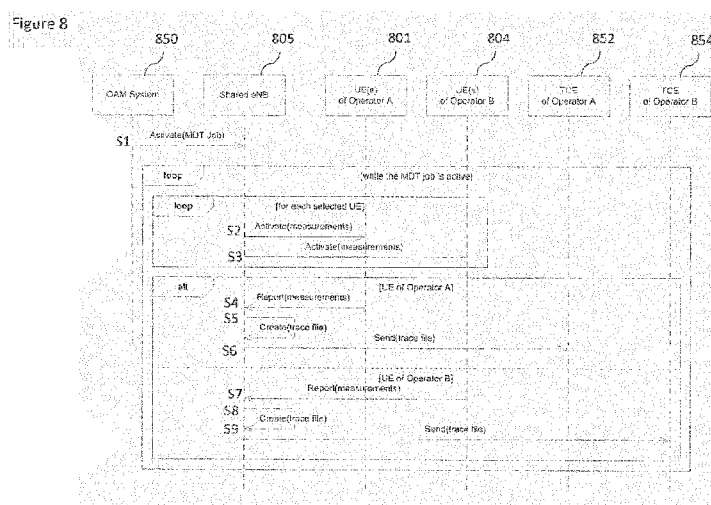
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(57) Abstract: A method comprising: receiving network measurements relating to an area based MDT measurement job from a plurality of user equipments at a shared eNB carrying out a network measurement operation, each of said user equipments belonging to one of first and second operators sharing said eNB; and using PLMN identity information of the first and second operators respectively to handle said received network measurements in a manner dependent upon whether the user equipment is associated with the first operator or the second operator, i.e. transmitting the received network measurements either to a TCE associated with the first operator or to a TCE associated with the second operator.

DESCRIPTION

TITLE

5 AREA BASED MINIMIZATION OF DRIVE TESTS (MDT) MEASUREMENTS IN NETWORK SHARING SCENARIO

Background

10 The invention relates to a method, apparatus and computer program, and in particular but not exclusively to a method, apparatus and computer program for network testing.

A communication system can be seen as a facility that enables communication sessions between two or more entities such as fixed or mobile communication devices, base stations, servers and/or other communication nodes. A communication system and compatible communicating entities typically operate in accordance with a given standard or specification which sets out what the various entities associated with the system are permitted to do and how that should be achieved. For example, the standards, specifications and related protocols can define the manner how communication devices can access the communication system and how various aspects of communication shall be implemented between communicating devices. A communication can be carried on wired or wireless carriers. In a wireless communication system at least a part of the communication between at least two stations occurs over a wireless link.

25 Examples of wireless systems include public land mobile networks (PLMN) such as cellular networks, satellite based communication systems and different wireless local networks, for example wireless local area networks (WLAN). A wireless system can be divided into cells, and hence these are often referred to as cellular systems. A cell is provided by a base station. Cells can have different shapes and sizes. A cell can also be divided into sectors. Regardless of the shape and size of the cell providing access for a user equipment, and whether the access is provided via a sector of a cell or a cell, such area can be called radio service area or access area. Neighbouring radio service areas typically overlap, and thus a communication in an area can listen to more than one base station.

35 A user can access the communication system by means of an appropriate communication device. A communication device of a user is often referred to as user equipment (UE) or terminal. A communication device is provided with an appropriate signal receiving and

transmitting arrangement for enabling communications with other parties. Typically a communication device is used for enabling receiving and transmission of communications such as speech and data. In wireless systems a communication device provides a transceiver station that can communicate with another communication device such as e.g.
5 a base station of an access network and/or another user equipment. The communication device may access a carrier provided by a station, for example a base station, and transmit and/or receive communications on the carrier.

Examples of communication systems attempting to satisfy the increased demands for capacity are architectures that are being standardized by the 3rd Generation Partnership Project (3GPP), such as the long-term evolution (LTE), or the Universal Mobile Telecommunications System (UMTS) radio-access technologies. The LTE aims to achieve various improvements, for example reduced latency, higher user data rates, improved system capacity and coverage, reduced cost for the operator and so on. A
10 further development of the LTE is often referred to as LTE-Advanced. The various development stages of the 3GPP LTE specifications are referred to as releases.

To collect network quality information, an operator often needs to send engineers directly to a geographical area to obtain radio measurements. Typically, a measurement vehicle
20 (for example a car or van equipped with specially developed test terminals, measurement devices and a GPS receiver) is used to obtain network-quality measurements outdoors. For example engineers will perform test calls in the car or van and record measurement results along a drive route. For indoor coverage an engineer may perform such tests on foot, using handheld test equipment. From these tests operators can take any necessary
25 measures to maintain and/or enhance the quality of the network, for example whether they need to deploy new base stations. Such tests, whether carried out in a vehicle or on foot involve significant time, effort and cost to obtain the necessary data.

In view of this, operators proposed Minimisation of Drive Tests (MDT) in 3GPP. MDT
30 uses commercial user equipment i.e. those already in use in the network, for collecting the necessary radio measurements.

Summary

In a first aspect there is provided a method comprising: receiving network measurements
35 from a plurality of user equipment at an apparatus carrying out a network measurement operation, each of said user equipment belonging to one of first and second operators sharing said apparatus; and using identity information of the first and second operators to

handle said received network measurements in a manner dependent upon whether the user equipment is associated with the first operator or the second operator.

5 In some embodiments, said identity information of the first and second operators comprise Public Land Mobile Network identities.

In some embodiments, said identity information is stored in a look-up table.

10 In some embodiments, the method comprises receiving said identity information.

In some embodiments, the method comprises configuring said apparatus with said received identity information prior to initiation of said network measurement operation.

15 In some embodiments, the method comprises receiving said identity information as part of initiation of said network measurement operation.

In some embodiments, the method comprises storing received network measurements for user equipment associated with said first operator separately from network measurements received from user equipment associated with said second operator.

20

In some embodiments, the method comprises selectively sending said received network measurements to a first information collecting entity associated with said first operator or a second information collecting entity associated with said second operator, in dependence on said identity information.

25

In some embodiments, said first and second information collecting entities comprise Trace Collection Entities.

30 In some embodiments, said_method comprises a Minimisation of Drive Test.

In some embodiments said method comprises a tracing operation.

In some embodiments said Minimisation of Drive Test is part of said tracing operation.

35 In some embodiments said apparatus comprises one of a base station and a radio network controller.

In a second aspect there is provided a computer program comprising computer executable instructions which when run on one or more processors perform the method of the first aspect.

- 5 In a third aspect there is provided an apparatus comprising at least one processor; and at least one memory including computer program code; the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus at least to: receive network measurements from a plurality of user equipment carrying out a network measurement operation, each of said user equipment belonging to
10 one of first and second operators sharing said apparatus; and use identity information of the first and second operators to handle said received network measurements in a manner dependent upon whether the user equipment is associated with the first operator or the second operator
- 15 In some embodiments, said identity information of the first and second operators comprise Public Land Mobile Network identities.

In some embodiments, said identity information is stored in a look-up table.

- 20 In some embodiments, the apparatus is configured to receive said identity information.

In some embodiments, said apparatus is configured with said received identity information prior to initiation of said network measurement operation.

- 25 In some embodiments, said apparatus is configured to receive said identity information as part of initiation of said network measurement operation.

- In some embodiments, the apparatus is configured to store received network measurements for user equipment associated with said first operator separately from
30 network measurements received from user equipment associated with said second operator.

- In some embodiments, the apparatus is configured to selectively send said received network measurements to a first information collecting entity associated with said first
35 operator or a second information collecting entity associated with said second operator, in dependence on said identity information.

In some embodiments, said first and second information collecting entities comprise Trace Collection Entities.

5 In some embodiments, the apparatus is configured to carry out a Minimisation of Drive Test.

In some embodiments the apparatus is configured to carry out a tracing operation.

10 In some embodiments the apparatus is configured to carry out said Minimisation of Drive Test as part of said tracing operation.

In some embodiments said apparatus comprises one of a base station and a radio network controller.

15 In a fourth aspect there is provided an apparatus comprising means for receiving network measurements from a plurality of user equipment carrying out a network measurement operation, each of said user equipment belonging to one of first and second operators sharing said apparatus; and means for using identity information of the first and second operators to handle said received network measurements in a manner dependent upon
20 whether the user equipment is associated with the first operator or the second operator

In some embodiments said identity information of the first and second operators comprise Public Land Mobile Network identities.

25 In some embodiments said identity information is stored in a look-up table.

In some embodiments the apparatus comprises means for receiving said identity information.

30 In some embodiments said apparatus is configured with said received identity information prior to initiation of said network measurement operation.

In some embodiments said apparatus comprises means for receiving said identity information as part of initiation of said network measurement operation.

35

In some embodiments said apparatus comprises means for storing received network measurements for user equipment associated with said first operator separately from

network measurements received from user equipment associated with said second operator.

5 In some embodiments the apparatus comprises means for selectively sending said received network measurements to a first information collecting entity associated with said first operator or a second information collecting entity associated with said second operator, in dependence on said identity information.

10 In some embodiments said first and second information collecting entities comprise Trace Collection Entities.

In some embodiments the apparatus comprises means for carrying out a Minimisation of Drive Test.

15 In some embodiments the apparatus comprises means for carrying out a tracing operation.

20 In some embodiments the apparatus comprises means for carrying out said Minimisation of Drive Test as part of said tracing operation.

In some embodiments said apparatus comprises one of a base station and a radio network controller.

25 In a fifth aspect there is provided a method comprising: sending information from a first apparatus to a second apparatus, said second apparatus shared by at least a first operator and a second operator in a communication network; said information comprising identity information associated with an information collecting entity of the first operator and identity information associated with an information collecting entity of the second operator.

30 In some embodiments, said identity information comprises Public Land Mobile Network identities.

35 In some embodiments, the method comprises sending said information prior to initiation of a network measurement operation at said second apparatus.

In some embodiments, the method comprises sending said information as part of initiation of a network measurement operation at said second apparatus.

In some embodiments said first apparatus comprises an Operations Administration and Maintenance Node.

- 5 In some embodiments said method comprises a Minimisation of Drive Test.

In some embodiments said method comprises a tracing operation.

In some embodiments said Minimisation of Drive Test is part of said tracing operation.

10

In a sixth aspect there is provided a computer program comprising computer executable instructions which when run on one or more processors perform the method of the sixth aspect.

- 15 In an seventh aspect there is provided an apparatus comprising at least one processor; and at least one memory including computer program code; the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus at least to: send information to a second apparatus, said second apparatus shared by at least a first operator and a second operator in a communication network; said
20 information comprising identity information associated with an information collecting entity of the first operator and identity information associated with an information collecting entity of the second operator.

- 25 In some embodiments, said identity information comprises Public Land Mobile Network identities.

In some embodiments, said apparatus is configured to send said information prior to initiation of a network measurement operation at said second apparatus.

- 30 In some embodiments, said apparatus is configured to send said information as part of initiation of a network measurement operation at said second apparatus.

In some embodiments said apparatus comprises an Operations Administration and Maintenance Node.

35

In some embodiments said apparatus is configured to carry out a Minimisation of Drive Test.

In some embodiments said apparatus is configured to carry out a tracing operation.

5 In some embodiments said apparatus is configured to carry out said Minimisation of Drive Test as part of said tracing operation.

10 In an eighth aspect there is provided an apparatus comprising means for sending information to a second apparatus, said second apparatus shared by at least a first operator and a second operator in a communication network; said information comprising identity information associated with an information collecting entity of the first operator and identity information associated with an information collecting entity of the second operator.

15 In some embodiments said identity information comprises Public Land Mobile Network identities.

In some embodiments said apparatus comprises means for sending said information prior to initiation of a network measurement operation at said second apparatus.

20 In some embodiments said apparatus comprises means for sending said information as part of initiation of a network measurement operation at said second apparatus.

In some embodiments said apparatus comprises an Operations Administration and Maintenance Node.

25 In some embodiments said apparatus comprises means for carrying out a Minimisation of Drive Test.

30 In some embodiments said apparatus comprises means for carrying out a tracing operation.

In some embodiments said apparatus comprises means for carrying out said Minimisation of Drive Test as part of said tracing operation.

Brief description of drawings

35

Some embodiments will now be described by way of example only with reference to the following Figures in which:

Figure 1 shows a schematic diagram of a network according to some embodiments;

Figure 2 shows a schematic diagram of a communication device according to some embodiments;

5 Figure 3 shows a schematic diagram of a control apparatus according to some embodiments;

Figure 4 is a flow chart showing steps of an MDT according to one example;

Figure 5 is a flow chart showing steps of an MDT according to another example;

Figure 6 is a flow chart showing steps of an MDT according to another example;

10 Figure 7 is a flow chart showing steps of an MDT according to one example;

Figure 8 is a flow chart showing steps of an MDT according to one embodiment;

Figure 9 is a flow chart showing steps of an MDT according to another embodiment;

Figures 10A to 10C show TCE mapping tables according to embodiments.

15 Detailed description

In the following certain exemplifying embodiments are explained with reference to a wireless or mobile communication system serving communication devices. Before explaining in detail the exemplifying embodiments, certain general principles of a wireless
20 communication system, access systems thereof, and communication devices are briefly explained with reference to Figures 1 to 3 to assist in understanding the technology underlying the described examples.

A communication device or user equipment 101, 102, 103, 104 is typically provided
25 wireless access via at least one base station or similar wireless transmitter and/or receiver node of an access system. In Figure 1 three neighbouring and overlapping access systems or radio service areas 100, 110 and 120 are shown being provided by base stations 105, 106, and 108.

30 However, it is noted that instead of three access systems, any number of access systems can be provided in a communication system. An access system can be provided by a cell of a cellular system or another system enabling a communication device to access a communication system. A base station site 105, 106, 108 can provide one or more cells. A base station can also provide a plurality of sectors, for example three radio sectors,
35 each sector providing a cell or a subarea of a cell. All sectors within a cell can be served by the same base station. A radio link within a sector can be identified by a single logical identification belonging to that sector. Thus a base station can provide one or more radio

service areas. Each communication device 101, 102, 103, 104, and base station 105, 106, and 108 may have one or more radio channels open at the same time and may send signals to and/or receive signals from more than one source.

5 Base stations 105, 106, 108 are typically controlled by at least one appropriate controller apparatus 109, 107 so as to enable operation thereof and management of communication devices 101, 102, 103, 104 in communication with the base stations 105, 106, 108. The control apparatus 107, 109 can be interconnected with other control entities. The control apparatus 109 can typically be provided with memory capacity 301 and at least one data
10 processor 302. The control apparatus 109 and functions may be distributed between a plurality of control units. Although not shown in Figure 1, in some embodiments each base station 105, 106 and 108 can comprise a control apparatus 109, 107.

The cell borders or edges are schematically shown for illustration purposes only in Figure
15 1. It shall be understood that the sizes and shapes of the cells or other radio service areas may vary considerably from the similarly sized omni-directional shapes of Figure 1.

In particular, Figure 1 depicts two wide area base stations 105, 106, which can be macro-eNBs 105, 106 in an LTE system. The macro-eNBs 105, 106 transmit and receive data
20 over the entire coverage of the cells 100 and 110 respectively. Figure 1 also shows a smaller area base station or access point which in some embodiments can be a pico, a femto or Home eNB 108. The coverage of the smaller area base station 108 is generally smaller than the coverage of the wide area base stations 105, 106. The coverage provided by the smaller area node 108 overlaps with the coverage provided by the macro-eNBs 105, 106. Pico eNBs can be used to extend coverage of the macro-eNBs 105, 106
25 outside the original cell coverage 100, 110 of the macro-eNBs 105, 106. The pico eNB can also be used to provide cell coverage in "gaps" or "shadows" where there is no coverage within the existing cells 100, 110 and/or may serve "hot spots". In some embodiments, the smaller area node can be a femto or Home eNB which can provide
30 coverage for a relatively small area such as the home. Some environments may have both pico and femto cells.

As shown, the radio service areas can overlap. Thus signals transmitted in an area can interfere with communications in another area (macro to macro, pico/femto to either one or
35 both of the macro cells, and/or pico/femto to pico/femto).

The communication devices 101, 102, 103, 104 can access the communication system based on various access techniques, such as code division multiple access (CDMA), or wideband CDMA (WCDMA). Other examples include time division multiple access (TDMA), frequency division multiple access (FDMA) and various schemes thereof such as the interleaved frequency division multiple access (IFDMA), single carrier frequency division multiple access (SC-FDMA) and orthogonal frequency division multiple access (OFDMA), space division multiple access (SDMA) and so on.

Some non-limiting examples of the recent developments in communication systems are the long-term evolution (LTE) of the Universal Mobile Telecommunications System (UMTS) that is being standardized by the 3rd Generation Partnership Project (3GPP). As explained above, further development of the LTE is referred to as LTE-Advanced. Non-limiting examples of appropriate access nodes are a base station of a cellular system, for example what is known as NodeB (NB) in the vocabulary of the 3GPP specifications. The LTE employs a mobile architecture known as the Evolved Universal Terrestrial Radio Access Network (E-UTRAN). Base stations of such systems are known as evolved Node Bs (eNBs) and may provide E-UTRAN features such as user plane Radio Link Control/Medium Access Control/Physical layer protocol (RLC/MAC/PHY) and control plane Radio Resource Control (RRC) protocol terminations towards the user devices. Other examples of radio access systems include those provided by base stations of systems that are based on technologies such as wireless local area network (WLAN) and/or WiMax (Worldwide Interoperability for Microwave Access). Fifth Generation (5G) radio systems may be commercially available around 2020.

In Figure 1 the base stations 105, 106, 108 of the access systems can be connected to a wider communications network 113. A controller apparatus 107, 109 may be provided for coordinating the operation of the access systems. A gateway function 112 may also be provided to connect to another network via the network 113. The smaller area base station 108 can also be connected to the other network by a separate gateway function 111. The base stations 105, 106, 108 can be connected to each other by a communication link for sending and receiving data. The communication link can be any suitable means for sending and receiving data between the base stations 105, 106 and 108 and in some embodiments the communication link is an X2 link.

The other network may be any appropriate network. A wider communication system may thus be provided by one or more interconnect networks and the elements thereof, and one or more gateways may be provided for interconnecting various networks.

The communication devices will now be described in more detail with reference to Figure 2. Figure 2 shows a schematic, partially sectioned view of a communication device 200 that a user can use for communication. The other communication devices shown in Figure 1 may have the same or similar features. Such a communication device is often referred to as user equipment (UE) or terminal. An appropriate communication device may be provided by any device capable of sending and receiving radio signals. The communication device may be mobile or may be generally stationary. Non-limiting examples include a mobile station (MS) such as a mobile phone or what is known as a 'smart phone', a portable computer provided with a wireless interface card or other wireless interface facility, personal data assistant (PDA) provided with wireless communication capabilities, a computer or any combinations of these or the like.

A communication device may provide, for example, communication of data for carrying communications such as voice, electronic mail (email), text message, multimedia and so on. Users may thus be offered and provided numerous services via their communication devices. Non-limiting examples of these services include two-way or multi-way calls, data communication or multimedia services or simply an access to a data communications network system, such as the Internet. User may also be provided broadcast or multicast data. Non-limiting examples of the content include downloads, television and radio programs, videos, advertisements, various alerts and other information.

The device 200 may receive signals over an air interface 207 via appropriate apparatus for receiving and may transmit signals via appropriate apparatus for transmitting radio signals. In Figure 2 transceiver apparatus is designated schematically by block 206. The transceiver apparatus 206 may be provided for example by means of a radio part and associated antenna arrangement. The antenna arrangement may be arranged internally or externally to the communication device.

The communication device is also typically provided with at least one data processing entity 201, at least one memory 202 and other possible components 203 for use in software and hardware aided execution of tasks it is designed to perform, including control of access to and communications with access systems and other communication devices. The data processing, storage and other relevant control apparatus can be provided on an appropriate circuit board and/or in chipsets. This feature is denoted by reference 204.

The user may control the operation of the communication device by means of a suitable user interface such as key pad 205, voice commands, touch sensitive screen or pad, combinations thereof or the like. A display 208, a speaker and a microphone can be also provided. Furthermore, a communication device may comprise appropriate connectors
5 (either wired or wireless) to other devices and/or for connecting external accessories, for example hands-free equipment, thereto.

Figure 3 shows an example of a control apparatus 300 for a communication system, for example to be coupled to and/or for controlling a station of an access system. In some
10 embodiments the base stations 105, 106, and 108 of Figure 1 comprise a control apparatus 300. Such a control apparatus may also be comprised in a radio network controller. In some embodiments, each base station will have a control apparatus. In other embodiments the control apparatus can be another network element. The control apparatus 300 can be arranged to provide control of communications by communication
15 devices that are in the service area of the system. The control apparatus 300 can be configured to provide control functions in association with generation and communication of transmission patterns and other related information by means of the data processing facility in accordance with certain embodiments described below. For this purpose the control apparatus 300 comprises at least one memory 301, at least one data processing
20 unit 302, 303 and an input/output interface 304. Via the interface the control apparatus can be coupled to a receiver and a transmitter of the base station. The control apparatus 300 can be configured to execute an appropriate software code to provide the control functions.

25 As briefly discussed above, minimisation of drive tests (MDT) was defined in the 3GPP Rel-10 specification. In MDT, the measurements collected from a UE may be referred to as MDT log or MDT data.

UE tracing refers generally to obtaining information, such as network information, from
30 one or more UEs. MDT may be part of a general tracing operation. According to some embodiments tracing mechanisms may be used to obtain the MDT data.

A dedicated entity, known as a trace collection entity (TCE) can be used to store the collected trace/MDT data (also called as MDT record or trace record). The TCE may be a
35 dedicated entity or may be incorporated in another entity. The TCE may comprise a database for storing the Trace/MDT records. Multiple TCEs can co-exist in the same network, and the TCE of a particular trace session can be chosen at the activation time of

trace/MDT job. The chosen TCE may remain fixed for an entire tracing process.

Some of the features of MDT defined in Rel-10 include the ability of a UE to include location information as part of the UE radio measurement reporting; and the ability of a UE to log radio measurements during the UE's idle state.

In a network sharing environment (such as those documented in 3GPP TR32.851), multiple operators can share the same eNB/RNC. In this scenario the same eNB/RNC can serve multiple users belonging to different operators sharing the same RAN resources.

In an area based MDT job, the eNB/RNC collect MDT information from multiple (possibly all) active users. The collected information is then sent (directly or indirectly) to the TCE.

The same eNB/RNC may collect information as part of the same MDT job from multiple users belonging to different operators. Each operator may be identified by a PLMN ID (public land mobile network identifier). Each operator may have different privacy policies limiting the access to any sensitive MDT data.

Accordingly, the present inventors have determined that an eNB/RNC operating an area based MDT job needs to be able to dispatch collected pieces of data (MDT data for example) to the correct operator sharing that eNB/RNC. With a single TCE configured per trace job (as currently standardised), such data dispatching is not possible in practice.

Figure 4 illustrates a current situation with area based MDT. According to the example of Figure 4, only UEs belonging to a single operator are selected for an MDT job. The MDT data from the UEs of a second sharing operator is not collected at all.

Referring to Figure 4 in more detail, an operations, administration and maintenance system (OAM) is shown at 450. An eNB which is shared by multiple operators (in this example operator A and operator B) is shown at 405. One or more UEs belonging to operator A is shown at 401. UEs belonging to operator B are shown at 404. A TCE of operator A is shown at 452. A TCE of operator B is shown at 454.

At step S1 an MDT is activated by a message sent from the OAM system 450 to the shared eNB 405. In this example the Activate(MDT Job) message contains information which enables and/or causes the eNB 405 to obtain MDT data from the UEs of operator A.

In some embodiments this may be an instruction from the OAM to do so. An MDT loop is shown generally at 456.

5 An activation loop is shown generally at 458. In this activation loop, as shown at step S2 the shared eNB 405 sends an "activate" message to one or more UEs of operator A 401. This informs those UEs that MDT measurements are required by the shared eNB 405.

10 As shown at step S3 the UEs of operator A send their report measurements back to the shared eNB 405. Then at step S4 the shared eNB 405 creates a trace file which contains the measurement information i.e. the MDT data. At step S5 this trace file is sent from the shared eNB 405 to the TCE of operator A 452. The MDT data is then stored in the TCE of operator A 452. These measurements can be obtained at any time by the operator as required. It will be understood that the trace file may in some examples also contain other information in addition to the MDT data.

15

It will be noted that in the example of Figure 4 no measurements are taken from the UEs of operator B. Accordingly no measurements are sent to the TCE of operator B.

20 Figure 5 shows a potential development of the Figure 4 scenario, with area based immediate MDT. In the Figure 5 example the UEs of both operators are selected for an MDT job. However, because currently only one TCE can be configured for a trace/MDT job, all the trace logs are delivered to one TCE only, in this case the operator who initiated the trace/MDT job. Therefore this scenario does not fulfil the expectations of the other operator and could also potentially violate the privacy of UEs of the unfulfilled operator (since potentially sensitive data collected from them is exposed to the other operator).
25 This scenario may also violate user consent which may be operator specific.

This is described in more detail with respect to Figure 5.

30 As shown at step S1 the OAM system 550 sends an "activate" message to the shared eNB 505 indicating start of an MDT job. This message includes information which causes the eNB to obtain MDT relating to the UEs of operator A and operator B. The message at step S1 may include an instruction to obtain such measurements.

35 At step S2 the shared eNB 505 sends an "activate" message to the UEs of operator A (in this example the MDT job is initiated by operator A). At step S3 an activate message is also sent to the UEs of operator B 504. Therefore the UEs of operator A and the UEs of

operator B are informed that an MDT job is active and that they need to report measurements back.

At step S4 the UEs of operator A 501 send their measurements back to the shared eNB
5 505. At step S5 the shared eNB 505 creates a trace file for those received measurements, and at step S6 sends the trace file to the TCE of operator A 552.

At step S7 the UEs of operator B 504 send their reported measurements to the shared eNB 505. At step S8 a trace file is created for those measurements, and at step S9 the
10 trace file is sent to the TCE of operator A.

In some examples a single trace file may be used for the MDT data retrieved from the UEs of operator A and operator B.

15 The TCE of operator A 552 can therefore, in this example, store the trace files of the UEs of both operator A and operator B. The trace files may be received separately on a “per-operator” basis, or alternatively the eNB may send the data to the TCE 554 in one or more trace files which contain MDT data for a mixture of UEs from operator A and operator B. In some embodiments the eNB may create one file per UE. It will be appreciated that TCE of
20 operator B 554 has not received any trace files. It will also be appreciated that the privacy of the UEs of operator B may be violated by virtue of being stored at the TCE of operator A (and therefore accessible by operator A).

Figure 6 illustrates an example whereby the trace/MDT logs collected from the UEs of
25 operator B are identified at the TCE of operator A and then either discarded or forwarded to the TCE of operator B.

In more detail, at step S1 the OAM system 650 sends an activate message to shared eNB 605 to begin the MDT job. At step S2 the shared eNB 605 sends an activate message to
30 the UEs of operator A 601, and at step S3 sends an activate message to the UEs of operator B 604, to inform the UEs of operator A and operator B that MDT measurements are required.

At step S4 the measurements from UEs of operator A 601 are sent to the shared eNB
35 605. At step S5 the shared eNB creates a trace file for those measurements, which is sent to the TCE of operator A 652 at step S6.

At step S7 the UEs of operator B 604 forward their measurements to the shared eNB 605. A trace file is created at step S8, which is sent to the TCE of operator A 652 at step S9.

As discussed above, to mitigate security concerns the TCE of operator A can either
5 discard the trace files corresponding to the UEs of operator B, as shown at step S10. Alternatively, as shown at step S11 the TCE of operator A 652 can forward the trace files associated with the UEs of operator B 604 to the TCE of operator B 654.

Therefore it will be appreciated that if measurements from the UEs of only a single
10 operator are used for the measurements (for example so as not to violate any privacy requirements) then the number of UEs from which measurements can be obtained may be reduced, which may reduce the measurement accuracy. On the other hand, if measurements from UEs of multiple operators are used then there may be privacy concerns, since according to current standards these measurements need to be sent to
15 the TCE of one operator only.

Figure 7 shows a signalling based MDT illustration from 3GPP TSG-RAN WG3 meeting number 84; R3-141228. The system shows an MDT server 760, a home subscriber server (HSS) 762, a mobility management entity (MME) 764, and eNB 705 which is
20 shared between participating and hosting operators, and a UE 701. A TCE of the participating operator is shown at 752, and a TCE of the hosting operator is shown at 754.

At step S1 the MDT server sends a trace session activation message to HSS 762. Then, at step S2 the HSS sends an "insert subscriber data" message to MME 764. Then, at
25 step S3 the MME 764 sends a "trace start" message to the sharing eNB 705. Then, at step S4 the sharing eNB 705 sends an MDT configuration message to the UE 701, which informs UE 701 to begin MDT measurements. At step S5 the UE 701 then sends the collected MDT logs to the sharing eNB 705.

Steps S6 and S7 are alternative steps and are not both carried out as part of the same method. At step S6 the sharing eNB 705 sends the trace record to the TCE of the participating operator 752. Alternatively, as shown at step S7 the sharing eNB 705 sends the trace record to the TCE of the hosting operator 754. That is the trace record is sent to either TCE 752 or TCE 754, but not both.
35

In this example it illustrates that in signalling based MDT (where only one UE is selected) there is no ambiguity on which operator the UE belongs to and where the collective logs

- are to be sent (the TCE IP address parameter of the MDT trace job configuration contains the addresses of the desired TCE). That is, as described above, in Figure 7 the two arrows towards "participating operator TCE" and towards "hosting operator TCE" show alternative paths of trace data, and the particular path is selected based on the TCE IP address configurations parameter. That is in signalling based MDT where a single UE is selected, its "owner" operator is known and the TCE of this operator is configured to specify explicitly as part of the trace/MDT job). This mechanism does not work for area based MDT where multiple UEs are selected.
- 10 According to an embodiment, an area based MDT job in a network sharing environment supports data logging to multiple TCEs. To support data logging to multiple TCEs within a single trace job, the trace job configuration is enhanced to have multiple TCE addresses. This enables the trace files for UEs of different operators to be sent to their respective TCE. In embodiments the maximum number of TCE addresses per MDT job is no fewer than the maximum number of operators sharing a network element e.g. eNB/RNC. Current standards state that there should be no more than six operators per network element, and therefore in some embodiments no fewer than six TCE addresses per MDT job are configured.
- 20 The TCE addresses are associated with the operators. In some embodiments this is achieved by linking each TCE address to a specific PLMN ID that identifies the operator's network. In some embodiments additional configuration is used to create a mapping table between TCE IDs and TCE addresses that are used for logged MDT. The table may be logged MDT specific. The table may also be enhanced so that for each entry the PLMN ID of the relevant operator is added. Therefore the table mapping TCE ID to TCE address (e.g. IP address), is enhanced by also including a PLMN (operator ID) column. For example a lookup table can be used to make the association between TCE ID, TCE address and PLMN ID.
- 30 Figures 10A to 10C show examples of such mapping tables according to some embodiments.

The Table of Figure 10A comprises column 1070 for TCE IDs, column 1072 for the corresponding TCE IP address, and column 1074 for the TCE PLMN.

35

The Table of Figure 10B comprises column 1070 for TCE ID and column 1074 for TCE PLMN.

The Table of Figure 10C comprises column 1072 for TCE IP address and column 1074 for TCE PLMN.

- 5 Therefore it will be appreciated that the tables of Figures 10A to 10C show a mapping of the identity or address of the TCE, to the identity of the operator of that TCE (i.e. TCE PLMN).

10 It will of course be appreciated that in embodiments these rows and columns will be filled with suitable values. The tables may also be updatable. For example a row may be added or removed as TCEs are respectively added and removed. Also any of the Tables may be updated by the addition or removal of columns. For example Table 10A could be updated by the removal of column 1072, such that it then resembles Table 10B (and vice versa). Table 10A could be updated by the removal of column 1070, such that it then resembles
15 Table 10C (and vice versa)

MDT data collection may be classified in two categories (logged and immediate). In immediate MDT, the eNB activates the measurements for connected UEs and these UEs report individual measurements directly. In logged MDT, the eNB activates logged MDT
20 job to a UE, the UE then goes into idle (disconnected) mode and starts collecting measurements storing them in a local file. When UE containing such a file goes into active/connected mode, this file is transferred to the eNB. For security reasons it is not allowed for UE to know the IP address of the TCE where the logged MDT file will be transferred to. So, the eNB has to maintain the mapping table of TCE identities (TCE
25 numbers known to the UEs running logged MDT jobs) to TCE IP addresses where the log files will be transferred to.

The currently standardised restriction which limits the UE selection for a trace/MDT job to only those with rPLMN (registered PLMN) matching a PLMN ID of the trace reference may
30 be removed/relaxed to facilitate the multiple TCE concept. This may allow UE selection with rPLMN matching any of the TCE PLMNs. According to embodiments each MDT and trace job has an existing parameter, standardised in 3GPP TS32.422 section 5.9, called the IP address of trace collection entity. In embodiments this trace job parameter is extended to allow multiple TCEs (each rPLMN ID), to indicate the specific operator/PLMN
35 the given TCE address is associated with. Then, for each TCE a separate trace file containing trace records of the matching PLMN is created. Each trace record file can then be sent to the correct TCE based on the PLMN ID.

Figure 8 shows a first embodiment. The system comprises OAM system 850, shared eNB 805, UEs of operator A 801, UEs of operator B 804, TCE of operator A 852, and TCE of operator B 854.

5

According to this embodiment the PLMN ID of the TCE is configured as part of the trace job (MDT job). Therefore in this case the activate trace job operation in the trace integration reference point (IRP) is extended so that it can indicate the PLMN ID of the TCE.

10

Referring back to Figure 8, at step S1 the OAM system 850 sends an "activate (MDT job)" message to the shared eNB 805. As discussed briefly above, this activate (MDT job) message includes an identifier of the relevant operator TCEs. These identifiers may be PLMN IDs. That is in this example the activate (MDT job) message will indicate the PLMN IDs of TCE of operator A 852 and TCE operator B 854 to the shared eNB 805. It will be understood that each operator may have more than one PLMN, so for two sharing operators (for example), there may be more than two TCE to PLMN tuples configured in the activation parameters.

15

At step S2 the shared eNB 805 sends an "activate (measurements)" message to the UEs of operator A 801, and at step S3 also sends an activate (measurements) message to the UEs of operator B 804. The activate messages sent at steps S2 and S3 inform the UEs of operator A and B respectively to start recording measurements.

25

At step S4 the shared eNB 805 receives the report measurements from the UEs of operator A 801, and at step S5 creates a trace file for those measurements. At step S6 the shared eNB 805 sends the trace file to the TCE of operator A 852. The TCE of operator A 852 can then store that trace file in memory.

30

At step S7 the UE of operator B sends its report measurements to the shared eNB 805, and at step S8 the shared eNB 805 creates a trace file for those measurements. At step S9 the shared eNB 805 sends the trace file for the UEs of operator B to the TCE of operator B 804. The TCE of operator B 854 can then store that trace file.

35

Therefore it will be appreciated in the embodiments of Figure 8 that TCE of operator A 852 has received trace files relating only to the UEs of operator A, and that the TCE of operator B 854 has received trace files relating only to the UEs of operator B. Therefore

privacy concerns may be mitigated according to this embodiment.

Figure 9 shows a further embodiment. Figure 9 shows the signalling between an OAM system 950, a shared eNB 905, UEs of operator A 901, UEs of operator B 904, TCE of operator A 952, and TCE of operator B 954.

At step S1 a "Configure (TCEs-PLMNs)" message is sent from the OAM system 950 to the shared eNB 905. That is in this embodiment the PLMN ID is configured via the OAM, not via trace IRP. The "configure" message sent at step S1 comprises a configurations attribute indicating the association of TCE addresses to the specific operator (PLMN ID).

At step S2 an "activate (MDT job)" message is sent from the OAM system 950 to the shared eNB 905.

At step S3 an activate (measurements) message is sent to the UEs of operator A 901, and at step S4 an activate (measurements) message is sent from the shared eNB 905 to the UEs of operator B 904. These "activate" messages inform the UEs to begin performing measurements.

At step S5 the report measurements are received from the UEs of operator A 901. Then, at step S6 a trace file is created for those measurements. Then, at step S7 the shared eNB 905 identifies the TCE to which that trace file should be sent. This may be done for example by using a look up table that cross checks the UEs of operator A with the PLMN of its respective TCE. Then, at step S8 the trace file is sent to the identified TCE, in this case TCE of operator A 952.

At step S9 the report measurements are received at the shared eNB 905 from the UEs of operator B 904. Then, at step S10 a trace is created at the shared eNB 905 for those measurements. At step S11 the shared eNB 905 identifies the TCE to which those measurements should be sent, again for example using a look up table which associates the UEs of operator B with in this case the TCE of operator B 954. Then, at step S12 the trace file for the UEs of operator B is sent to the TCE of operator B 954, where the file can be stored in memory.

Therefore it will be appreciated that in the embodiment of Figure 9 privacy and/or security concerns may again be mitigated since the trace files of UEs belonging to a certain operator are only sent to the TCE of the respective operator.

In the embodiments of Figure 8 and Figure 9, when the eNB/RNC decides whether to select a particular UE (e.g. for a cell trace or an area based MDT), and to start a trace recording session for it, the eNB/RNC checks to which PLMN the UE belongs to (in some
5 embodiments this is done by examining the rPLMN of the UE). Once the eNB/RNC determines the PLMN ID, this PLMN is compared with the TCE PLMNs. If the UE's PLMN matches a TCE PLMN, this UE may be selected for the trace/MDT job and the recorded information from this UE can be allocated to the correct trace record. Trace records may be linked to one PLMN ID only. The trace records (or trace files) can then be sent to the
10 corresponding TCEs according to the TCE to PLMN mapping.

It will therefore be appreciated that the embodiments of both Figure 8 and Figure 9 enable MDT data to be sent to multiple TCEs in a secure manner.

15 In some embodiments, the receipt of the "Activate(MDT Job)" message at the shared eNB may cause initiation of the network measurement operation. In other embodiments initiation of the network measurement operation may be separate. In the embodiment of Figure 9 step S1 may be considered a form of pre-configuration i.e. where the TCE-PLMN information is sent to the shared eNB. The step S1 of Figure 8 and the step S2 of Figure 9
20 may be considered equivalent, in that both "Activate(MDT Job)" messages may specify which TCE to use for data collection. The step S1 of Figure 8 may also deliver information of the TCE owner's PLMN. That is the Activate(MDT Job) message of Figure 8 may be enhanced to carry multiple TCEs with multiple PLMNs. Step S2 of Figure 9 may not need this information in the Activate(MDT Job), because of the pre-configuration step at step S1
25 where the TCE-PLMNs are configured. Step S2 in Figure 9 may nevertheless carry information of one or more TCEs (e.g. TCE ID and/or TCE IP address etc.).

It is also noted herein that while the above describes exemplifying embodiments of the invention, there are several variations and modifications which may be made to the
30 disclosed solution without departing from the scope of the present invention.

For example, some of the steps shown in the Figures may be carried out in a different order to that shown. For example in Figures 8 and 9 it is shown that the operation is carried out for Operator A before the operation is carried out for Operator B. It will of
35 course be appreciated that the operation could be carried out for Operator B first, or at least some of the steps may be carried out in parallel for both operators. Aspects from the various examples and embodiments described can also be combined in any suitable way.

In at least some embodiments the network measurements obtained comprise network quality information. For example such network quality information may comprise quality of service.

5

The required data processing apparatus and functions of a base station apparatus, a communication device and any other appropriate station may be provided by means of one or more data processors. The described functions at each end may be provided by separate processors or by an integrated processor. The data processors may be of any type suitable to the local technical environment, and may include one or more of general purpose computers, special purpose computers, microprocessors, digital signal processors (DSPs), application specific integrated circuits (ASIC), gate level circuits and processors based on multi core processor architecture, as non-limiting examples. The data processing may be distributed across several data processing modules. A data processor may be provided by means of, for example, at least one chip. Appropriate memory capacity can also be provided in the relevant devices. The memory or memories may be of any type suitable to the local technical environment and may be implemented using any suitable data storage technology, such as semiconductor based memory devices, magnetic memory devices and systems, optical memory devices and systems, fixed memory and removable memory.

In general, the various embodiments may be implemented in hardware or special purpose circuits, software, logic or any combination thereof. Some aspects of the invention may be implemented in hardware, while other aspects may be implemented in firmware or software which may be executed by a controller, microprocessor or other computing device, although the invention is not limited thereto. While various aspects of the invention may be illustrated and described as block diagrams, flow charts, or using some other pictorial representation, it is well understood that these blocks, apparatus, systems, techniques or methods described herein may be implemented in, as non-limiting examples, hardware, software, firmware, special purpose circuits or logic, general purpose hardware or controller or other computing devices, or some combination thereof.

Some embodiments may be implemented by computer software executable by a data processor of the communication device, such as in the processor entity, or by hardware, or by a combination of software and hardware.

Further in this regard it should be noted that any blocks of the logic flow as in the Figures may represent program steps, or interconnected logic circuits, blocks and functions, or a combination of program steps and logic circuits, blocks and functions. The software may be stored on such physical media as memory chips, or memory blocks implemented within
5 the processor, magnetic media such as hard disk or floppy disks, and optical media such as for example DVD and the data variants thereof, CD.

The memory may be of any type suitable to the local technical environment and may be implemented using any suitable data storage technology, such as semiconductor-based
10 memory devices, magnetic memory devices and systems, optical memory devices and systems, fixed memory and removable memory.

The foregoing description has provided by way of exemplary and non-limiting examples a full and informative description of the exemplary embodiment of this invention. However,
15 various modifications and adaptations may become apparent to those skilled in the relevant arts in view of the foregoing description, when read in conjunction with the accompanying drawings and the appended claims. However, all such and similar modifications of the teachings of this invention will still fall within the scope of this invention as defined in the appended claims. Indeed there is a further embodiment
20 comprising a combination of one or more of any of the other embodiments previously discussed.

Claims

1. A method comprising:
receiving network measurements from a plurality of user equipment at an
5 apparatus carrying out a network measurement operation, each of said user equipment
belonging to one of first and second operators sharing said apparatus;
and using identity information of the first and second operators to handle said
received network measurements in a manner dependent upon whether the user
equipment is associated with the first operator or the second operator.
10
2. A method as set forth in claim 1, wherein said identity information of the first and
second operators comprise Public Land Mobile Network identities.
3. A method as set forth in claim 1 or claim 2, wherein said identity information is
15 stored in a look-up table.
4. A method as set forth in any of claims 1 to 3, comprising receiving said identity
information.
- 20 5. A method as set forth in claim 4, comprising configuring said apparatus with said
received identity information prior to initiation of said network measurement operation.
6. A method as set forth in any of claims 1 to 4, comprising receiving said identity
information as part of initiation of said network measurement operation.
25
7. A method as set forth in any preceding claim, comprising storing received network
measurements for user equipment associated with said first operator separately from
network measurements received from user equipment associated with said second
operator.
30
8. A method as set forth in any preceding claim, comprising selectively sending said
received network measurements to a first information collecting entity associated with said
first operator or a second information collecting entity associated with said second
operator, in dependence on said identity information.
35
9. A method as set forth in claim 8, wherein said first and second information
collecting entities comprise Trace Collection Entities.

10. A method as set forth in any preceding claim, wherein said method comprises a Minimisation of Drive Test.
11. An apparatus comprising
5 at least one processor;
and at least one memory including computer program code;
the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus at least to:
receive network measurements from a plurality of user equipment carrying out a
10 network measurement operation, each of said user equipment belonging to one of first and second operators sharing said apparatus;
and use identity information of the first and second operators to handle said received network measurements in a manner dependent upon whether the user equipment is associated with the first operator or the second operator
15
12. An apparatus as set forth in claim 11, wherein said identity information of the first and second operators comprise Public Land Mobile Network identities.
13. An apparatus as set forth in claim 11 or claim 12, wherein said identity information
20 is stored in a look-up table.
14. An apparatus as set forth in any of claims 11 to 13, wherein the apparatus is configured to receive said identity information.
- 25 15. An apparatus as set forth in claim 14, wherein said apparatus is configured with said received identity information prior to initiation of said network measurement operation.
16. An apparatus as set forth in any of claims 11 to 14, wherein said apparatus is
30 configured to receive said identity information as part of initiation of said network measurement operation.
17. An apparatus as set forth in any of claims 11 to 16, wherein the apparatus is configured to store received network measurements for user equipment associated with
35 said first operator separately from network measurements received from user equipment associated with said second operator.

18. An apparatus as set forth in any of claims 11 to 17, wherein the apparatus is configured to selectively send said received network measurements to a first information collecting entity associated with said first operator or a second information collecting entity associated with said second operator, in dependence on said identity information.
- 5 19. An apparatus as set forth in claim 18, wherein said first and second information collecting entities comprise Trace Collection Entities.
20. An apparatus as set forth in any of claims 11 to 19, wherein the apparatus is
10 configured to carry out a Minimisation of Drive Test.
21. A method comprising:
sending information from a first apparatus to a second apparatus, said second
apparatus shared by at least a first operator and a second operator in a communication
15 network;
said information comprising identity information associated with an information
collecting entity of the first operator and identity information associated with an information
collecting entity of the second operator.
- 20 22. A method as set forth in claim 21, wherein said identity information comprises
Public Land Mobile Network identities.
23. A method as set forth in claim 21 or claim 22, comprising sending said information
prior to initiation of a network measurement operation at said second apparatus.
- 25 24. A method as set forth in claim 21 or claim 22, comprising sending said information
as part of initiation of a network measurement operation at said second apparatus.
25. An apparatus comprising
30 at least one processor;
and at least one memory including computer program code;
the at least one memory and the computer program code configured to, with the at
least one processor, cause the apparatus at least to:
send information to a second apparatus, said second apparatus shared by at least
35 a first operator and a second operator in a communication network;

said information comprising identity information associated with an information collecting entity of the first operator and identity information associated with an information collecting entity of the second operator.

5 26. An apparatus as set forth in claim 25, wherein said identity information comprises Public Land Mobile Network identities.

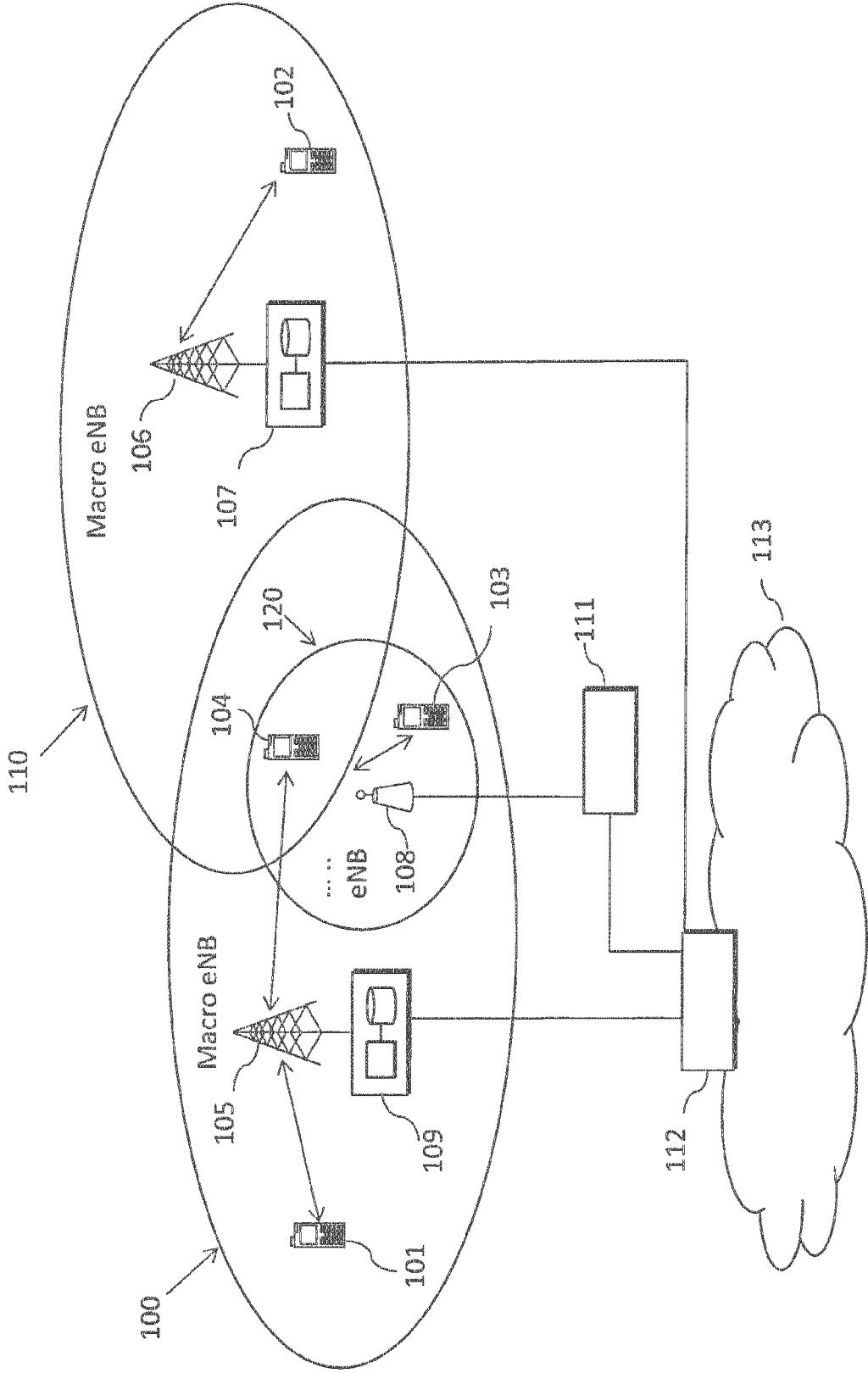
27. An apparatus as set forth in claim 25 or claim 26, wherein said apparatus is configured to send said information prior to initiation of a network measurement operation
10 at said second apparatus.

28. An apparatus as set forth in claim 25 or claim 26, wherein said apparatus is configured to send said information as part of initiation of a network measurement operation at said second apparatus.
15

29. A computer program comprising computer executable instructions which when run on one or more processors perform the method of any of claims 1 to 10.

30. A computer program comprising computer executable instructions which when run
20 on one or more processors perform the method of any of claims 21 to 24.

Figure 1



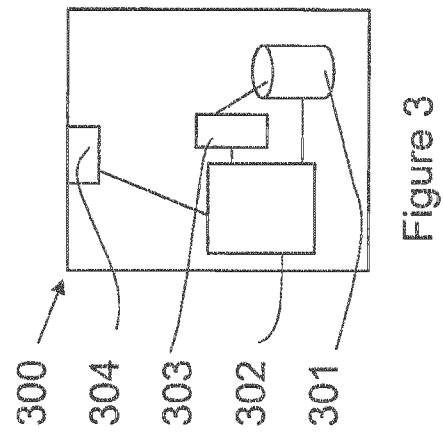
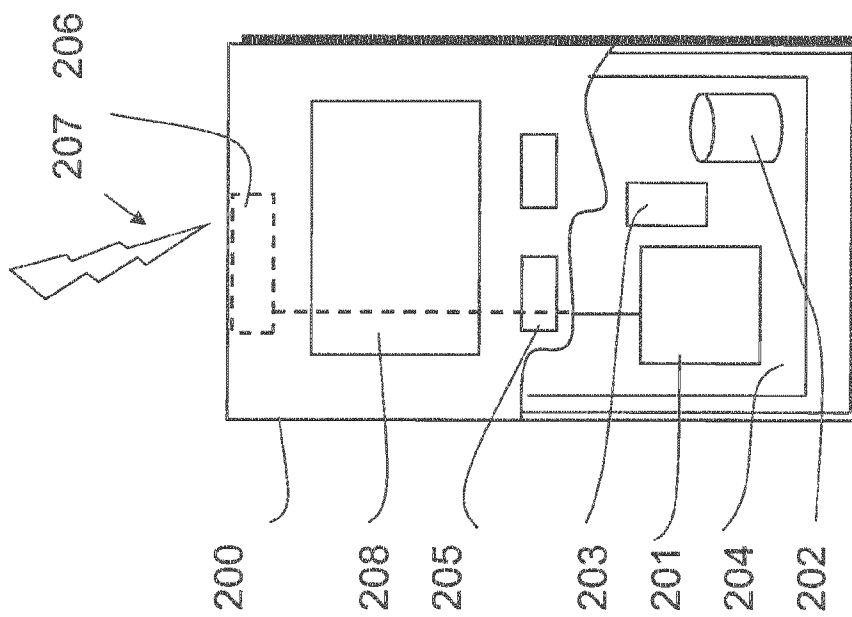


Figure 4

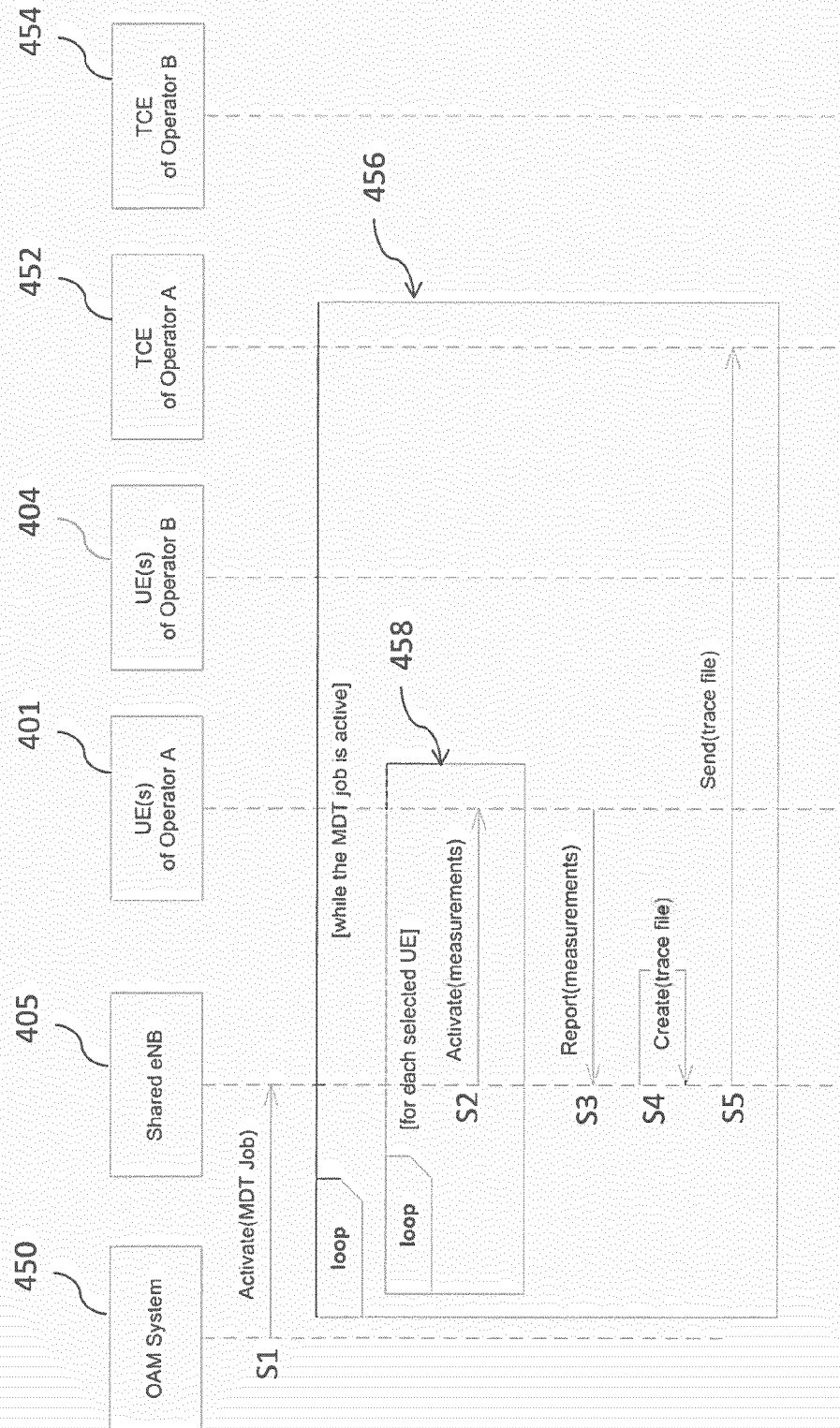


Figure 5

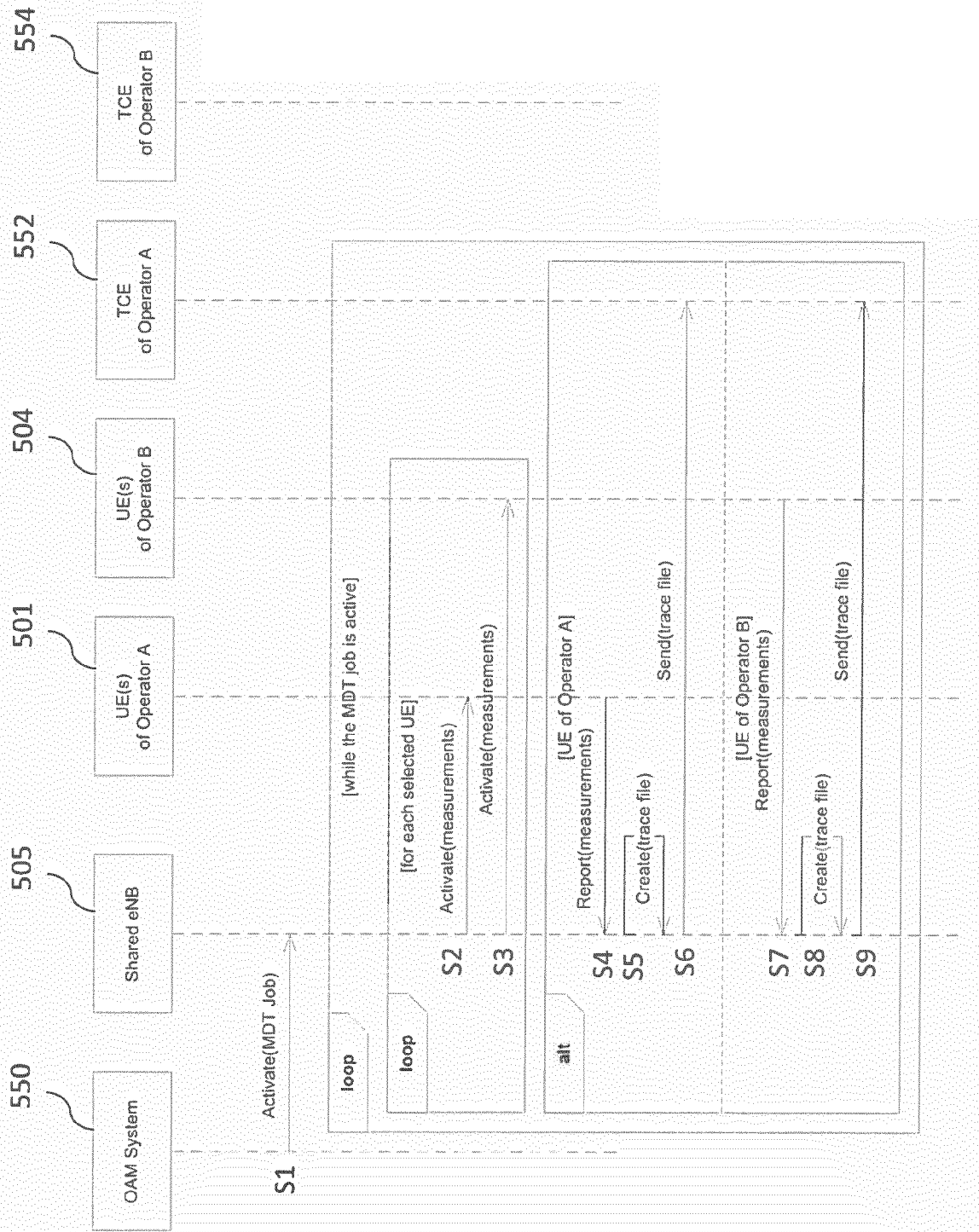


Figure 6

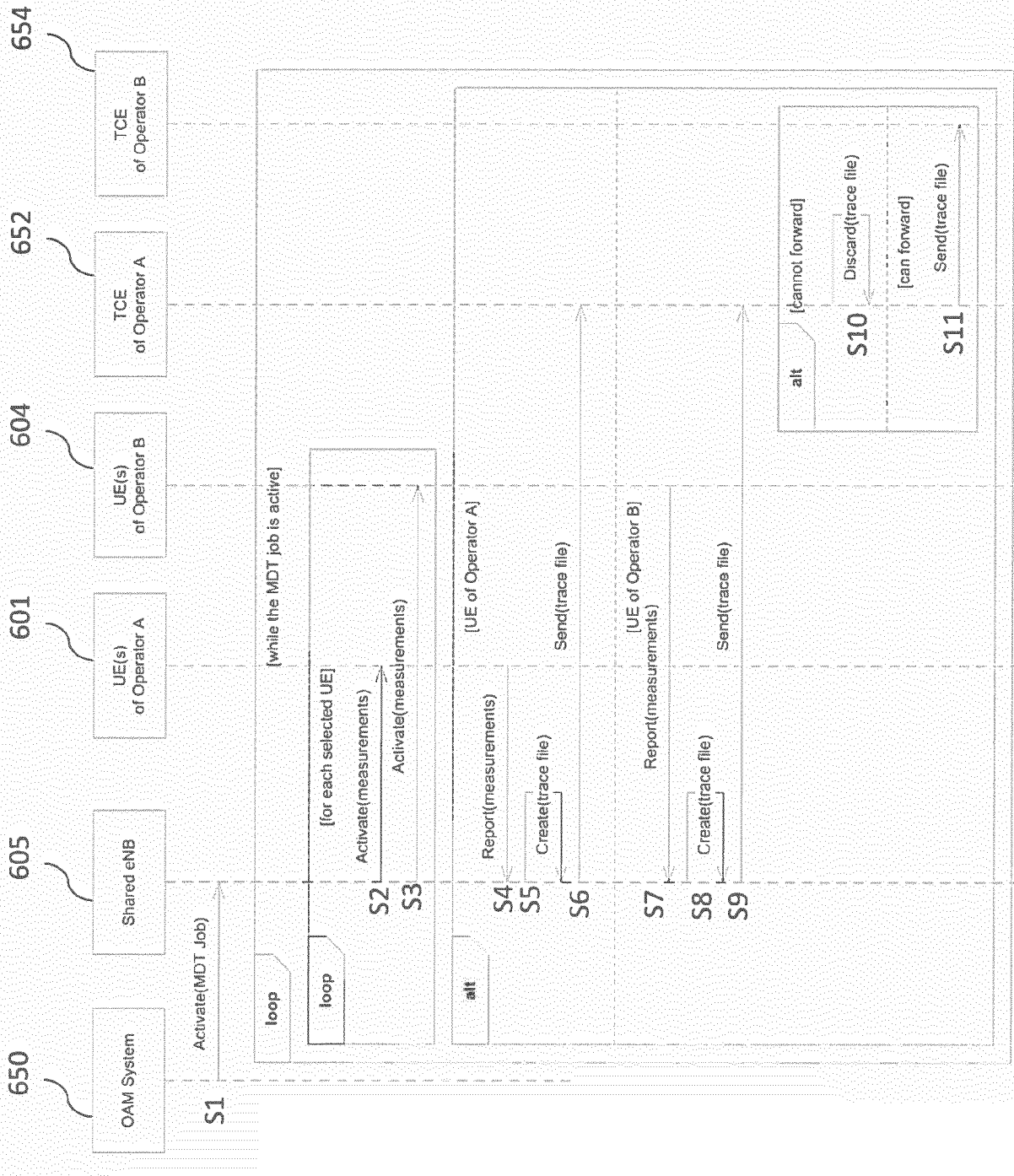


Figure 7

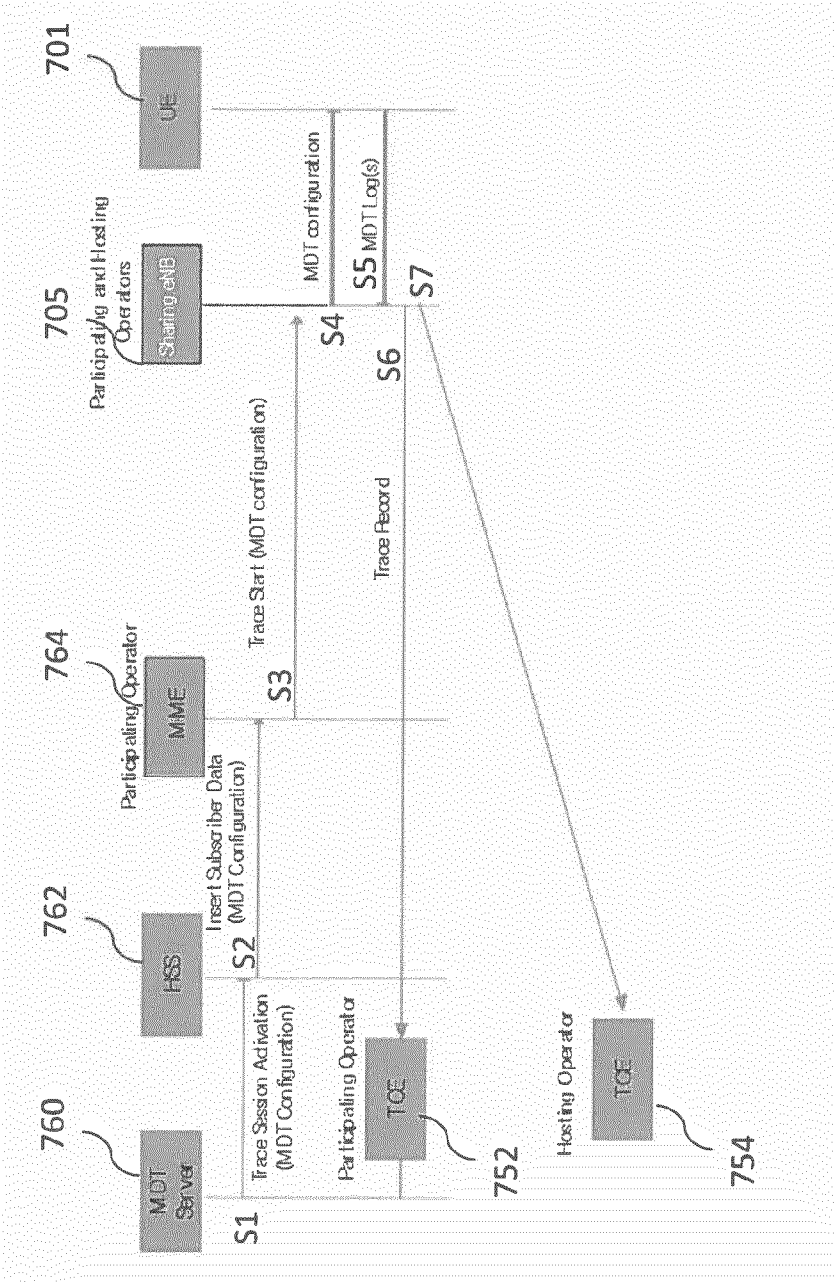


Figure 8

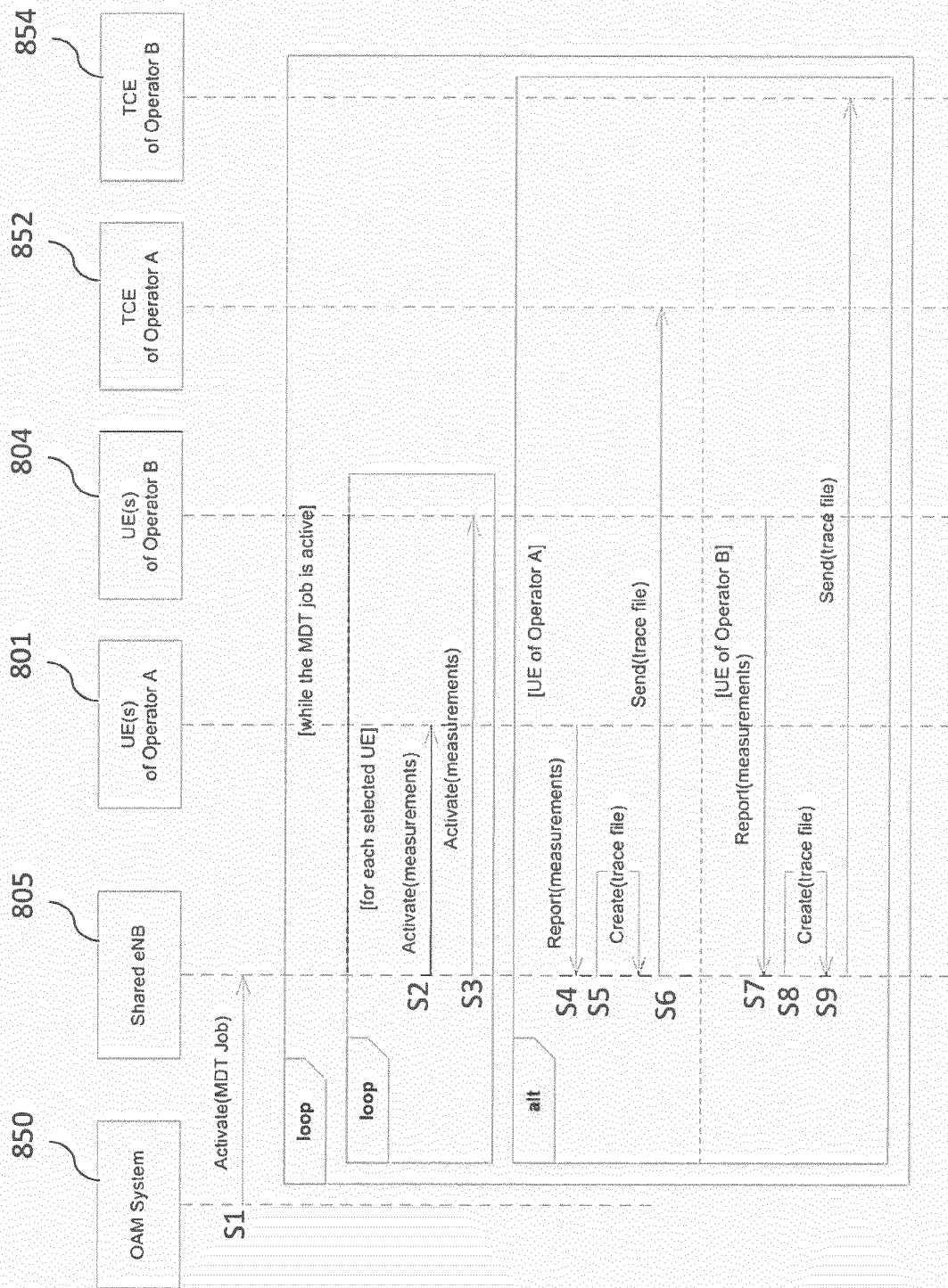
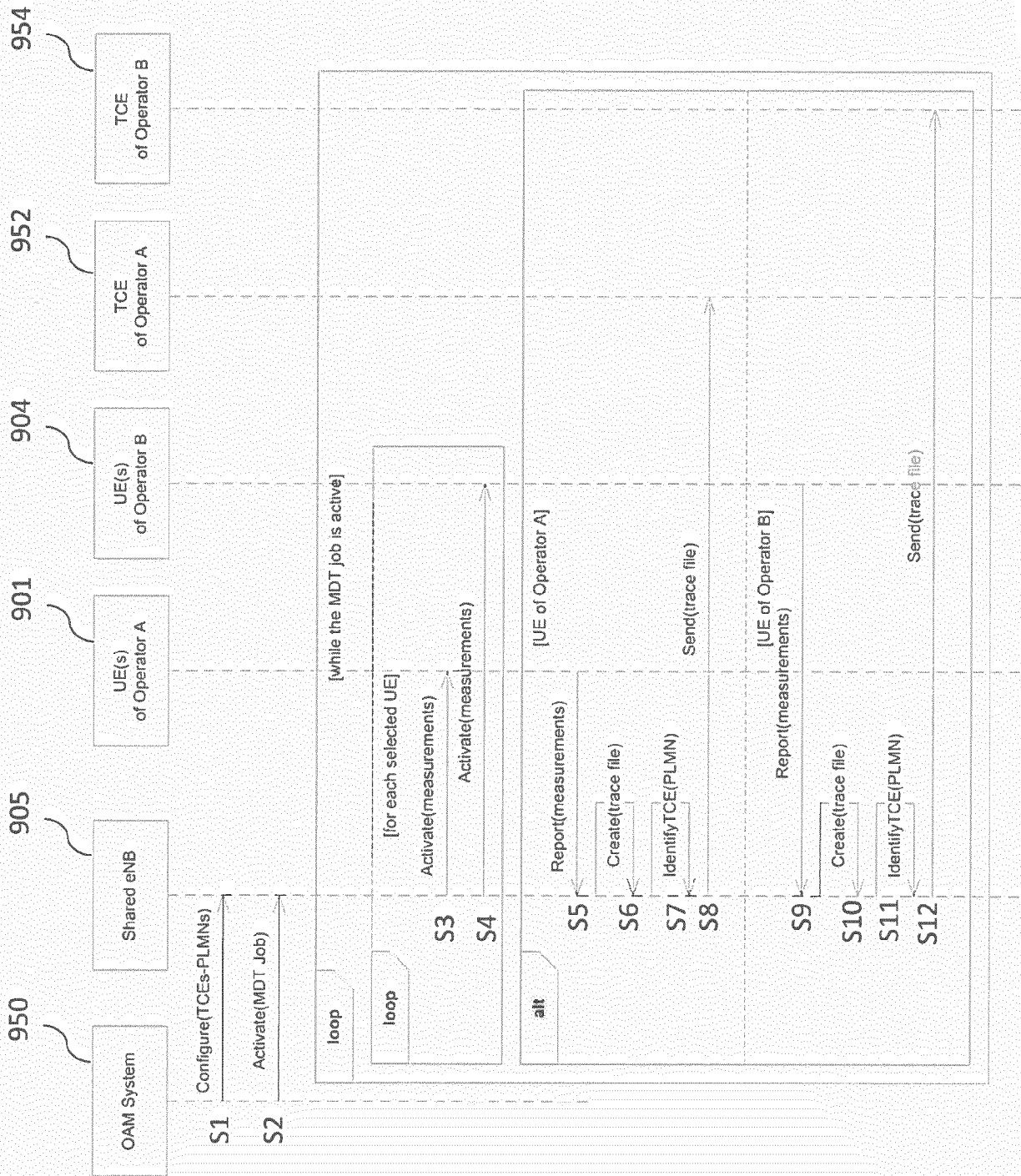


Figure 9



1070 TCE ID	1072 TCE IP	1074 TCE PLMN
...	...	...
...	...	...
...	...	...

Figure 10A

1070 TCE ID	1074 TCE PLMN
...	...
...	...
...	...

Figure 10B

1072 TCE IP	1074 TCE PLMN
...	...
...	...
...	...

Figure 10C

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/065888

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04W24/10
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
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 practicable, search terms used)

EP0-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.
Y	3GPP TR 32.851 V12.2.0 (2014-03): "3GPP TR 32.851 V12.2.0 (2014-03); 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Telecommunication management; Study on Operations, Administration and Maintenance (OAM) aspects of network sharing (Release 12)", 3GPP DRAFT; 32851-C20, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE 14 March 2014 (2014-03-14), XP050907238, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/Specs/2014-12/Rel-12/32_series/ [retrieved on 2014-03-14] -/--	1-20,29

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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

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"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

20 March 2015

Date of mailing of the international search report

30/03/2015

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Authorized officer

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/065888

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	pages 16-19; par. 4.1.7; 4.1.7.1; 4.1.7.2.1; 4.1.7.2.2; 4.1.7.2.3 ----- US 2014/052871 A1 (ANDRIANOV ANATOLY [US] ET AL) 20 February 2014 (2014-02-20) abstract figures 1,2 paragraph [0026] paragraph [0047] - paragraph [0053] paragraph [0065] - paragraph [0069] paragraph [0075] - paragraph [0077] -----	21-28,30
Y	ERICSSON: "3GPP TSG-SA5 Meeting #87, S5-130235; Addition of missing Network Sharing support for MDT", 3GPP DRAFT; 28658 CR0002R1 (REL-11) S5-130235 CR R11 28658-B00 MDT SHARED NETWORK SUPPORT, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHI , vol. SA WG5, no. Malta; 20130114 - 20130118 11 February 2013 (2013-02-11), XP050690251, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/tsg_sa/WG5_TM/ TSGS5_87/Input to SA#59/ [retrieved on 2013-02-11] page 1 par. 4.3.1.2; 4.3.1.3 page 13, "plmnIdList" page 17, "sharNetTceMappingInfoList" ----- -/--	1-30

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/065888

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	"3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Telecommunication management; Subscriber and equipment trace; Trace control and configuration management (Release 12)", 3GPP STANDARD; 3GPP TS 32.422, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. SA WG5, no. V12.2.0, 26 June 2014 (2014-06-26), pages 1-136, XP050774324, [retrieved on 2014-06-26] page 10, par. 3.1 pages 13-16; par. 4.1.1.2a pages 18-22; par. 4.1.1.6a pages 75-76; par. 4.2.2.5; Fig. 4.2.2.5.1 page 77, par. 4.2.2.7 pages 106-108; par. 4.6.2 page 120; par. 5.9 page 121; par. 5.9b -----	1-30

INTERNATIONAL SEARCH REPORT

Information on patent family members

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US 2014052871	A1	20-02-2014	NONE
