

GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

ADAPTIVE MONITORING MECHANISM FOR SERVICE CONFIGURATION INFORMATION

FIELD

- 5 The following disclosure relates to the field of multicast and broadcast services, or more particularly relates to systems, apparatuses and methods for transmitting and/or receiving service configuration information for different multicast/broadcast services provided in a cell.

BACKGROUND

10

3GPP Rel-17 MBS WI specifies broadcast reception for user equipment (UE) that can be in IDLE/INACTIVE/CONNECTED RRC states (e.g. RRC_IDLE, RRC_INACTIVE, RRC_CONNECTED).

15

System Information Block 20 (SIB20) is a message that contains information for the UE to receive the Multicast Control Channel (MCCH) data, including the repetition period and configured transmission/reception window of MCCH. The MCCH data includes control information necessary for the UE to understand the broadcast services provided in the cell and scheduling information to receive the broadcasted data. This information is transmitted periodically by a gNB (gNodeB) with a configurable repetition period and within a configured transmission window.

20

The MCCH provides essential information about the Multicast Traffic Channels (MTCHs), which are the data channels where the broadcast services are provided. This information includes search spaces, Discontinuous Reception (DRX) information, etc. The UE uses this information to receive the relevant MTCH(s). Each Temporary Mobile Group Identity (TMGI), which is an identifier of a specific broadcast service, is mapped to a specific MTCH.

25

To receive the MCCH data, the UE reads and decodes the SIB20 message to learn the MCCH configuration/scheduling details. Then the UE reads the MCCH data to learn about the services provided in the cell and their scheduling information. However, for the UEs in RRC_CONNECTED state, the SIB reading is ignored, and the UE is provided with the search space configuration to receive MCCH within PDCCH-ConfigCommon. While in RRC_INACTIVE state, the UE retrieves information from the SIB20 block such as the MCCH repetition scheduling configuration, window duration, and start slot. The MCCH contents and the repetition window of the MCCH do not change within the modification period.

35

SUMMARY OF SOME EXEMPLARY EMBODIMENTS

The current approach of MCCH monitoring that includes a modification period proves to be not efficient and not scalable in terms of supporting multiple MBS multicast/broadcast services that have different requirements.

- 5 It is thus, inter alia, an object of embodiments disclosed to achieve a more flexible MCCH handling for multicast/broadcast services with different requirements in terms of delay budgets.

According to a first exemplary aspect, a method is disclosed, the method comprising

- 10 - obtaining fallback configuration information indicative of a fallback configuration for monitoring service configuration set information, the service configuration set information being indicative of a set of service configurations, the set of service configurations comprising service configurations for different services provided in a cell,
- determining a service configuration monitoring interval for a corresponding service configuration within the set of service configurations based, at least in part, on the fallback configuration information, and
- 15 - monitoring the service configuration set information based, at least in part, on the service configuration monitoring interval for the corresponding service configuration.

The service configuration set information may for example be periodic service configuration set information.

20

It is conceivable that the method comprises, for example,

- determining service configuration monitoring intervals for a corresponding service configuration within the set of service configurations based, at least in part, on the fallback configuration information, and
- 25 - monitoring the service configuration set information based, at least in part, on the service configuration monitoring intervals for the corresponding service configuration.

The fallback configuration information may be included in a System Information Block message, in particular System Information Block 20 (SIB20) message, and/or in an MCCH message. For example, SIB20 and/or MCCH message may contain a special field X as fallback configuration information, the special field X including information elements indicative of the fallback configuration. The fallback configuration may be for monitoring multicast and broadcast service configuration set information. Thus, the service configuration set information may be a broadcast and broadcast service configuration set information, Such a service configuration set information or such a multicast and broadcast service configuration set information may be indicative of a set of service configurations. In case of multicast and broadcast service configuration set information, the set of service configurations may comprise service configurations for different multicast and broadcast services, e.g. provided in a cell.

30

35

Example embodiments of all aspects may use (e.g. only) one periodic MCCH. As used herein, the term “MCCH” may be understood to represent a full (MCCH) message. The term “MCCH part(s)” may be understood to represent one or more parts of the full (MCCH) message. If multiple (e.g. at least two) MCCHs are introduced, a respective fallback configuration may be applied to different MCCHs, e.g. rather than MCCH parts of the same MCCH (e.g. full message).

The service configuration set information may contain information for provided multicast/broadcast services available in a cell, in particular information about the Multicast Traffic Channels (MTCHs) of the respective services, e.g. including information about search spaces, DRX information etc. The service configuration set information may be a MCCH message. The cell may be a PCell, SCell and/or PSCell, for example.

The services may be broadcast and/or multicast services provided in a cell. For example, Rel-18 multicast contains RRC_INACTIVE MCCH operation.

Obtaining may include receiving, in particular receiving a SIB20 and/or MCCH message. Obtaining may also include decoding, in particular decoding a SIB20 and/or MCCH message.

Determining a service configuration monitoring interval for a corresponding service configuration may for example include: assigning an interval value, which may for example be contained in the fallback configuration, to the service configuration monitoring interval. It is conceivable that the obtained fallback configuration information directly contains one or more values for the the one or more service configuration monitoring intervals so that, for determining the one or more service configuration monitoring intervals, it is sufficient to assign these one or more values to the respective one or more service configuration monitoring intervals. It is also conceivable that the obtained fallback configuration information contains one or more indicators that enable the apparatus, e.g. UE, to further determine, e.g. calculate, the one or more service configuration monitoring intervals. For example, the obtained fallback configuration information may include differential values for the one or more service configuration monitoring intervals which from which the actual service configuration monitoring intervals may be calculated by an addition. For example, the obtained fallback configuration information may include an indicator selecting a predefined service configuration monitoring mode, the predefined service configuration monitoring mode being assigned to one or more predefined service configuration monitoring intervals.

The one or more service configuration monitoring intervals may be determined based, at least in part, on a special field X. The one or more service configuration monitoring intervals may for example be one or more fixed-length intervals or variable-length intervals.

The fallback configuration information may for example apply for a current or for a next modification period. Monitoring the service configuration set information based, at least in part, on the one or more service configuration monitoring intervals for the corresponding service configuration may accordingly be performed for example for a current or for a next modification period.

In an embodiment, the method comprises

- receiving a fallback configuration (e.g. fallback configuration information, for example SIB20);
 - determining, a fallback indication (e.g. one or more service configuration monitoring intervals) for monitoring of MCCH (e.g. service configuration set information) or parts thereof (e.g. service configurations within a set of service configurations);
 - determining types (e.g. multicast/broadcast, type of the service configuration) of MCCH parts (e.g. service configurations within a set of service configurations) in an MCCH corresponding to different services (e.g. multicast/broadcast services);
 - monitoring, within a modification period, the MCCH parts/the MCCH based on repetition period intervals (e.g. service configuration monitoring intervals) corresponding to the different services;
 - determining, change(s) in the MCCH content per service (e.g. in the service configuration of a respective service) within the modification period.
- Provisioning of necessary information or indication related to the MCCHs monitoring periodicity may for example be carried out through SIB20 or the content of MCCH.

The method may further comprise:

- receiving service data of one or more of the different services according to the respective service configurations.

Receiving service data of a respective service may include: receiving MTCH(s) for the respective service.

The method may for instance be performed and/or controlled by a mobile device, e.g. an IoT device, and/or a UE. For instance, the method may be performed and/or controlled by using at least one processor of the mobile device.

The mobile communication network may for instance be a cellular network. The mobile communication network may for example be a mobile phone network like a 2G/3G/4G/5G/New Radio (NR) and/or future cellular communication network. The 2G/3G/4G/5G/NR cellular radio communication standards are developed by the 3GPP and presently available under <http://www.3gpp.org/>.

According to a further exemplary aspect, a computer program is disclosed, the computer program when executed by a processor causing an apparatus, for instance a server, to perform and/or control the actions of the method according to the first exemplary aspect.

5 The computer program may be stored on computer-readable storage medium, in particular a tangible and/or non-transitory medium. The computer readable storage medium could for example be a disk or a memory or the like. The computer program could be stored in the computer readable storage medium in the form of instructions encoding the computer-readable storage medium. The computer readable storage medium may be intended for taking part in the operation of a device, like an internal or external memory,
10 for instance a Read-Only Memory (ROM) or hard disk of a computer, or be intended for distribution of the program, like an optical disc.

According to a further exemplary aspect, an apparatus is disclosed, configured to perform and/or control or comprising respective means for performing and/or controlling the method according to the first
15 exemplary aspect.

The means of the apparatus can be implemented in hardware and/or software. They may comprise for instance at least one processor for executing computer program code for performing the functions, at least one memory storing the program code, or both. Alternatively, they could comprise for instance circuitry
20 that is designed to implement the functions, for instance implemented in a chipset or a chip, like an integrated circuit. In general, the means may comprise for instance one or more processing means or processors.

According to a further exemplary aspect, an apparatus is disclosed, comprising at least one processor and
25 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 an apparatus, for instance the apparatus, at least to perform and/or to control the method according to the first exemplary aspect.

The above-disclosed apparatus according to any aspect may be a module or a component for a device, for
30 example a chip. Alternatively, the disclosed apparatus according to any aspect may be a device, for instance a server or server cloud. The disclosed apparatus according to any aspect may comprise the disclosed components, for instance means, processor, memory, or may further comprise one or more additional components.

35 Such an apparatus (e.g. a mobile device), as used herein, may for instance be portable (e.g. weigh less than 1, 0.9, 0.8, 0.7, 0.6, 0.5, 0.4, 0.3, 0.2, 0.1 kg, or less), like a mobile phone, personal digital assistance device, computer, laptop computer as a non-limiting examples. The apparatus may for instance comprise or be connectable to a display for displaying information, e.g. a picture or a video that is transferred to the

apparatus via the mobile communication network, to name but one non-limiting example. The apparatus may for instance comprise or be connectable to means for outputting sound, e.g. in the form of spoken commands or information.

- 5 According to a second exemplary aspect, a method is disclosed, the method comprising:
- sending service configuration set information, the service configuration set information being indicative of a set of service configurations, the set of service configurations comprising service configurations for different services provided in a cell,
 - sending fallback configuration information indicative of a fallback configuration for monitoring
10 the service configuration set information, the fallback configuration being indicative for a service configuration monitoring interval for a corresponding service configuration within the set of service configurations, and
 - changing a service configuration within the set of service configurations at a time within a
15 modification period adapted to the service configuration monitoring interval for the corresponding service configuration.

Sending service configuration set information may for example be periodically sending service configuration set information.

- 20 Accordingly, the second exemplary aspect inter alia relates to a method comprising:
- periodically sending service configuration set information, the service configuration set information being indicative of a set of service configurations, the set of service configurations comprising service configurations for different services provided in a cell,
 - sending fallback configuration information indicative of a fallback configuration for monitoring
25 the service configuration set information, the fallback configuration being indicative for a service configuration monitoring interval for a corresponding service configuration within the set of service configurations, and
 - changing a service configuration within the set of service configurations at a time within a
30 modification period adapted to the service configuration monitoring interval for the corresponding service configuration.

- The fallback configuration may for example be indicative for service configuration monitoring intervals for a corresponding service configuration within the set of service configurations, and changing a service configuration within the set of service configurations at a time within a modification period may be
35 adapted to the service configuration monitoring intervals for the corresponding service configuration.

The fallback configuration information may be included in a System Information Block message, in particular System Information Block 20 (SIB20) message, and/or in an MCCH message. For example,

SIB20 and/or MCCH message may contain a special field X as fallback configuration information, the special field X including information elements indicative of the fallback configuration.

The service configuration set information may contain information for provided multicast/broadcast services available in a cell, in particular information about the Multicast Traffic Channels (MTCHs) of the respective services, e.g. including information about search spaces, DRX information etc. The service configuration set information may be a MCCH message.

The services may be broadcast and/or multicast services provided in a cell.

Sending may include broadcasting and/or multicasting. Periodically sending may include sending with defined transmission windows and/or repetition periods. The periodic sending may be performed for one or a plurality of modification periods.

The method may further comprise:

- sending service data of the different services according to the respective service configurations.

Sending service data of a respective service may include: sending MTCH(s) for the respective service.

This method may for instance be performed and/or controlled by an apparatus, for instance a radio access node, e.g. a primary node, e.g. an en-gNB or a ng-eNB. Alternatively, this method may be performed and/or controlled by more than one apparatus, for instance the master node (e.g. a eNB, or a ng-eNB) and a secondary node. For instance, the method may be performed and/or controlled by using at least one processor of the radio access node.

According to a further exemplary aspect, a computer program is disclosed, the computer program when executed by a processor causing an apparatus, for instance a server, to perform and/or control the actions of the method according to the second exemplary aspect.

The computer program may be stored on computer-readable storage medium, in particular a tangible and/or non-transitory medium. The computer readable storage medium could for example be a disk or a memory or the like. The computer program could be stored in the computer readable storage medium in the form of instructions encoding the computer-readable storage medium. The computer readable storage medium may be intended for taking part in the operation of a device, like an internal or external memory, for instance a Read-Only Memory (ROM) or hard disk of a computer, or be intended for distribution of the program, like an optical disc.

According to a further exemplary aspect, an apparatus is disclosed, configured to perform and/or control or comprising respective means for performing and/or controlling the method according to the second exemplary aspect.

5 The means of the apparatus can be implemented in hardware and/or software. They may comprise for instance at least one processor for executing computer program code for performing the required functions, at least one memory storing the program code, or both. Alternatively, they could comprise for instance circuitry that is designed to implement the required functions, for instance implemented in a chipset or a chip, like an integrated circuit. In general, the means may comprise for instance one or more
10 processing means or processors.

According to a further exemplary aspect, an apparatus is disclosed, 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 an apparatus, for instance the
15 apparatus, at least to perform and/or to control the method according to the second exemplary aspect.

The above-disclosed apparatus according to any aspect may be a module or a component for a device, for example a chip. Alternatively, the disclosed apparatus according to any aspect may be a device, for instance a server or server cloud. The disclosed apparatus according to any aspect may comprise only the
20 disclosed components, for instance means, processor, memory, or may further comprise one or more additional components.

According to a further exemplary aspect, a system is disclosed, comprising:
at least one apparatus according to the first exemplary aspect as disclosed above, and at least one
25 apparatus according to the second exemplary aspect as disclosed above.

With the aspects described above, it may be possible to provide a mechanism to configure, e.g., MCCH (e.g. service configuration set information) in a more flexible way for different services. In order to flexibly update the content of MCCH per service requirements, the gNB may configure a fallback MCCH mechanism
30 which enables decoding of multiple MCCH repetition for different services within the same modification period that is indicated as fallback, to identify changes in the content of MCCH. Provisioning of necessary information or indication related to the MCCHs monitoring periodicity may be carried out, for example, through SIB20 or the content of the MCCH sets.

35 In the following, exemplary features and exemplary embodiments of all aspects will be described in further detail.

According to an exemplary embodiment of the first exemplary aspect, monitoring the service configuration set information based, at least in part, on the one or more service configuration monitoring intervals for the corresponding service configuration includes:

- monitoring the service configuration set information for changes in the corresponding service configuration.

According to an exemplary embodiment of the first exemplary aspect, the method further comprises:

- determining a fallback usage indicator based, at least in part, on the fallback configuration information, the fallback usage indicator being indicative of whether a fallback configuration is used, in particular during a defined modification period,

wherein determining of one or more service configuration monitoring intervals for a corresponding service configuration and the monitoring of the service configuration set information based, at least in part, on the one or more service configuration monitoring intervals for the corresponding service configuration are performed, in particular during the defined modification period, if the fallback usage indicator indicates that the fallback configuration is used.

The defined modification period may be a current or a next modification period.

The fallback usage indicator may be for example an IE, e.g. A, in a special field X in, e.g., SIB20 or MCCH.

The defined modification period, as used herewith, may be a period within which (e.g. all) transmitted MCCH content is the same, except that (e.g. now) such MCCH(s) may be indicated as fallback for a service. For instance, there may be one or more exceptions for at least some services, so that e.g. MCCH content may change even within the same modification period. However, the modification period as such may be compatible with legacy standard, at least for some services.

According to a further exemplary embodiment, determining of one or more service configuration monitoring intervals for a corresponding service configuration and the monitoring of the service configuration set information based, at least in part, on the one or more service configuration monitoring intervals for the corresponding service configuration are performed, in particular during the defined modification period, if and only if the fallback usage indicator indicates that the fallback configuration is used.

According to an exemplary embodiment of the first exemplary aspect, the method further comprises:

- determining one or more service configuration monitoring intervals for different corresponding service configurations within the set of service configurations based, at least in part, on the fallback configuration information, and

- monitoring the service configuration set information based, at least in part, on the one or more service configuration monitoring intervals for the corresponding service configurations.

Accordingly, the first exemplary aspect inter alia also relates to a method, comprising:

- 5 - obtaining fallback configuration information indicative of a fallback configuration for monitoring periodic service configuration set information, the service configuration set information being indicative of a set of service configurations, the set of service configurations comprising service configurations for different services provided in a cell,
- 10 - determining one or more service configuration monitoring intervals for different corresponding service configurations within the set of service configurations based, at least in part, on the fallback configuration information, and
- monitoring the service configuration set information based, at least in part, on the one or more service configuration monitoring intervals for the corresponding service configurations.

- 15 Monitoring the service configuration set information based, at least in part, on the one or more service configuration monitoring intervals for the corresponding service configurations may for example include: monitoring the service configuration set information for changes in one, some or all of the different corresponding service configurations, for example depending on whether the UE intends to receive one, some or all of the provided services.

20

According to an exemplary embodiment of the first exemplary aspect, determining one or more service configuration monitoring intervals for different corresponding service configurations within the set of service configurations based, at least in part, on the fallback configuration information includes:

- 25 - determining a service configurations number based, at least in part, on the fallback configuration information, the service configurations number being indicative of the number of service configurations within the set of service configurations, and
- determining one or more service configuration monitoring intervals for said number of service configurations based, at least in part, on the fallback configuration information.

- 30 The service configurations number may be for example an IE, e.g. B, in a special field X in, e.g., SIB20 or MCCH.

According to an exemplary embodiment of the first exemplary aspect, determining one or more service configuration monitoring intervals for a corresponding service configuration includes:

- 35 - determining a fixed repetition period monitoring interval based, at least in part, on the fallback configuration information, the fixed repetition period monitoring interval being indicative for a fixed repetition period of the one or more service configuration monitoring intervals for the corresponding service configuration, and

- determining the one or more service configuration monitoring intervals based, at least in part, on the fixed repetition period monitoring interval.

The fixed repetition period monitoring interval may be included for example in an IE, e.g. Y, in a special field X in, e.g., SIB20 or MCCH. For example, Y may contain one or more fixed repetition period monitoring intervals for the service configurations in the set of service configurations.

The fixed repetition period monitoring interval may for example imply one or more service configuration monitoring intervals for monitoring a service configuration within the set of service configurations in every 2nd, 3rd, 4th or 5th etc. service configuration set information, e.g. MCCH.

The one or more service configuration monitoring intervals may for example apply for a defined modification period, for example a current or a next modification period.

Determining the one or more service configuration monitoring intervals based, at least in part, on the fixed repetition period monitoring interval may include: skipping the remaining MCCH of the modification period if the fixed repetition period monitoring interval corresponds to a defined skip index, for example 0.

The fixed repetition period of the one or more service configuration monitoring intervals for the corresponding service configuration, may be fixed repetitions within a specific modification period.

According to an exemplary embodiment of the first exemplary aspect, determining one or more service configuration monitoring intervals for a corresponding service configuration includes:

- determining a set of monitoring interval indices based, at least in part, on the fallback configuration information, the monitoring interval indices being indicative of indices for the service configuration, for example periodic service configuration set information, and
- determining the one or more service configuration monitoring intervals based, at least in part, on the set of monitoring interval indices.

The set of monitoring interval indices may be included for example in an IE, e.g. Y, in a special field X in, e.g., SIB20 or MCCH. For example, Y may contain sets of monitoring interval indices for the service configurations in the set of service configurations.

The set of monitoring interval indices may indicate the order numbers of the service configuration set informations, e.g. MCCHs, within a modification unit to be monitored. For example, the set of monitoring interval indices may indicate that the MCCHs with indices 1, 3 and 7, i.e. the 1st, 3rd and 7th MCCH message in the modification unit has to be monitored for changes of the service configuration of a respective

service. One or more indices of the set of monitoring interval indices may be mapped to MCCH parts, for instance.

According to an exemplary embodiment of the first exemplary aspect, monitoring the service

5 configuration set information based, at least in part, on the one or more service configuration monitoring intervals for the corresponding service configuration includes:

- monitoring the service configuration set information for occurrence, existence or presence of a monitoring skip indicator, and,
 - upon occurrence or upon determining the existence or presence of the monitoring skip indicator,
- 10 skipping, in particular for a current modification period, the monitoring of the service configuration set information based on the one or more service configuration monitoring intervals for the corresponding service.

The skipping may apply for example for a respective service or for the service configuration set
15 information, e.g. MCCH, as a whole. The monitoring skip indicator may constitute an interrupt flag in the MCCH indicating that no further changes will occur until the next modification period, for example, either for a service configuration of a respective service or for the service configurations of all services. The skipping may for instance be or comprise at least one of not following the fallback configuration, or not monitoring of the fallback configuration at least for the rest e.g. of a/the current (e.g. ongoing)
20 modification period.

After the first occurrence, existence or presence of the monitoring skip indicator in a service configuration set information (e.g. MCCH), the monitoring skip indicator may be included in (e.g. all) following service configuration set informations (e.g. MCCHs) within the same modification period to ensure that it is
25 received by (e.g. all) UEs.

According to an exemplary embodiment of the first exemplary aspect, the method further comprises:

- determining one or more fallback configuration intervals based, at least in part, on the fallback configuration information, the one or more fallback configuration intervals indicating the
30 applicability of the fallback configuration for a plurality of modification periods in a series of consecutive modification periods,

wherein monitoring the service configuration set information based, at least in part, on the one or more service configuration monitoring intervals for the corresponding service configuration is performed for said plurality of modification periods.

35

The fallback configuration interval may be for example an IE, e.g. A, in a special field X in, e.g., SIB20 or MCCH. The fallback configuration interval may indicate the periodicity of the fallback configurations in a series of modification periods. For example, the fallback configuration interval, e.g. a fallback

configuration interval of 2, 3, 4 etc., may indicate that the fallback configuration applies for every 2nd, 3rd, 4th etc. modification period.

According to an exemplary embodiment of the first exemplary aspect, obtaining fallback configuration information includes:

- receiving a service configuration set information, and
- determining the fallback configuration information based, at least in part, on the service configuration set information.

The fallback configuration information, including, for example the fallback usage indicator, service configurations number, fixed repetition period monitoring interval and/or set of monitoring interval indices, may be included in the service configuration set information, for example in MCCH. In particular, the service configuration set information (e.g. MCCH) may contain special field X.

According to an exemplary embodiment of the first exemplary aspect, the apparatus is or is part of a mobile device and/or an Internet-of-Things, IoT device, or a user equipment (UE). For example, the mobile device or IoT device or UE may be or may be part of an autonomous driverless vehicle, an air taxi, a location and context awareness assisted multiplayer gaming in extended reality environment (AR+VR+mixed reality), a geofencing application, a V2X scenario, or combinations thereof, to name a few non-limiting examples.

According to an exemplary embodiment of the second exemplary aspect, the fallback configuration information is indicative for a fallback usage indicator, the fallback usage indicator being indicative of whether a fallback configuration is used, in particular during a defined modification period, and changing a service configuration within the set of service configurations at a time within a modification period is only performed if the fallback usage indicator indicates that the fallback configuration is used.

According to an exemplary embodiment of the second exemplary aspect, the method comprises:

- sending fallback configuration information indicative of a fallback configuration for monitoring the service configuration set information, the fallback configuration being indicative for a service configuration monitoring interval for different corresponding service configurations within the set of service configurations, and
- changing service configurations within the set of service configurations at respective times within a modification period adapted to the respective service configuration monitoring interval for the corresponding service configurations.

Accordingly, the second exemplary aspect inter alia also relates to a method, comprising:

- periodically sending service configuration set information, the service configuration set information being indicative of a set of service configurations, the set of service configurations comprising service configurations for different services provided in a cell,
- sending fallback configuration information indicative of a fallback configuration for monitoring the service configuration set information, the fallback configuration being indicative for a service configuration monitoring interval for different corresponding service configurations within the set of service configurations, and
- changing service configurations within the set of service configurations at respective times within a modification period adapted to the respective service configuration monitoring interval for the corresponding service configurations.

It is conceivable that the method comprises, for example,

- sending fallback configuration information indicative of a fallback configuration for monitoring the service configuration set information, the fallback configuration being indicative for service configuration monitoring intervals for different corresponding service configurations within the set of service configurations, and
- changing service configurations within the set of service configurations at respective times within a modification period adapted to the respective service configuration monitoring intervals for the corresponding service configurations.

20

According to an exemplary embodiment of the second exemplary aspect, the fallback configuration information is indicative of a service configurations number, the service configurations number being indicative of the number of service configurations within the set of service configurations.

- 25 According to an exemplary embodiment of the second exemplary aspect, the fallback configuration information is indicative of a fixed repetition period monitoring interval, the fixed repetition period monitoring interval being indicative for a fixed repetition period of the one or more service configuration monitoring intervals for the corresponding service configuration.

- 30 According to an exemplary embodiment of the second exemplary aspect, the fallback configuration information is indicative of a set of monitoring interval indices, the monitoring interval indices being indicative of indices for the service configuration set information, e.g. periodic service configuration set information, the indices corresponding to the one or more service configuration monitoring intervals.

- 35 According to an exemplary embodiment of the second exemplary aspect, the method comprises:
- at a skip time during a current modification period, including a monitoring skip indicator into the service configuration set information,

wherein changing a service configuration within the set of service configurations at a time within a modification period adapted to the one or more service configuration monitoring intervals for the corresponding service configuration is not performed after (or upon) occurrence, existence or presence, or after (or upon) determining an existence or presence of the skip indicator in the service configuration set information.

According to an exemplary embodiment of the second exemplary aspect, the fallback configuration information is indicative of one or more fallback configuration intervals, the one or more fallback configuration intervals indicating the applicability of the fallback configuration for a plurality of modification periods in a series of consecutive modification periods, and the method comprises:

- changing a service configuration within the set of service configurations at a time within said plurality of modification periods adapted to the one or more service configuration monitoring intervals for the corresponding service configuration.

According to an exemplary embodiment of the second exemplary aspect, the service configuration set information includes the fallback configuration information.

According to an exemplary embodiment of the second exemplary aspect, the apparatus is or is part of a source master node of the mobile communication network.

The features and example embodiments described above may equally pertain to the different aspects.

It is to be understood that the embodiments and aspects in this section is merely by way of examples and non-limiting.

Other features will become apparent from the following detailed description considered in conjunction with the accompanying drawings. It is to be understood, however, that the drawings are designed solely for purposes of illustration, for which reference should be made to the appended claims. It should be further understood that the drawings are not drawn to scale and that they are merely intended to conceptually illustrate the structures and procedures described herein.

BRIEF DESCRIPTION OF THE DRAWINGS

In the figures show:

Fig. 1 a schematic diagram of a system according to an exemplary aspect;

- Fig. 2 a signalling chart showing an example embodiment of a method for periodically signalling service configuration set information and an example embodiment of a method for monitoring the service configuration set information;
- Fig. 3 a signalling chart showing an example embodiment of a method according to the first exemplary aspect and further showing an example embodiment of a method according to the second exemplary aspect;
- Fig. 4 a signaling chart showing a further example embodiment of a method according to the first exemplary aspect and further showing a further example embodiment of a method according to the second exemplary aspect;
- Fig. 5 a signaling chart showing a further example embodiment of a method according to the first exemplary aspect and further showing a further example embodiment of a method according to the second exemplary aspect;
- Fig. 6 a signaling chart showing a further example embodiment of a method according to the first exemplary aspect and further showing a further example embodiment of a method according to the second exemplary aspect;
- Fig. 7 a signaling chart showing a further example embodiment of a method according to the first exemplary aspect and further showing a further example embodiment of a method according to the second exemplary aspect;
- Fig. 8 a schematic block diagram of an apparatus configured to perform the method according to the first exemplary aspect;
- Fig. 9 a schematic block diagram of an apparatus configured to perform the method according to the second exemplary aspect;
- Fig. 10 a schematic flow diagram of a further example embodiment of a method according to the first exemplary aspect; and
- Fig. 11 a schematic flow diagram of a further example embodiment of a method according to the second exemplary aspect.

DETAILED DESCRIPTION OF SOME EXEMPLARY EMBODIMENTS

- The following description serves to deepen the understanding of the exemplary embodiments and shall be understood to complement and be read together with the description as provided in the above summary section of this specification.

Fig. 1 is a schematic diagram of a system according to an exemplary aspect. The system 100 comprises a mobile device 130-1, which may be a UE/IoT device.

The system 100 further comprises a plurality of gNBs 120-1 to 120-3 with corresponding cells 140-1 to 140-3. The gNBs 120-1 to 120-3 are part of mobile communication network.

The signals of gNBs 120-1 are observable by the mobile device 130-1 and the mobile device 130-1 is served by gNB 120-1 within the cell 140-1. There may be other mobile devices 130-2 to 130-3, which may be UE/IoT devices, e.g. a mobile phone or an autonomously driving vehicle.

5

A plurality of different broadcast and/or multicast services (MBS) may be provided by gNB 120-1 in cell 140-1 over Multicast Traffic Channels (MTCH) which are the data channels where the multicast/broadcast services are provided.

- 10 gNB 120-1 provides information about the Multicast Traffic Channels (MTCHs) by, e.g. periodically, sending Multicast Control Channel (MCCH) messages which contain MTCH information (e.g. service configuration information) for the mobile devices within cell 140-1, such as mobile device 130-1, to receive the MTCH. Said MTCH information may include control information necessary for the mobile device to understand the multicast/broadcast services provided in the cell and scheduling information to
- 15 receive the multicasted/broadcasted data.

The MCCH message is transmitted, e.g. periodically, by gNB 120-1 with a configured repetition period and within a configured transmission window.

- 20 gNB 120-1 provides information about the MCCH by sending SIB20 messages. SIB20 contains information (e.g. fallback configuration information) for mobile devices to receive the MCCH data, including the repetition period and configured transmission/reception window of MCCH.

Mobile device 130-1 may be in RRC_IDLE, RRC_INACTIVE or RRC_CONNECTED state.

25

- If mobile device 130-1 is in RRC_IDLE or RRC_INACTIVE state, in order to receive MBS, mobile device 130-1 receives SIB20 message which is sent by gNB 120-1. Mobile device 130-1 then decodes the SIB20 message and therewith determines the MCCH configuration/scheduling details (e.g. service configuration set information). Then mobile device 130-1 receives the MCCH message sent by gNB 120-1 to learn about
- 30 which MBSs are provided in the cell 140-1 and their scheduling information. Mobile device 130-1 is then able to receive the desired MBSs over the respective MTCHs.

- Fig. 2 is a signalling chart 200 showing an example embodiment of how a standard process for periodically signalling service configuration set information (e.g. MCCH) by a gNB 220 and monitoring of the same by a UE 230 may be performed.
- 35

For example, UE 130-1 may be configured as UE 230 and/or source gNB 120-1 may be configured as gNB 220.

The process may comprise some or all of the following steps:

- 5 Step 250: gNB transmits SIB20 message to the UE.
- Step 251: UE decodes SIB20 and therewith determines the MCCH configuration/scheduling details.
- 10 Step 252a: gNB periodically sends MCCH messages with defined transmission windows and
repetition periods (Δt) within consecutive modification periods. The MCCH messages
sent within one modification period are identical.
- 15 Step 252b: UE monitors for MCCH messages based on the information in the SIB20 message. When
UE has received an MCCH message within a modification period, UE can skip the
remaining MCCH messages within the same modification period as they are identical.
With the received MCCH messages, UE receives the information necessary for receiving
the desired MBSs provided by gNB.
- 20 Rel-17 MBS W1 has specified broadcast reception for the UEs that can be in IDLE/INACTIVE/CONNECTED
RRC states.
- In order for the UE to receive the MBS broadcast in the RRC_IDLE/RRC_INACTIVE state, SIB20 includes
the necessary information for the UE to receive the Multicast Control Channel (MCCH) information
including the repetition period and configured transmission/reception window of MCCH.
- 25 The MCCH information, that is the control information for the UE to understand which broadcast services
are provided in the cell and the scheduling information to receive the broadcasted data (see TS 38.331
Sec. 5.9), is transmitted periodically by a base station (e.g. gNB) using a configurable repetition period and
within a configured transmission window.
- 30 MCCH provides the information about the Multicast Traffic Channels (MTCHs) (the data channels where
the broadcast services are provided). This information includes search spaces, discontinuous reception
(DRX) information, etc. for the UE to be able to receive the relevant MTCH(s). Each TMGI – which is an
identifier of a specific broadcast service – is mapped to a specific MTCH.
- 35 UE reads and decodes the SIB20 message and learns the MCCH configuration/scheduling details. Then the
UE reads the MCCH to learn about which services are provided in the cell and their scheduling
information.

For the UEs in RRC_CONNECTED state, SIB reading is bypassed, as the UE is provided with the search space configuration to receive MCCH within PDCCH-ConfigCommon. For the UEs in RRC_CONNECTED state, a respective base station (e.g. gNB) may configure a/the search space configuration(s) in such a way that a respective UE in RRC_CONNECTED state can monitor also fallback configurations. Further, for the
5 UEs in RRC_CONNECTED state, a respective UE may be provided with (e.g. get) such fallback configuration(s) from MCCH, e.g. rather than from SIB.

Fig. 2 illustrates the MCCH transmission operation of Rel-17 MBS in a cell.

- 10 As per Rel-18 WID on MBS, reception of MBS multicast services by the UEs in RRC_INACTIVE will be specified. Towards reception of the PTM configuration two approaches have been widely agreed upon for further studies. One of them is direct RRC signalling through which the MCCH contents will be delivered to the UE and the second approach is similar to broadcast reception in RRC_INACTIVE. For broadcast in RRC_INACTIVE, the UE reads the SIB20 block to obtain some of the important parameters like
15 configuration of the MCCH repetition scheduling, window duration and the respective start slot. The MCCH contents and the repetition window of the MCCH do not change within the modification period.

- It is envisaged that MBS broadcast/ multicast services will be implemented by the operators for mission critical and latency sensitive applications for e.g. V2X scenarios, autonomous driverless vehicles, air taxis,
20 location and context awareness assisted multiplayer gaming in extended reality environment (AR+VR+mixed reality), geofencing applications.

- The main problem for the solution whereby a single MCCH with corresponding modification and repetition periods along with a single MCCH window is configured and sent along with SIB20, is the issue
25 of application diversity for a single given UE or for multiple UEs. For next generation UEs, it can be assumed that UEs with suitable capability may have to process multiple MBS multicast/broadcast services with different requirements in terms of delay budgets. Therefore, UEs monitoring a specific MCCH with a “one size fits all” modification period for all the MBS services in a cell is not an efficient and scalable approach.

- 30 For example, in some use cases the non-adaptive nature of modification period with long time duration is a significant constraint since the UEs will have to wait till the end of this long modification period to get an updated configuration for an MBS service, even if that service requires short latency for the MBS multicast reception, i.e., gNB is not allowed to change the content of MCCH within a modification period. The
35 modification period limits the latency performance with which a multicast/broadcast service can be started/stopped in the cell. On the other hand by choosing the modification period small would lead to UEs trying to acquire MCCH too frequently (UEs should at least try to decode the first MCCH repetition of

the modification period in order to see whether there are any changes in the modification period). For that reason, a small modification period may mean unnecessary energy consumption at the UE side.

Thus, one MCCH configuration for all the services is a sub-optimal solution agreed in 3GPP for the baseline broadcast behavior, which needs further enhancements.

It has been conceived to configure and provision multiple MCCHs for the UEs where each MCCH has its corresponding unique modification period. However, such an approach has its complications and is not favorable.

Fig. 3 is a signalling chart 300 showing an example of how an exemplary process for, e.g. periodically, signalling service configuration set information by a gNB 320 and monitoring of the same by a UE 330 may be performed.

Fig. 3 further shows an example embodiment of a method according to the first exemplary aspect and further showing an example embodiment of a method according to the second exemplary aspect. UE 330 may be an example embodiment for an apparatus according to the first exemplary aspect. Further, source gNB 320 may be an example embodiment for an apparatus according to the second exemplary aspect.

The process may comprise some or all of the following steps:

Step 350: gNB transmits SIB20 message to the UE. The SIB20 message includes fallback configuration information, e.g. including a special field X that includes information elements (IEs). $X = \{A; B; Y\}$, wherein

- A is a fallback usage indicator denoting whether fallback configuration is used (e.g., $A=1$) or not (e.g., $A=0$);
- B is a service configurations number denoting the number of different types of MCCH parts within the MCCH message, the MCCH parts containing respective service configurations (P, Q, R in Fig. 3) for different MBS within the MCCH message;
- Y is a set of fixed repetition period monitoring intervals for the number of MCCH parts denoted by B.

In an illustrative example shown in Fig. 3, X may be equal to $\{1, 3, 2, 3, 4\}$, that is $A = 1$; $B = 3$ and $Y = \{2, 3, 4\}$.

Step 351: UE decodes SIB20 and therewith determines the MCCH configuration/scheduling details. This includes determining service configuration monitoring intervals for the different MCCH parts based on the special field X provided with the SIB20 message. If the fallback

- usage indicator A denotes that fallback configuration is used (as is the case in the illustrative example shown in Fig. 3), UE may determine service configurations number B (=3 in the illustrative example shown in Fig. 3) and, with this information on the size of set Y, decode Y as a set of fixed repetition period monitoring intervals ({2, 3, 4} in the illustrative example shown in Fig. 3). UE may then determine, based on Y, service configuration monitoring intervals for the individual services configurations (P, Q, R in Fig. 3) in the MCCH message.
- In the illustrative example shown in Fig. 3, the service configuration monitoring intervals are: 2 repetition period intervals for service configuration P, 3 repetition period intervals for service configuration Q and 4 repetition period intervals for service configuration R.
- Step 352a: gNB, e.g. periodically, sends MCCH messages with defined transmission windows and repetition periods (Δt) within consecutive modification periods. An illustrative example of one modification period, during which gNB sends ten MCCH (1) to (10), is shown in Fig. 3. Each MCCH message contains a plurality of MCCH parts (3 in the illustrative example shown in Fig. 3) with service configurations (P, Q, R in Fig. 3) for different MBS. gNB may change the service configurations (P, Q, R) within a modification period. The changes in the service configurations (P, Q, R) are adapted to the service configuration monitoring intervals so that a change in the service configurations (e.g. P) may only occur according to the respective monitoring intervals (e.g. each 2 repetition period interval for service configuration P).
- Step 352b: UE monitors for MCCH messages based on the information in the SIB20 message, in particular based on the determined service configuration monitoring intervals for the service configurations for the services UE intends to receive. In the illustrative example shown in Fig. 3, UE accordingly monitors, in substep 352b.1, for changes of service configuration P in every 2nd MCCH, in substep 352b.2, for changes of service configuration Q in every 3rd MCCH and, in substep 352b.3, for changes of service configuration R within MCCH in every 4th MCCH. The remaining MCCHs/MCCH parts are skipped. Therewith, UE is able to monitor for any changes that may occur to the service configurations P, Q, R during the current modification period.
- With the received service configurations P, Q, R, UE receives the information necessary for receiving the desired MBSs provided by gNB.
- In some example embodiments, UE may monitor for changes of the service configurations for only one or some of the provided services which UE intends to receive, e.g. of the service configurations P and R.

In some example embodiments, per cell specific fallback indication and configuration (e.g. fallback configuration information) is provisioned to the UE through SIB20 message which contains special field X that includes information elements (IEs).

- 5 X may be defined as $X=\{A;B;Y\}$ where,
- A: 1 if fallback MCCH set monitoring is enabled (e.g. fallback configuration is used)
0 if fallback MCCH set monitoring is disabled (e.g. fallback configuration is not used)
- B: number of different types of MCCH parts (e.g. service configurations within a set of service configurations) within the MCCH message, the MCCH parts corresponding to different services
10 (e.g. MBSs)
- Y: indicator for fallback MCCHs or MCCH parts that have be monitored by UE throughout the modification period (e.g. including service configuration monitoring intervals).

- 15 In such example embodiment, if A, which is the first field of the IE X, is set to '1', it may imply that the fallback option is enabled, which indicates that UE is assumed to monitor specific MCCHs within a given modification period with certain periodicity, so that MCCH content may change within the modification period.

- 20 In Fig. 3, service configurations P, Q and R (indicated by boxes with different hatching: linear hatching from bottom left to top right for P, linear hatching from top left to bottom right for Q, cross hatching for R) correspond to different parts of the same MCCH transmitted in a cell. The MCCH is thus a set of service configurations, or, in other words, service configuration set information.

- 25 Tighter hatching of the boxes (e.g. P, Q and R in MCCH (1), P in MCCH (3), Q in MCCH (4) etc.) indicates that the corresponding service configurations are monitored by the UE 330 (also indicated by the arrows from the respective boxes to the boxes of substeps 352b.1, 352b.2 and 352b.3) as these service configurations may change. The other service configurations (boxes with less tight hatching) do not change and are not monitored by UE 330.

- 30 The second field B of the IE X is set as '3' in the illustrative example in Fig. 3 to indicate that there are service configurations for three different services in the same MCCH. The MCCH therefore has three parts represented in Fig. 3 by the differently hatched boxes (P, Q, R). It is conceivable that the second field B of the IE X is omitted in some embodiments.

- 35 In the illustrative example in Fig. 3, the field Y of the IE X is set to $Y=\{2,3,4\}$ for the given modification period. This implies that UE monitors for MCCH modification for the three MCCH parts marked as P, Q and R, respectively, skipping 2, 3 and 4 repetition periods as indicated in IE X. Since there are 1, 2 and 3 MCCH sets between 2, 3 and 4 repetition periods which are skipped by the UE therefore, it also implicitly means

that periodicity of MCCH set monitoring is skipping order of 1, 2 and 3 MCCH sets for the service configurations P, Q and R, respectively.

In case if any element in Y takes value 0, this may imply that for a given service, there is no fallback option so that only the initial MCCH set will be monitored by UE and then UE will wait until the beginning of the next modification period to monitor for the change in MCCH. Thus, gNB cannot change MCCH content within modification period.

The method described is a highly scalable and flexible approach as it allows no limitation on the number of MCCH repetitions within the modification period.

Fig. 4 is a signalling chart 400 showing an example of how an exemplary process for, e.g. periodically, signalling service configuration set information by a gNB 420 and monitoring of the same by a UE 430 may be performed.

Fig. 4 further shows an example embodiment of a method according to the first exemplary aspect and further showing an example embodiment of a method according to the second exemplary aspect. UE 430 may be an example embodiment for an apparatus according to the first exemplary aspect. Further, source gNB 420 may be an example embodiment for an apparatus according to the second exemplary aspect.

The process may comprise some or all of the following steps:

Step 450: Identical to step 350.

Step 451: Identical to step 351.

Step 452a: gNB, e.g. periodically, sends MCCH messages with defined transmission windows and repetition periods (Δt) within consecutive modification periods. An illustrative example of one modification period, during which gNB sends ten MCCH (1) to (10), is shown in Fig. 4. Each MCCH message contains a plurality of MCCH parts (3 in the illustrative example shown in Fig. 4) with service configurations (P, Q, R in Fig. 4) for different MBS. gNB may change the service configurations (P, Q, R) within a modification period. The changes in the service configurations (P, Q, R) are adapted to the service configuration monitoring intervals so that a change in the service configurations (e.g. P) may only occur according to the respective monitoring intervals (e.g. each 2 repetition period interval for service configuration P).

Furthermore, at respective times during the modification period, gNB transmits in MCCH monitoring skip indicators/flags for the respective service configurations. In the

illustrative example shown in Fig. 4, monitoring skip flags (indicated by "X" below the respective box) are included in MCCH for service configurations P and R from MCCH (5) and for service configuration Q from MCCH (7).

- 5 Step 452b: UE monitors for MCCH messages based on the information in the SIB20 message, in particular based on the determined service configuration monitoring intervals for the service configurations for the services UE intends to receive. In the illustrative example shown in Fig. 4, UE accordingly monitors, in substep 452b.1, for changes of service configuration P in every 2nd MCCH, in substep 452b.2, for changes of service configuration
- 10 Q in every 3rd MCCH and, in substep 452b.3, for changes of service configuration R within MCCH in every 4th MCCH. The remaining MCCHs/MCCH parts are skipped .
- Further UE monitors for occurrence, existence, or presence of monitoring skip flags for the respective service configurations in MCCH. Upon occurrence or upon determining the existence or presence of the monitoring skip flag, UE skips the monitoring for the
- 15 respective service configuration for the rest of the current modification period. In the illustrative example shown in Fig. 4, UE accordingly skips monitoring for changes of service configurations P and R after MCCH (5) and of service configuration Q after MCCH (7). Therewith, UE is able to monitor for any changes that may occur to the service configurations P, Q, R during the current modification period.
- 20 With the received service configurations P, Q, R, UE receives the information necessary for receiving the desired MBSs provided by gNB.

- In some example embodiments, MCCH itself may include an interrupt flag (e.g. monitoring stop flag), such that it would indicate to the UEs that the MCCH content will not be changed in the rest of the modification
- 25 period, so that the UEs do not need to monitor the fallback MCCHs. The flag can also be per service/MCCH part (e.g. service configuration in the set of service configurations). The interrupt flag may be repeated in the subsequent MCCH repetitions to guarantee that all UEs reading MCCH receive the flag.

- In Fig. 4, service configurations P, Q and R (indicated by boxes with different hatching: linear hatching from bottom left to top right for P, linear hatching from top left to bottom right for Q, cross hatching for R) correspond to different parts of the same MCCH transmitted in a cell. The MCCH is thus a set of service configurations, or, in other words, service configuration set information.
- 30

- Tighter hatching of the boxes (e.g. P, Q and R in MCCH (1), P in MCCH (3), Q in MCCH (4) etc.) indicates that the corresponding service configurations are monitored by the UE 430 (also indicated by the arrows from the respective boxes to the boxes of substeps 452b.1, 452b.2 and 452b.3) as these service configurations may change. The other service configurations (boxes with less tight hatching) do not change and are not monitored by UE 430.
- 35

Fig. 5 is a signalling chart 500 showing an example of how an exemplary process for, e.g. periodically, signalling service configuration set information by a gNB 520 and monitoring of the same by a UE 530 may be performed.

Fig. 5 further shows an example embodiment of a method according to the first exemplary aspect and further showing an example embodiment of a method according to the second exemplary aspect. UE 530 may be an example embodiment for an apparatus according to the first exemplary aspect. Further, source gNB 520 may be an example embodiment for an apparatus according to the second exemplary aspect.

The process may comprise some or all of the following steps:

Step 550: gNB transmits SIB20 message to the UE. The SIB20 message includes fallback configuration information, e.g. a special field X that includes information elements (IEs). X = {A; B; Y}, wherein

- A is a fallback usage indicator denoting whether fallback configuration is used (e.g., A=1) or not (e.g., A=0);
- B is a service configurations number denoting the number of different types of MCCH parts within the MCCH message, the MCCH parts containing respective service configurations (P, Q, R in Fig. 5) for different MBS within the MCCH message;
- Y is a set of sets of monitoring interval indices for the number of MCCH parts denoted by B.

In an illustrative example shown in Fig. 5, X may be equal to {1, 3, [1, 3, 7], [1, 6, 9], [1, 8, 10]}, that is A = 1; B = 3 and Y = {[1, 3, 7], [1, 6, 9], [1, 8, 10]}.

Step 551: UE decodes SIB20 and therewith determines the MCCH configuration/scheduling details. This includes determining service configuration monitoring intervals for the different MCCH parts based on the special field X provided with the SIB20 message. If the fallback usage indicator A denotes that fallback configuration is used (as is the case in the illustrative example shown in Fig. 5), UE may determine service configurations number B (=3 in the illustrative example shown in Fig. 5) and, with this information on the size of set Y, decode Y as a set of sets of monitoring interval indices {[1, 3, 7], [1, 6, 9], [1, 8, 10]} in the illustrative example shown in Fig. 5). UE may then determine, based on Y, service configuration monitoring intervals for the individual services configurations (P, Q, R in Fig. 5) in the MCCH message.

In the illustrative example shown in Fig. 5, the service configuration monitoring intervals are: intervals corresponding to MCCHs with indices (1), (3), (7) for service configuration

P, intervals corresponding to MCCHs with indices (1), (6), (9) for service configuration Q and intervals corresponding to MCCHs with indices (1), (8), (10) for service configuration R.

5 Step 552a: gNB, e.g. periodically, sends MCCH messages with defined transmission windows and repetition periods (Δt) within consecutive modification periods. An illustrative example of one modification period, during which gNB sends ten MCCH (1) to (10), is shown in Fig. 5. Each MCCH message contains a plurality of MCCH parts (3 in the illustrative example shown in Fig. 5) with service configurations (P, Q, R in Fig. 5) for different MBS.

10 gNB may change the service configurations (P, Q, R) within a modification period. The changes in the service configurations (P, Q, R) are adapted to the service configuration monitoring intervals, which for the respective service configuration (e.g. P) correspond to the respective set of monitoring indices (e.g. [1, 3, 7]), so that a change in the service configurations (e.g. P) may only occur according to the respective monitoring intervals

15 corresponding to the respective set of monitoring indices (e.g. between MCCH (2) and (3) and/or between MCCH (6) and (7) for service configuration P).

Step 552b: UE monitors for MCCH messages based on the information in the SIB20 message, in particular based on the determined service configuration monitoring intervals for the

20 service configurations for the services UE intends to receive. In the illustrative example shown in Fig. 5, UE accordingly monitors, in substep 552b.1, for changes of service configuration P in MCCH (1), (3) and (7), in substep 552b.2, for changes of service configuration Q in MCCH (1), (6) and (9) and, in substep 552b.3, for changes of service configuration R in MCCH (1), (8) and (10). The remaining MCCHs/MCCH parts are

25 skipped. Therewith, UE is able to monitor for any changes that may occur to the service configurations P, Q, R during the current modification period.

With the received service configurations P, Q, R, UE receives the information necessary for receiving the desired MBSs provided by gNB.

30 In some example embodiments, the embodiment shown in Fig 3 may be further extended to scenarios where the index of the MCCH repetition that is to be monitored is specified by setting the value of field Y in IE X within a structure of array. This works in particular if the number of MCCH sets within the modification period is limited. Fig. 5 shows such an approach.

35 In Fig. 5, service configurations P, Q and R (indicated by boxes with different hatching: linear hatching from bottom left to top right for P, linear hatching from top left to bottom right for Q, cross hatching for R) correspond to different parts of the same MCCH transmitted in a cell. The MCCH is thus a set of service configurations, or, in other words, service configuration set information.

Tighter hatching of the boxes (e.g. P, Q and R in MCCH (1), P in MCCH (3), Q in MCCH (6) etc.) indicates that the corresponding service configurations are monitored by the UE 530 (also indicated by the arrows from the respective boxes to the boxes of substeps 552b.1, 552b.2 and 552b.3) as these service configurations may change. The other service configurations (boxes with less tight hatching) do not change and are not monitored by UE 530.

Fig. 6 is a signalling chart 600 showing an example of how an exemplary process for, e.g. periodically, signalling service configuration set information by a gNB 620 and monitoring of the same by a UE 630 may be performed.

Fig. 6 further shows an example embodiment of a method according to the first exemplary aspect and further showing an example embodiment of a method according to the second exemplary aspect. UE 630 may be an example embodiment for an apparatus according to the first exemplary aspect. Further, source gNB 620 may be an example embodiment for an apparatus according to the second exemplary aspect.

The process may comprise some or all of the following steps:

Step 650: gNB transmits SIB20 message to the UE. The SIB20 message includes a special field X that includes information elements (IEs). $X = \{A; B; Y\}$, wherein

- A is a combined fallback usage and fallback configuration intervals indicator denoting whether fallback configuration is used (e.g., $A > 0$) or not (e.g., $A = 0$) and further denoting the modification period intervals for which the fallback configuration is used until a new/changed X is transmitted. For example, $A = 2$ denotes that the respective fallback configuration is used in every 2nd modification period.
- B is a service configurations number denoting the number of different types of MCCH parts within the MCCH message, the MCCH parts containing respective service configurations (P, Q, R in Fig. 6) for different MBS within the MCCH message;
- Y is a set of fixed repetition period monitoring intervals for the number of MCCH parts denoted by B. These may for instance be fixed repetitions within such a specific medication period.

In an illustrative example shown in Fig. 6, X may be equal to $\{2, 3, 2, 3, 4\}$, that is $A = 2$; $B = 3$ and $Y = \{2, 3, 4\}$.

Step 651: UE decodes SIB20 and therewith determines the MCCH configuration/scheduling details. This includes determining service configuration monitoring intervals for the different

- 5
10
15
- MCCH parts based on the special field X provided with the SIB20 message. If the fallback usage indicator A denotes that fallback configuration is used (as is the case in the illustrative example shown in Fig. 6), UE may determine service configurations number B (3 in the illustrative example shown in Fig. 6) and, with this information on the size of set Y, decode Y as the set of fixed repetition period monitoring intervals $\{2, 3, 4\}$ in the illustrative example shown in Fig. 6). UE may then determine, based on Y, service configuration monitoring intervals for the individual services configurations (P, Q, R in Fig. 6) in the MCCH message.
- In the illustrative example shown in Fig. 6, the service configuration monitoring intervals are: intervals corresponding to MCCHs with indices (1), (3), (7) for service configuration P, intervals corresponding to MCCHs with indices (1), (6), (9) for service configuration Q and intervals corresponding to MCCHs with indices (1), (8), (10) for service configuration R. These service configuration monitoring intervals are then applied for modification periods according to the fallback configuration intervals indicator A (every 2nd modification periods in Fig. 6, i.e. modification periods 1 and 3).
- 20
25
- Step 652a: gNB, e.g. periodically, sends MCCH messages with defined transmission windows and repetition periods (Δt) within consecutive modification periods. An illustrative example of three consecutive modification periods (1) to (3), during which gNB sends ten MCCH (1) to (5) each, is shown in Fig. 6. Each MCCH message contains a plurality of MCCH parts (3 in the illustrative example shown in Fig. 6) with service configurations (P, Q, R in Fig. 6) for different MBS.
- gNB may change the service configurations (P, Q, R) within modification periods (1) and (3). The changes in the service configurations (P, Q, R) are in each case adapted to the service configuration monitoring intervals so that a change in the service configurations (e.g. P) may only occur according to the respective monitoring intervals (e.g. between MCCH (2) and (3) and/or between MCCH (6) and (7) for service configuration P).
- 30
35
- Step 652b: UE monitors for MCCH messages based on the information in the SIB20 message, in particular based on the determined service configuration monitoring intervals for the service configurations for the services UE intends to receive. In the illustrative example shown in Fig. 6, during modification periods 1 and 3, UE accordingly monitors, in substep 652b.1, for changes of service configuration P in every 2nd MCCH, in substep 652b.2, for changes of service configuration Q in every 3rd MCCH and, in substep 652b.3, for changes of service configuration R within MCCH in every 4th MCCH. The remaining MCCHs/MCCH parts of modification periods 1 and 3 are skipped. During modification period 2, UE only monitors the first MCCH and skips the remaining MCCHs as fallback configuration is not used in this modification period. Therewith, UE is able to monitor for any changes that

may occur to the service configurations P, Q, R during the current modification period.

With the received service configurations P, Q, R, UE receives the information necessary for receiving the desired MBSs provided by gNB.

- 5 In some embodiments, e.g. in the embodiments described in Fig. 3, 4 and 5, $A=0$ or 1 in $X:\{A;B;Y\}$ may indicate that the fallback is enabled or disabled only for a current or a next modification period, respectively.

- 10 In some embodiments, parameter A can take any integer value which may indicate that fallback is enabled for the current modification period and also for the upcoming modification periods with a periodicity of A, e.g. $A=2$, to monitor and detect changes in MCCH sets. In Fig. 6, the field A is set to 2 and X in SIB 20 to $\{2,3,2,3,4\}$. This implies that from the first modification period fallback option is enabled with similar configuration for every modification periods at an increment of 2 from the initial modification period. For example, $1+2=3$, $3+2=5$, $5+2=7$ etc., i.e. the 1st, 3rd, 5th, 7th etc. modification periods will have the same
- 15 configuration for MCCH monitoring unless a new value of IE X is configured in SIB20. Similarly, if $A=3$ it would imply that fallback is enabled for the $1+3=4$, $4+3=7$, $7+3=10$ etc., i.e. for the 1st, 4th, 7th, 10th etc. modification periods with similar configurations.

- Fig.6 illustrates such an example embodiment. Fallback is disabled for the next subsequent modification
- 20 periods if there is no change in the SIB20 contents i.e. the IE X. The UE can consider radio frames for which system frame number (SFN) mod (MCCH modification period $\times$ A) = 0 to be the first MCCH modification period, when indexing.

- In such embodiments, every modification period may be considered differently thus providing better
- 25 flexibility dynamic selection for MCCH monitoring.

- In Fig. 6, service configurations P, Q and R (indicated by boxes with different hatching: linear hatching from bottom left to top right for P, linear hatching from top left to bottom right for Q, cross hatching for R) correspond to different parts of the same MCCH transmitted in a cell. The MCCH is thus a set of service
- 30 configurations, or, in other words, service configuration set information.

- Tighter hatching of the boxes (e.g., for modification period 1, P, Q and R in MCCH (1), P in MCCH (3), Q in MCCH (4) etc.) indicates that the corresponding service configurations are monitored by the UE 630 (also indicated by the arrows from the respective boxes to the boxes of substeps 652b.1, 652b.2 and 652b.3) as
- 35 these service configurations may change. The other service configurations (boxes with less tight hatching) do not change and are not monitored by UE 630.

Fig. 7 is a signalling chart 700 showing an example of how an exemplary process for, e.g. periodically, signalling service configuration set information by a gNB 720 and monitoring of the same by a UE 730 may be performed.

5 Fig. 7 further shows an example embodiment of a method according to the first exemplary aspect and further showing an example embodiment of a method according to the second exemplary aspect. UE 730 may be an example embodiment for an apparatus according to the first exemplary aspect. Further, source gNB 720 may be an example embodiment for an apparatus according to the second exemplary aspect.

10 The process may comprise some or all of the following steps:

Step 750: gNB transmits SIB20 message to the UE.

Step 751: UE decodes SIB20 and therewith determines the MCCH configuration/scheduling details.

15

Step 752a: gNB, e.g. periodically, sends MCCH messages with defined transmission windows and repetition periods (Δt) within consecutive modification periods. An illustrative example of one modification period, during which gNB sends ten MCCH (1) to (10), is shown in Fig. 7. Each MCCH message contains a plurality of MCCH parts (3 in the illustrative example shown in Fig. 7) with service configurations (P, Q, R in Fig. 7) for different MBS. Each MCCH message further includes a fallback configuration information, e.g. a special field X that includes information elements (IEs). $X = \{A; B; Y\}$, wherein

20

- A is a fallback usage indicator denoting whether fallback configuration is used (e.g., $A=1$) or not (e.g., $A=0$);
- 25 - B is a service configurations number denoting the number of different types of MCCH parts within the MCCH message, the MCCH parts containing respective service configurations (P, Q, R in Fig. 7) for different MBS within the MCCH message;
- Y is a set of fixed repetition period monitoring intervals for the number of MCCH parts denoted by B.

30

In an illustrative example shown in Fig. 3, X may be equal to {1, 3, 2, 3, 4}, that is $A = 1$; $B = 3$ and $Y = \{2, 3, 4\}$.

gNB may change the service configurations (P, Q, R) within a modification period. The changes in the service configurations (P, Q, R) are adapted to service configuration monitoring intervals according to X so that a change in the service configurations (e.g. P) may only occur according to the respective monitoring intervals (e.g. each 2 repetition period interval for service configuration P).

35

- Step 752b: UE monitors for MCCH messages based on the information in the SIB20 message. When the first UE MCCH is received, UE determines service configuration monitoring intervals for the different MCCH parts based on the special field X provided with the MCCH message. If the fallback usage indicator A denotes that fallback configuration is used (as is the case in the illustrative example shown in Fig. 7), UE may determine service configurations number B (3 in the illustrative example shown in Fig. 7) and, with this information on the size of set Y, decode Y as the set of fixed repetition period monitoring intervals $\{2, 3, 4\}$ in the illustrative example shown in Fig. 7). UE may then determine, based on Y, service configuration monitoring intervals for the individual service configurations (P, Q, R in Fig. 7) in the MCCH message.
- In the illustrative example shown in Fig. 7, the service configuration monitoring intervals are: 2 repetition period intervals for service configuration P, 3 repetition period intervals for service configuration Q and 4 repetition period intervals for service configuration R. UE then continues monitoring for MCCH messages also based on the determined service configuration monitoring intervals for the service configurations for the services UE intends to receive. In the illustrative example shown in Fig. 7, UE accordingly monitors, in substep 752b.1, for changes of service configuration P in every 2nd MCCH, in substep 752b.2, for changes of service configuration Q in every 3rd MCCH and, in substep 752b.3, for changes of service configuration R within MCCH in every 4th MCCH. The remaining MCCHs/MCCH parts are skipped. Therewith, UE is able to monitor for any changes that may occur to the service configurations P, Q, R during the current modification period. With the received service configurations P, Q, R, UE receives the information necessary for receiving the desired MBSs provided by gNB.
- In some embodiments, fallback indication and configuration (e.g. fallback configuration information) are provisioned to the UE within the MCCH sets which may contain a special field X that includes the specification information elements (IEs), e.g. fields X as described for the previously described embodiments, for example the embodiments described in the contexts of Fig. 3 - 6. An example embodiment for such operation is shown in Fig. 7.
- To target the case of the first MCCH repetition not being detected by the UE, e.g., UE coming to a cell in the middle of the modification period, message X may be included in all MCCH repetitions.
- In Fig. 7, service configurations P, Q and R (indicated by boxes with different hatching: linear hatching from bottom left to top right for P, linear hatching from top left to bottom right for Q, cross hatching for R) correspond to different parts of the same MCCH transmitted in a cell. The MCCH is thus a set of service configurations, or, in other words, service configuration set information.

Tighter hatching of the boxes (e.g. P, Q and R in MCCH (1), P in MCCH (3), Q in MCCH (4) etc.) indicates that the corresponding service configurations are monitored by the UE 730 (also indicated by the arrows from the respective boxes to the boxes of substeps 752b.1, 752b.2 and 752b.3) as these service configurations may change. The other service configurations (boxes with less tight hatching) do not change and are not monitored by UE 730.

Fig. 8 is a schematic block diagram of an apparatus 800 according to an exemplary aspect, which may for instance represent the mobile devices 130-1 of Fig. 1.

Apparatus 800 comprises a processor 810, working memory 820, program memory 830, data memory 840, communication interface(s) 850, an optional user interface 860 and an optional sensor(s) 870.

Apparatus 800 may for instance be configured to perform and/or control or comprise respective means (at least one of 810 to 870) for performing and/or controlling the method according to the first exemplary aspect. Apparatus 800 comprising at least one processor (810) and at least one memory (830) including computer program code, the at least one memory and the computer program code configured to, with the at least one processor, cause an apparatus, e.g. apparatus 800 at least to perform and/or control the method according to method according to the first exemplary aspect.

Processor 810 may for instance comprise an information obtainer 811 as a functional and/or structural unit. Information obtainer 811 may for instance be configured to obtain (e.g. retrieve, receive and/or decode) respective information, e.g. fallback configuration information, service configuration set information, MBS information, RRC configuration, CPA configuration information, or a combination thereof, to name but a few non-limiting examples.

Processor 810 may for instance comprise a determining unit 812 as a functional and/or structural unit. Determining unit 812 may for instance be configured to determine (e.g. derive and/or calculate) service configuration monitoring intervals, fallback usage indicators, service configuration numbers, fixed repetition period monitoring intervals, sets of monitoring interval indices, fallback configuration intervals, or a combination thereof, to name but a few non-limiting examples.

Processor 810 may for instance comprise a monitoring configurator 813 as a functional and/or structural unit. Monitoring configurator 813 may for instance be configured to configure a monitoring to be performed, for example with respect to transmission windows, repetition periods, monitoring intervals, skipping events, or a combination thereof, to name but a few non-limiting examples.

Processor 810 may for instance comprise a monitoring starter 814 as a functional and/or structural unit. Monitoring starter 814 may for instance be configured to start a monitoring of service configuration set

information, in particular based on a monitoring configuration with respect to transmission windows, repetition periods, monitoring intervals, to name but a few non-limiting examples. Monitoring starter 814 may for instance be configured to start a monitoring of service configuration set information for changes in a service configuration or occurrence, existence or presence, or determining the existence or presence of a monitoring skip indicator, or a combination thereof, to name but a few non-limiting examples.

Processor 810 may for instance further control the memories 820 to 840, the communication interface(s) 850, the optional user interface 860 and the optional sensor(s) 870.

Processor 810 may for instance execute computer program code stored in program memory 830, which may for instance represent a computer readable storage medium comprising program code that, when executed by processor 810, causes the processor 810 to perform the method according to the first exemplary aspect.

Processor 810 (and also any other processor mentioned in this specification) may be a processor of any suitable type. Processor 810 may comprise but is not limited to one or more microprocessor(s), one or more processor(s) with accompanying one or more digital signal processor(s), one or more processor(s) without accompanying digital signal processor(s), one or more special-purpose computer chips, one or more field-programmable gate array(s) (FPGA(s)), one or more controller(s), one or more application-specific integrated circuit(s) (ASIC(s)), or one or more computer(s). The relevant structure/hardware has been programmed in such a way to carry out the described function. Processor 810 may for instance be an application processor that runs an operating system.

Program memory 830 may also be included into processor 810. This memory may for instance be fixedly connected to processor 810, or be at least partially removable from processor 810, for instance in the form of a memory card or stick. Program memory 830 may for instance be non-volatile memory. It may for instance be a FLASH memory (or a part thereof), any of a ROM, PROM, EPROM and EEPROM memory (or a part thereof) or a hard disc (or a part thereof), to name but a few examples. Program memory 830 may also comprise an operating system for processor 810. Program memory 830 may also comprise a firmware for apparatus 800.

Apparatus 800 comprises a working memory 820, for instance in the form of a volatile memory. It may for instance be a Random Access Memory (RAM) or Dynamic RAM (DRAM), to give but a few non-limiting examples. It may for instance be used by processor 810 when executing an operating system and/or computer program.

Data memory 840 may for instance be a non-volatile memory. It may for instance be a FLASH memory (or a part thereof), any of a ROM, PROM, EPROM and EEPROM memory (or a part thereof) or a hard disc (or a

part thereof), to name but a few examples. Data memory 840 may for instance store measurement configuration information, handover configuration information, RRC configuration, CPA configuration information, or a combination thereof, to name but a few non-limiting examples.

5 Communication interface(s) 850 enable apparatus 800 to communicate with other entities, e.g. with gNB 120-1 to 120-3 of Fig. 1. The communication interface(s) 850 may for instance comprise a wireless interface, e.g. a cellular radio communication interface and/or a WLAN interface) and/or wire-bound interface, e.g. an IP-based interface, for instance to communicate with entities via the Internet. Communication interface(s) may enable apparatus 800 to communicate with other entities not shown in
10 Fig. 1.

User interface 860 is optional and may comprise a display for displaying information to a user and/or an input device (e.g. a keyboard, keypad, touchpad, mouse, etc.) for receiving information from a user.

15 Sensor(s) 870 are optional and may for instance comprise a barometric sensor, e.g. to gather pressure information.

Some or all of the components of the apparatus 800 may for instance be connected via a bus. Some or all of the components of the apparatus 800 may for instance be combined into one or more modules.

20 Fig. 9 is a schematic block diagram of an apparatus 900 according to an exemplary aspect, which may for instance represent one of the gNBs 120-1 to 120-3 of Fig. 1.

Apparatus 900 comprises a processor 910, working memory 920, program memory 930, data memory
25 940, communication interface(s) 950, and an optional user interface 960.

Apparatus 900 may for instance be configured to perform and/or control or comprise respective means (at least one of 910 to 960) for performing and/or controlling the method according to the second exemplary aspect. Apparatus 900 may as well constitute an apparatus comprising at least one processor
30 910 and at least one memory 930 including computer program code, the at least one memory and the computer program code configured to, with the at least one processor, cause an apparatus, e.g. apparatus 900 at least to perform and/or control the method according to second exemplary aspect.

Processor 910 may for instance comprise a transmission unit 911 as a functional and/or structural unit.
35 Transmission unit 911 may for instance be configured to start, control and/or perform, e.g. periodic, sending of service configuration set information, sending of fallback configuration information, sending of MBS information, or a combination thereof, to name but a few non-limiting examples.

Processor 910 may for instance comprise a configuration unit 912 as a functional and/or structural unit. Configuration unit 912 may for instance be configured to configure (e.g. with respect to transmission channels, transmission windows, modification periods, repetition periods, timing of, or a combination thereof) transmission of MBS information, transmission and content of service configuration set

information, transmission and content of fallback configuration information, or a combination thereof, to name but a few non-limiting examples.

Processor 910 may for instance further control the memories 920 to 940, the communication interface(s) 950 and the optional user interface 960.

Processor 910 may for instance execute computer program code stored in program memory 930, which may for instance represent a computer readable storage medium comprising program code that, when executed by processor 910, causes the processor 910 to perform the method according to the second exemplary aspect.

Processor 910 (and also any other processor mentioned in this specification) may be a processor of any suitable type. Processor 910 may comprise but is not limited to one or more microprocessor(s), one or more processor(s) with accompanying one or more digital signal processor(s), one or more processor(s) without accompanying digital signal processor(s), one or more special-purpose computer chips, one or more field-programmable gate array(s) (FPGA(s)), one or more controller(s), one or more application-specific integrated circuit(s) (ASIC(s)), or one or more computer(s). The relevant structure/hardware has been programmed in such a way to carry out the described function. Processor 910 may for instance be an application processor that runs an operating system.

Program memory 930 may also be included into processor 910. This memory may for instance be fixedly connected to processor 910, or be at least partially removable from processor 910, for instance in the form of a memory card or stick. Program memory 930 may for instance be non-volatile memory. It may for instance be a FLASH memory (or a part thereof), any of a ROM, PROM, EPROM and EEPROM memory (or a part thereof) or a hard disc (or a part thereof), to name but a few examples. Program memory 930 may also comprise an operating system for processor 910. Program memory 930 may also comprise a firmware for apparatus 900.

Apparatus 900 comprises a working memory 920, for instance in the form of a volatile memory. It may for instance be a Random Access Memory (RAM) or Dynamic RAM (DRAM), to give but a few non-limiting examples. It may for instance be used by processor 910 when executing an operating system and/or computer program.

Data memory 940 may for instance be a non-volatile memory. It may for instance be a FLASH memory (or a part thereof), any of a ROM, PROM, EPROM and EEPROM memory (or a part thereof) or a hard disc (or a part thereof), to name but a few examples. Data memory 940 may for instance store measurement configuration information, handover configuration information, RRC configuration, CPA configuration information, or a combination thereof, to name but a few non-limiting examples.

Communication interface(s) 950 enable apparatus 900 to communicate with other entities, e.g. with mobile device 130 of Fig. 1. The communication interface(s) 950 may for instance comprise a wireless interface, e.g. a cellular radio communication interface and/or a WLAN interface) and/or wire-bound interface, e.g. an IP-based interface, for instance to communicate with entities via the Internet. Communication interface(s) may enable apparatus 900 to communicate with other entities, for instance with other gNBs 120-1 to 120-3 of Fig. 1.

User interface 960 is optional and may comprise a display for displaying information to a user and/or an input device (e.g. a keyboard, keypad, touchpad, mouse, etc.) for receiving information from a user.

Some or all of the components of the apparatus 900 may for instance be connected via a bus. Some or all of the components of the apparatus 900 may for instance be combined into one or more modules.

Fig. 10 is a schematic flow diagram of a further example embodiment of a method according to the first exemplary aspect.

The method may comprise some or all of the following steps:

Step 1011: obtaining fallback configuration information indicative of a fallback configuration for monitoring, e.g. periodic, service configuration set information, the service configuration set information being indicative of a set of service configurations, the set of service configurations comprising service configurations for different services provided in a cell,

Step 1012: determining service configuration monitoring intervals for a corresponding service configuration within the set of service configurations based, at least in part, on the fallback configuration information, and

Step 1013: monitoring the service configuration set information based, at least in part, on the service configuration monitoring intervals for the corresponding service configuration.

The order of the steps indicated by the arrows in Fig. 10 is not mandatory. The steps may also be performed in a different order.

Fig. 11 is a schematic flow diagram of a further example embodiment of a method according to the second exemplary aspect.

5 The method may comprise some or all of the following steps:

Step 1111: sending, e.g. periodically sending, service configuration set information, the service configuration set information being indicative of a set of service configurations, the set of service configurations comprising service configurations for different services provided in a cell,

10

Step 1112: sending fallback configuration information indicative of a fallback configuration for monitoring the service configuration set information, the fallback configuration being indicative for service configuration monitoring intervals for a corresponding service configuration within the set of service configurations, and

15

Step 1113: changing a service configuration within the set of service configurations at a time within a modification period adapted to the service configuration monitoring intervals for the corresponding service configuration.

20

The order of the steps indicated by the arrows in Fig. 11 is not mandatory. The steps may also be performed in a different order.

The following embodiments shall also be considered to be disclosed:

25

Embodiment 1:

A method comprising:

- obtaining fallback configuration information indicative of a fallback configuration for monitoring, e.g. periodic, service configuration set information, the service configuration set information being indicative of a set of service configurations, the set of service configurations comprising service configurations for different services provided in a cell,
 - determining one or more service configuration monitoring intervals for a corresponding service configuration within the set of service configurations based, at least in part, on the fallback configuration information, and
 - monitoring the service configuration set information based, at least in part, on the one or more service configuration monitoring intervals for the corresponding service configuration.
- 30
- 35

Embodiment 2:

The method according to embodiment 1, wherein

- monitoring the service configuration set information based, at least in part, on the one or more service configuration monitoring intervals for the corresponding service configuration includes:
 - monitoring the service configuration set information for changes in the corresponding service configuration.

Embodiment 3:

The method according to embodiment 1 or 2, further comprising:

- determining a fallback usage indicator based, at least in part, on the fallback configuration information, the fallback usage indicator being indicative of whether a fallback configuration is used, in particular during a defined modification period,
- wherein determining of one or more service configuration monitoring intervals for a corresponding service configuration and the monitoring of the service configuration set information based, at least in part, on the one or more service configuration monitoring intervals for the corresponding service configuration are performed, in particular during the defined modification period, if the fallback usage indicator indicates that the fallback configuration is used.

Embodiment 4:

The method according to any one of embodiments 1 to 3, further comprising:

- determining one or more service configuration monitoring intervals for different corresponding service configurations within the set of service configurations based, at least in part, on the fallback configuration information, and
- monitoring the service configuration set information based, at least in part, on the one or more service configuration monitoring intervals for the corresponding service configurations.

Embodiment 5:

The method according to embodiment 4, wherein

- determining one or more service configuration monitoring intervals for different corresponding service configurations within the set of service configurations based, at least in part, on the fallback configuration information includes:
 - determining a service configurations number based, at least in part, on the fallback configuration information, the service configurations number being indicative of the number of service configurations within the set of service configurations, and
 - determining one or more service configuration monitoring intervals for said number of service configurations based, at least in part, on the fallback configuration information.

Embodiment 6:

The method according to any one of embodiments 1 to 5, wherein:

- determining one or more service configuration monitoring intervals for a corresponding service configuration includes:
 - determining a fixed repetition period monitoring interval based, at least in part, on the fallback configuration information, the fixed repetition period monitoring interval being indicative for a fixed repetition period of the one or more service configuration monitoring intervals for the corresponding service configuration, and
 - determining the one or more service configuration monitoring intervals based, at least in part, on the fixed repetition period monitoring interval.

Embodiment 7:

The method according to any one of embodiments 1 to 5, wherein:

- determining one or more service configuration monitoring intervals for a corresponding service configuration includes:
 - determining a set of monitoring interval indices based, at least in part, on the fallback configuration information, the monitoring interval indices being indicative of indices for the, e.g. periodic, service configuration or service configuration set information, and
 - determining the one or more service configuration monitoring intervals based, at least in part, on the set of monitoring interval indices.

Embodiment 8:

The method according to any one of embodiments 1 to 7, wherein:

- monitoring the service configuration set information based, at least in part, on the one or more service configuration monitoring intervals for the corresponding service configuration includes:
 - monitoring the service configuration set information for occurrence, existence or presence of a monitoring skip indicator, and,
 - upon occurrence or upon determining existence or presence of the monitoring skip indicator, skipping, in particular for a current modification period, the monitoring of the service configuration set information based on the one or more service configuration monitoring intervals for the corresponding service.

Embodiment 9:

The method according to any one of embodiments 1 to 8, further comprising:

- determining one or more fallback configuration intervals based, at least in part, on the fallback configuration information, the one or more fallback configuration intervals indicating the applicability of the fallback configuration for a plurality of modification periods in a series of consecutive modification periods,

- wherein monitoring the service configuration set information based, at least in part, on the one or more service configuration monitoring intervals for the corresponding service configuration is performed for said plurality of modification periods.

5 Embodiment 10:

The method according to any one of embodiments 1 to 9, wherein

- obtaining fallback configuration information includes:
 - receiving a service configuration set information, and
 - determining the fallback configuration information based, at least in part, on the service
- 10 configuration set information.

Embodiment 11:

The method according to any one of embodiments 1 to 9, wherein obtaining fallback configuration information, determining one or more service configuration monitoring intervals and monitoring the service configuration set information is carried out on or with a mobile device and/or an Internet-of-Things, IoT device.

15

Embodiment 12:

A method comprising:

- 20 - sending, e.g. periodically sending, service configuration set information, the service configuration set information being indicative of a set of service configurations, the set of service configurations comprising service configurations for different services provided in a cell,
 - sending fallback configuration information indicative of a fallback configuration for monitoring the service configuration set information, the fallback configuration being indicative for one or
 - 25 more service configuration monitoring intervals for a corresponding service configuration within the set of service configurations, and
 - changing a service configuration within the set of service configurations at a time within a modification period adapted to the one or more service configuration monitoring intervals for the corresponding service configuration.
- 30

Embodiment 13:

The method according to embodiment 12, wherein

- the fallback configuration information is indicative for a fallback usage indicator, the fallback usage indicator being indicative of whether a fallback configuration is used, in particular during a defined modification period, and
- 35 - changing a service configuration within the set of service configurations at a time within a modification period is only performed if the fallback usage indicator indicates that the fallback configuration is used.

Embodiment 14:

The method according to embodiment 12 or 13, further comprising

- 5 - sending fallback configuration information indicative of a fallback configuration for monitoring the service configuration set information, the fallback configuration being indicative for one or more service configuration monitoring intervals for different corresponding service configurations within the set of service configurations, and
- 10 - changing service configurations within the set of service configurations at respective times within a modification period adapted to the respective one or more service configuration monitoring intervals for the corresponding service configurations.

Embodiment 15:

The method according to any one of embodiments 12 to 14, wherein

- 15 - the fallback configuration information is indicative of a service configurations number, the service configurations number being indicative of the number of service configurations within the set of service configurations.

Embodiment 16:

The method according to any one of embodiments 12 to 15, wherein

- 20 - the fallback configuration information is indicative of a fixed repetition period monitoring interval, the fixed repetition period monitoring interval being indicative for a fixed repetition period of the one or more service configuration monitoring intervals for the corresponding service configuration.

25 Embodiment 17:

The method according to any one of embodiments 12 to 15, wherein

- 30 - the fallback configuration information is indicative of a set of monitoring interval indices, the monitoring interval indices being indicative of indices for the, e.g. periodic, service configuration set information, the indices corresponding to the one or more service configuration monitoring intervals.

Embodiment 18:

The method according to any one of embodiments 12 to 17, further comprising

- 35 - at a skip time during a current modification period, including a monitoring skip indicator into the service configuration set information,
- wherein changing a service configuration within the set of service configurations at a time within a modification period adapted to the one or more service configuration monitoring intervals for

the corresponding service configuration is not performed after occurrence or after determining existence or presence of the skip indicator in the service configuration set information.

Embodiment 19:

- 5 The method according to any one of embodiments 12 to 18, wherein
- the fallback configuration information is indicative of one or more fallback configuration intervals, the one or more fallback configuration intervals indicating the applicability of the fallback configuration for a plurality of modification periods in a series of consecutive modification periods, and
 - 10 - the method comprises:
 - changing a service configuration within the set of service configurations at a time within said plurality of modification periods adapted to the one or more service configuration monitoring intervals for the corresponding service configuration.

15 Embodiment 20:

The method according to any one of embodiments 12 to 19, wherein

- the service configuration set information includes the fallback configuration information.

Embodiment 20:

- 20 The method according to any one of embodiments 12 to 20, wherein the method is carried out on or with a source master node of the mobile communication network.

Embodiment 21:

- A tangible computer-readable medium storing computer program code, the computer program code when
- 25 executed by a processor causing an apparatus to perform and/or control:
- obtaining fallback configuration information indicative of a fallback configuration for monitoring, e.g. periodic, service configuration set information, the service configuration set information being indicative of a set of service configurations, the set of service configurations comprising service configurations for different services provided in a cell,
 - 30 - determining one or more service configuration monitoring intervals for a corresponding service configuration within the set of service configurations based, at least in part, on the fallback configuration information, and
 - monitoring the service configuration set information based, at least in part, on the one or more service configuration monitoring intervals for the corresponding service configuration.

35

Embodiment 22:

The tangible computer-readable medium according to embodiment 21, wherein

- monitoring the service configuration set information based, at least in part, on the one or more service configuration monitoring intervals for the corresponding service configuration includes:
 - monitoring the service configuration set information for changes in the corresponding service configuration.

5

Embodiment 23:

The tangible computer-readable medium according to embodiment 21 or 22, the computer program code when executed by a processor causing an apparatus to perform and/or control:

- 10 - determining a fallback usage indicator based, at least in part, on the fallback configuration information, the fallback usage indicator being indicative of whether a fallback configuration is used, in particular during a defined modification period,
- wherein determining of one or more service configuration monitoring intervals for a corresponding service configuration and the monitoring of the service configuration set information based, at least in part, on the one or more service configuration monitoring intervals
15 for the corresponding service configuration are performed, in particular during the defined modification period, if the fallback usage indicator indicates that the fallback configuration is used.

Embodiment 24:

- 20 The tangible computer-readable medium according to any one of embodiments 21 to 23, the computer program code when executed by a processor causing an apparatus to perform and/or control:
 - determining one or more service configuration monitoring intervals for different corresponding service configurations within the set of service configurations based, at least in part, on the fallback configuration information, and
 - 25 - monitoring the service configuration set information based, at least in part, on the one or more service configuration monitoring intervals for the corresponding service configurations.

Embodiment 25:

The tangible computer-readable medium according to embodiment 24, wherein

- 30 - determining one or more service configuration monitoring intervals for different corresponding service configurations within the set of service configurations based, at least in part, on the fallback configuration information includes:
 - determining a service configurations number based, at least in part, on the fallback configuration information, the service configurations number being indicative of the
35 number of service configurations within the set of service configurations, and
 - determining one or more service configuration monitoring intervals for said number of service configurations based, at least in part, on the fallback configuration information.

Embodiment 26:

The tangible computer-readable medium according to any one of embodiments 21 to 25, wherein

- determining one or more service configuration monitoring intervals for a corresponding service configuration includes:
 - 5 - determining a fixed repetition period monitoring interval based, at least in part, on the fallback configuration information, the fixed repetition period monitoring interval being indicative for a fixed repetition period of the one or more service configuration monitoring intervals for the corresponding service configuration, and
 - 10 - determining the one or more service configuration monitoring intervals based, at least in part, on the fixed repetition period monitoring interval.

Embodiment 27:

The tangible computer-readable medium according to any one of embodiments 21 to 26, wherein

- determining one or more service configuration monitoring intervals for a corresponding service configuration includes:
 - 15 - determining a set of monitoring interval indices based, at least in part, on the fallback configuration information, the monitoring interval indices being indicative of indices for the, e.g. periodic, service configuration or service configuration set information, and
 - 20 - determining the one or more service configuration monitoring intervals based, at least in part, on the set of monitoring interval indices.

Embodiment 28:

The tangible computer-readable medium according to any one of embodiments 21 to 27, wherein

- monitoring the service configuration set information based, at least in part, on the one or more service configuration monitoring intervals for the corresponding service configuration includes:
 - 25 - monitoring the service configuration set information for occurrence, existence or presence of a monitoring skip indicator, and,
 - 30 - upon occurrence or upon determining existence or presence of the monitoring skip indicator, skipping, in particular for a current modification period, the monitoring of the service configuration set information based on the one or more service configuration monitoring intervals for the corresponding service.

Embodiment 29:

The tangible computer-readable medium according to any one of embodiments 21 to 28, the computer program code when executed by a processor causing an apparatus to perform and/or control:

- determining one or more fallback configuration intervals based, at least in part, on the fallback configuration information, the one or more fallback configuration intervals indicating the

- applicability of the fallback configuration for a plurality of modification periods in a series of consecutive modification periods,
- wherein monitoring the service configuration set information based, at least in part, on the one or more service configuration monitoring intervals for the corresponding service configuration is performed for said plurality of modification periods.

Embodiment 30:

The tangible computer-readable medium according to any one of embodiments 21 to 29, wherein

- obtaining fallback configuration information includes:
 - receiving a service configuration set information, and
 - determining the fallback configuration information based, at least in part, on the service configuration set information.

Embodiment 31:

- A tangible computer-readable medium storing computer program code, the computer program code when executed by a processor causing an apparatus to perform and/or control:

- sending, e.g. periodically sending, service configuration set information, the service configuration set information being indicative of a set of service configurations, the set of service configurations comprising service configurations for different services provided in a cell,
- sending fallback configuration information indicative of a fallback configuration for monitoring the service configuration set information, the fallback configuration being indicative for one or more service configuration monitoring intervals for a corresponding service configuration within the set of service configurations, and
- changing a service configuration within the set of service configurations at a time within a modification period adapted to the one or more service configuration monitoring intervals for the corresponding service configuration.

Embodiment 32:

The tangible computer-readable medium according to embodiment 31, wherein

- the fallback configuration information is indicative for a fallback usage indicator, the fallback usage indicator being indicative of whether a fallback configuration is used, in particular during a defined modification period, and
- changing a service configuration within the set of service configurations at a time within a modification period is only performed if the fallback usage indicator indicates that the fallback configuration is used.

Embodiment 33:

The tangible computer-readable medium according to embodiment 31 or 32, the computer program code when executed by a processor causing an apparatus to perform and/or control:

- sending fallback configuration information indicative of a fallback configuration for monitoring the service configuration set information, the fallback configuration being indicative for one or more service configuration monitoring intervals for different corresponding service configurations within the set of service configurations, and
- changing service configurations within the set of service configurations at respective times within a modification period adapted to the respective one or more service configuration monitoring intervals for the corresponding service configurations.

Embodiment 34:

The tangible computer-readable medium according to any one of embodiments 31 to 33, wherein

- the fallback configuration information is indicative of a service configurations number, the service configurations number being indicative of the number of service configurations within the set of service configurations.

Embodiment 35:

The tangible computer-readable medium according to any one of embodiments 31 to 34, wherein

- the fallback configuration information is indicative of a fixed repetition period monitoring interval, the fixed repetition period monitoring interval being indicative for a fixed repetition period of the one or more service configuration monitoring intervals for the corresponding service configuration.

Embodiment 36:

The tangible computer-readable medium according to any one of embodiments 31 to 35, wherein

- the fallback configuration information is indicative of a set of monitoring interval indices, the monitoring interval indices being indicative of indices for the, e.g. periodic, service configuration set information, the indices corresponding to the one or more service configuration monitoring intervals.

Embodiment 37:

The tangible computer-readable medium according to any one of embodiments 31 to 36, the computer program code when executed by a processor causing an apparatus to perform and/or control:

- at a skip time during a current modification period, including a monitoring skip indicator into the service configuration set information,
- wherein changing a service configuration within the set of service configurations at a time within a modification period adapted to the one or more service configuration monitoring intervals for

the corresponding service configuration is not performed after occurrence or after determining existence or presence of the skip indicator in the service configuration set information.

Embodiment 38:

- 5 The tangible computer-readable medium according to any one of embodiments 31 to 37, wherein
- the fallback configuration information is indicative of one or more fallback configuration intervals, the one or more fallback configuration intervals indicating the applicability of the fallback configuration for a plurality of modification periods in a series of consecutive modification periods, and
 - 10 - the computer program code when executed by a processor causing an apparatus to perform and/or control:
 - changing a service configuration within the set of service configurations at a time within said plurality of modification periods adapted to the one or more service configuration monitoring intervals for the corresponding service configuration.
- 15

Embodiment 39:

The tangible computer-readable medium according to any one of embodiments 31 to 38, wherein

- the service configuration set information includes the fallback configuration information.

20 Embodiment 40:

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 an apparatus at least to perform and/or control the method of the first exemplary aspect.

25 Embodiment 41:

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 an apparatus at least to perform and/or control the method of the second exemplary aspect.

30

Embodiment 42:

An apparatus comprising:

- means for obtaining fallback configuration information indicative of a fallback configuration for monitoring, e.g. periodic, service configuration set information, the service configuration set information being indicative of a set of service configurations, the set of service configurations comprising service configurations for different services provided in a cell,
- 35

- means for determining one or more service configuration monitoring intervals for a corresponding service configuration within the set of service configurations based, at least in part, on the fallback configuration information, and
- means for monitoring the service configuration set information based, at least in part, on the one or more service configuration monitoring intervals for the corresponding service configuration.

Embodiment 43:

The apparatus according to embodiment 42, wherein monitoring the service configuration set information based, at least in part, on the one or more service configuration monitoring intervals for the corresponding service configuration includes:

- monitoring the service configuration set information for changes in the corresponding service configuration.

Embodiment 44:

The apparatus according to embodiment 42 or 43, further comprising:

- means for determining a fallback usage indicator based, at least in part, on the fallback configuration information, the fallback usage indicator being indicative of whether a fallback configuration is used, in particular during a defined modification period,

wherein determining of one or more service configuration monitoring intervals for a corresponding service configuration and the monitoring of the service configuration set information based, at least in part, on the one or more service configuration monitoring intervals for the corresponding service configuration are performed, in particular during the defined modification period, if the fallback usage indicator indicates that the fallback configuration is used.

Embodiment 45:

The apparatus according to any one of embodiments 42 to 44, comprising:

- means for determining one or more service configuration monitoring intervals for different corresponding service configurations within the set of service configurations based, at least in part, on the fallback configuration information, and
- means for monitoring the service configuration set information based, at least in part, on the one or more service configuration monitoring intervals for the corresponding service configurations.

Embodiment 46:

The apparatus according to any one of embodiments 42 to 45, wherein determining one or more service configuration monitoring intervals for different corresponding service configurations within the set of service configurations based, at least in part, on the fallback configuration information includes:

- determining a service configurations number based, at least in part, on the fallback configuration information, the service configurations number being indicative of the number of service configurations within the set of service configurations, and
- determining one or more service configuration monitoring intervals for said number of service configurations based, at least in part, on the fallback configuration information.

Embodiment 47:

The apparatus according to any one of embodiments 42 to 46, wherein determining one or more service configuration monitoring intervals for a corresponding service configuration includes:

- determining a fixed repetition period monitoring interval based, at least in part, on the fallback configuration information, the fixed repetition period monitoring interval being indicative for a fixed repetition period of the one or more service configuration monitoring intervals for the corresponding service configuration, and
- determining the one or more service configuration monitoring intervals based, at least in part, on the fixed repetition period monitoring interval.

Embodiment 48:

The apparatus according to any one of embodiments 42 to 46, wherein determining one or more service configuration monitoring intervals for a corresponding service configuration includes:

- determining a set of monitoring interval indices based, at least in part, on the fallback configuration information, the monitoring interval indices being indicative of indices for the, e.g. periodic, service configuration or service configuration set information, and
- determining the one or more service configuration monitoring intervals based, at least in part, on the set of monitoring interval indices.

Embodiment 49:

The apparatus according to any one of embodiments 42 to 48, wherein monitoring the service configuration set information based, at least in part, on the one or more service configuration monitoring intervals for the corresponding service configuration includes:

- monitoring the service configuration set information for occurrence, existence or presence of a monitoring skip indicator, and,
- upon occurrence or upon determining existence or presence of the monitoring skip indicator, skipping, in particular for a current modification period, the monitoring of the service configuration set information based on the one or more service configuration monitoring intervals for the corresponding service.

Embodiment 50:

The apparatus according to any one of embodiments 42 to 49, further including:

- means for determining one or more fallback configuration intervals based, at least in part, on the fallback configuration information, the one or more fallback configuration intervals indicating the applicability of the fallback configuration for a plurality of modification periods in a series of consecutive modification periods,

5 wherein monitoring the service configuration set information based, at least in part, on the one or more service configuration monitoring intervals for the corresponding service configuration is performed for said plurality of modification periods.

Embodiment 51:

10 The apparatus according to any one of embodiments 42 to 50, wherein obtaining fallback configuration information includes:

- receiving a service configuration set information, and
- determining the fallback configuration information based, at least in part, on the service configuration set information.

15

Embodiment 52:

The apparatus according to any one of embodiments 42 to 51, wherein the apparatus is or is part of a mobile device and/or an Internet-of-Things, IoT device.

20 Embodiment 53:

An apparatus comprising:

- means for sending, e.g. periodically sending, service configuration set information, the service configuration set information being indicative of a set of service configurations, the set of service configurations comprising service configurations for different services provided in a cell,
- 25 - means for sending fallback configuration information indicative of a fallback configuration for monitoring the service configuration set information, the fallback configuration being indicative for one or more service configuration monitoring intervals for a corresponding service configuration within the set of service configurations, and
- means for changing a service configuration within the set of service configurations at a time
- 30 within a modification period adapted to the one or more service configuration monitoring intervals for the corresponding service configuration.

Embodiment 54:

35 The apparatus according to embodiment 54, wherein the fallback configuration information is indicative for a fallback usage indicator, the fallback usage indicator being indicative of whether a fallback configuration is used, in particular during a defined modification period, and changing a service configuration within the set of service configurations at a time within a modification period is only performed if the fallback usage indicator indicates that the fallback configuration is used.

Embodiment 55:

The apparatus according to embodiment 53 or 54, comprising:

- 5 - means for sending fallback configuration information indicative of a fallback configuration for monitoring the service configuration set information, the fallback configuration being indicative for one or more service configuration monitoring intervals for different corresponding service configurations within the set of service configurations, and
- 10 - means for changing service configurations within the set of service configurations at respective times within a modification period adapted to the respective one or more service configuration monitoring intervals for the corresponding service configurations.

Embodiment 56:

15 The apparatus according to any one of embodiments 53 to 55, wherein the fallback configuration information is indicative of a service configurations number, the service configurations number being indicative of the number of service configurations within the set of service configurations.

Embodiment 57:

20 The apparatus according to any one of embodiments 53 to 56, wherein the fallback configuration information is indicative of a fixed repetition period monitoring interval, the fixed repetition period monitoring interval being indicative for a fixed repetition period of the one or more service configuration monitoring intervals for the corresponding service configuration.

Embodiment 58:

25 The apparatus according to any one of embodiments 53 to 56, wherein the fallback configuration information is indicative of a set of monitoring interval indices, the monitoring interval indices being indicative of indices for the, e.g. periodic, service configuration set information, the indices corresponding to the one or more service configuration monitoring intervals.

Embodiment 59:

30 The apparatus according to any one of embodiments 53 to 58, further comprising

- means for including a monitoring skip indicator into the service configuration set information at a skip time during a current modification period,

wherein changing a service configuration within the set of service configurations at a time within a modification period adapted to the one or more service configuration monitoring intervals for the

35 corresponding service configuration is not performed after occurrence or after determining existence or presence of the skip indicator in the service configuration set information.

Embodiment 60:

The apparatus according to any one of embodiments 53 to 59, wherein the fallback configuration information is indicative of one or more fallback configuration intervals, the one or more fallback configuration intervals indicating the applicability of the fallback configuration for a plurality of modification periods in a series of consecutive modification periods, and the method further comprises

- 5 - means for changing a service configuration within the set of service configurations at a time within said plurality of modification periods adapted to the one or more service configuration monitoring intervals for the corresponding service configuration.

Embodiment 61:

- 10 The apparatus according to any one of embodiments 53 to 60, wherein the service configuration set information includes the fallback configuration information.

Embodiment 62:

- 15 The apparatus according to any one of embodiments 53 to 61, wherein the apparatus is or is part of a source master node of the mobile communication network.

Embodiment 63:

A system, comprising:

- 20 - at least one apparatus according to any of the embodiments 42 to 52; and
- at least one apparatus according to any of the claims 53 to 62.

- 25 Example embodiments may thus be utilized to enable enhancements and solutions necessary to support high accuracy (e.g. horizontal and/or vertical), low latency, network efficiency (scalability, RS overhead, etc.) and device efficiency (power consumption, complexity) requirements for commercial uses cases (including general commercial use cases and specifically (I)IoT use cases.

- 30 In the present specification, any presented connection in the described embodiments is to be understood in a way that the involved components are operationally coupled. Thus, the connections can be direct or indirect with any number or combination of intervening elements, and there may be merely a functional relationship between the components.

- 35 Moreover, any of the methods, processes and actions described or illustrated herein may be implemented using executable instructions in a general-purpose or special-purpose processor and stored on a computer-readable storage medium (e.g., disk, memory, or the like) to be executed by such a processor.
References to a 'computer-readable storage medium' should be understood to encompass specialized circuits such as FPGAs, ASICs, signal processing devices, and other devices.

The expression "A and/or B" is considered to comprise any one of the following three scenarios: (i) A, (ii) B, (iii) A and B. Furthermore, the article "a" is not to be understood as "one", i.e. use of the expression "an element" does not preclude that also further elements are present. The term "comprising" is to be understood in an open sense, i.e. in a way that an object that "comprises an element A" may also comprise further elements in addition to element A.

It will be understood that all presented embodiments are exemplary, and that any feature presented for a particular example embodiment may be used with any aspect of the invention on its own or in combination with any feature presented for the same or another particular example embodiment and/or in combination with any other feature not mentioned. In particular, the example embodiments presented in this specification shall also be understood to be disclosed in all possible combinations with each other, as far as it is technically reasonable and the example embodiments are not alternatives with respect to each other. It will further be understood that any feature presented for an example embodiment in a particular category (method/apparatus/computer program/system) may also be used in a corresponding manner in an example embodiment of any other category. It should also be understood that presence of a feature in the presented example embodiments shall not necessarily mean that this feature forms an essential feature of the invention and cannot be omitted or substituted.

The statement of a feature comprises at least one of the subsequently enumerated features is not mandatory in the way that the feature comprises all subsequently enumerated features, or at least one feature of the plurality of the subsequently enumerated features. Also, a selection of the enumerated features in any combination or a selection of one of the enumerated features is possible. The specific combination of all subsequently enumerated features may as well be considered. Also, a plurality of one of the enumerated features may be possible.

The sequence of all method steps presented above is not mandatory, also alternative sequences may be possible. Nevertheless, the specific sequence of method steps exemplarily shown in the figures shall be considered as one possible sequence of method steps for the respective embodiment described by the respective figure.

The invention has been described above by means of example embodiments. It should be noted that there are alternative ways and variations which are obvious to a skilled person in the art and can be implemented without deviating from the scope of the appended claims.

The invention and its different aspects described herein provide, inter alia, a mechanism to configure the MCCH in a more flexible/unified way for different services, in addition to configuring a fallback MCCH mechanism to provide gNB more flexibility to be able to update the content of the MCCH per service requirements. The invention may enable UEs to newly read multiple MCCH repetitions in the same

modification period that is indicated as fallback with possibly different MCCH content. This mechanism is meant for MBS services supporting applications with different latency requirements, whose MCCH content may change within the modification period. UEs may be provisioned with the necessary information or indication about the periodicity of the MCCHs monitoring either through SIB20 or through the content of the MCCH sets.

With the invention and its different aspects described herein, it may for example be possible to achieve one or more of the following:

- UEs may be enabled to newly read multiple MCCH repetitions in the same modification period,
- 10 - Different modification periods for different services are enabled with a single periodic MCCH,
- Adaptive MCCH monitoring mechanism for simultaneous support of MBS services of different requirements,
- MBS services supporting applications with different latency requirements may be provided in a more effective manner,
- 15 - Power consumption of UEs may be reduced.

C l a i m s

1. An apparatus comprising at least one processor; and at least one memory including instructions that, when executed by the at least one processor, cause the apparatus at least to perform and/or control:
 - obtaining fallback configuration information indicative of a fallback configuration for monitoring service configuration set information, the service configuration set information being indicative of a set of service configurations, the set of service configurations comprising service configurations for different services provided in a cell,
 - determining a service configuration monitoring interval for a corresponding service configuration within the set of service configurations based, at least in part, on the fallback configuration information, and
 - monitoring the service configuration set information based, at least in part, on the service configuration monitoring interval for the corresponding service configuration.
2. The apparatus according to claim 1, wherein
 - monitoring the service configuration set information based, at least in part, on the service configuration monitoring interval for the corresponding service configuration includes:
 - monitoring the service configuration set information for changes in the corresponding service configuration.
3. The apparatus according to claim 1 or 2, wherein
 - the instructions, when executed by the at least one processor, cause the apparatus further to perform and/or control:
 - determining a fallback usage indicator based, at least in part, on the fallback configuration information, the fallback usage indicator being indicative of whether a fallback configuration is used, in particular during a defined modification period,
 - wherein determining of a service configuration monitoring interval for a corresponding service configuration and the monitoring of the service configuration set information based, at least in part, on the service configuration monitoring interval for the corresponding service configuration are performed, in particular during the defined modification period, if the fallback usage indicator indicates that the fallback configuration is used.
4. The apparatus according to any one of claims 1 to 3, wherein
 - the instructions, when executed by the at least one processor, cause the apparatus to perform and/or control:

- determining one or more service configuration monitoring intervals for different corresponding service configurations within the set of service configurations based, at least in part, on the fallback configuration information, and
 - monitoring the service configuration set information based, at least in part, on the one or more service configuration monitoring intervals for the corresponding service configurations.
5. The apparatus according to any one of claims 4, wherein determining one or more service configuration monitoring intervals for different corresponding service configurations within the set of service configurations based, at least in part, on the fallback configuration information includes:
- determining a service configurations number based, at least in part, on the fallback configuration information, the service configurations number being indicative of the number of service configurations within the set of service configurations, and
 - determining one or more service configuration monitoring intervals for said number of service configurations based, at least in part, on the fallback configuration information.
6. The apparatus according to any one of claims 1 to 5, wherein:
- determining a service configuration monitoring interval for a corresponding service configuration includes:
 - determining a fixed repetition period monitoring interval based, at least in part, on the fallback configuration information, the fixed repetition period monitoring interval being indicative for a fixed repetition period of the service configuration monitoring interval for the corresponding service configuration, and
 - determining the service configuration monitoring interval based, at least in part, on the fixed repetition period monitoring interval.
7. The apparatus according to any one of claims 1 to 5, wherein:
- determining a service configuration monitoring interval for a corresponding service configuration includes:
 - determining a set of monitoring interval indices based, at least in part, on the fallback configuration information, the monitoring interval indices being indicative of indices for the service configuration, and
 - determining the service configuration monitoring interval based, at least in part, on the set of monitoring interval indices.
8. The apparatus according to any one of claims 1 to 7, wherein:

- monitoring the service configuration set information based, at least in part, on the service configuration monitoring interval for the corresponding service configuration includes:
 - monitoring the service configuration set information for existence of a monitoring skip indicator, and,
 - upon determining the existence of the monitoring skip indicator, skipping, in particular for a current modification period, the monitoring of the service configuration set information based on the service configuration monitoring interval for the corresponding service.
9. The apparatus according to any one of claims 1 to 8, wherein
- the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus further to perform:
 - determining a fallback configuration interval based, at least in part, on the fallback configuration information, the fallback configuration interval indicating the applicability of the fallback configuration for a plurality of modification periods in a series of consecutive modification periods,
 - wherein monitoring the service configuration set information based, at least in part, on the service configuration monitoring interval for the corresponding service configuration is performed for said plurality of modification periods.
10. The apparatus according to any one of claims 1 to 9, wherein obtaining fallback configuration information includes:
- receiving a service configuration set information, and
 - determining the fallback configuration information based, at least in part, on the service configuration set information.
11. The apparatus according to any of the preceding claims, wherein the apparatus is or is part of a mobile device and/or an Internet-of-Things, IoT device and or a user equipment, UE.
12. An apparatus comprising at least one processor; and at least one memory including instructions that, when executed by the at least one processor, cause the apparatus at least to perform and/or control:
- sending service configuration set information, the service configuration set information being indicative of a set of service configurations, the set of service configurations comprising service configurations for different services provided in a cell,
 - sending fallback configuration information indicative of a fallback configuration for monitoring the service configuration set information, the fallback configuration being

- indicative for a service configuration monitoring interval for a corresponding service configuration within the set of service configurations, and
- changing a service configuration within the set of service configurations at a time within a modification period adapted to the service configuration monitoring interval for the corresponding service configuration.
13. The apparatus according to claim 12, wherein
- the fallback configuration information is indicative for a fallback usage indicator, the fallback usage indicator being indicative of whether a fallback configuration is used, in particular during a defined modification period, and
 - changing a service configuration within the set of service configurations at a time within a modification period is only performed if the fallback usage indicator indicates that the fallback configuration is used.
14. The apparatus according to claim 12 or 13, wherein
- the instructions, when executed by the at least one processor, cause the apparatus to perform and/or control:
 - sending fallback configuration information indicative of a fallback configuration for monitoring the service configuration set information, the fallback configuration being indicative for one or more service configuration monitoring intervals for different corresponding service configurations within the set of service configurations, and
 - changing service configurations within the set of service configurations at respective times within a modification period adapted to the respective one or more service configuration monitoring intervals for the corresponding service configurations.
15. The apparatus according to any one of claims 12 to 14, wherein
- the fallback configuration information is indicative of a service configurations number, the service configurations number being indicative of the number of service configurations within the set of service configurations.
16. The apparatus according to any one of claims 12 to 15, wherein
- the fallback configuration information is indicative of a fixed repetition period monitoring interval, the fixed repetition period monitoring interval being indicative for a fixed repetition period of the service configuration monitoring interval for the corresponding service configuration.
17. The apparatus according to any one of claims 12 to 15, wherein

- the fallback configuration information is indicative of a set of monitoring interval indices, the monitoring interval indices being indicative of indices for the service configuration set information, the indices corresponding to the service configuration monitoring interval.
18. The apparatus according to any one of claims 12 to 17, wherein
- the instructions, when executed by the at least one processor, cause the apparatus to perform and/or control:
 - at a skip time during a current modification period, including a monitoring skip indicator into the service configuration set information, and
 - changing a service configuration within the set of service configurations at a time within a modification period adapted to the service configuration monitoring interval for the corresponding service configuration is not performed after determining an existence of the skip indicator in the service configuration set information.
19. The apparatus according to any one of claims 12 to 18, wherein
- the fallback configuration information is indicative of a fallback configuration interval, the fallback configuration interval indicating the applicability of the fallback configuration for a plurality of modification periods in a series of consecutive modification periods, and
 - the instructions, when executed by the at least one processor, cause the apparatus to perform and/or control:
 - changing a service configuration within the set of service configurations at a time within said plurality of modification periods adapted to the service configuration monitoring interval for the corresponding service configuration.
20. The apparatus according to any one of claims 12 to 19, wherein
- the service configuration set information includes the fallback configuration information.
21. The apparatus according to any one of claims 12 to 20, wherein the apparatus is or is part of a source master node of the mobile communication network.
22. A system, comprising:
- at least one apparatus according to any of the claims 1 to 11; and
 - at least one apparatus according to any of the claims 12 to 21.

100

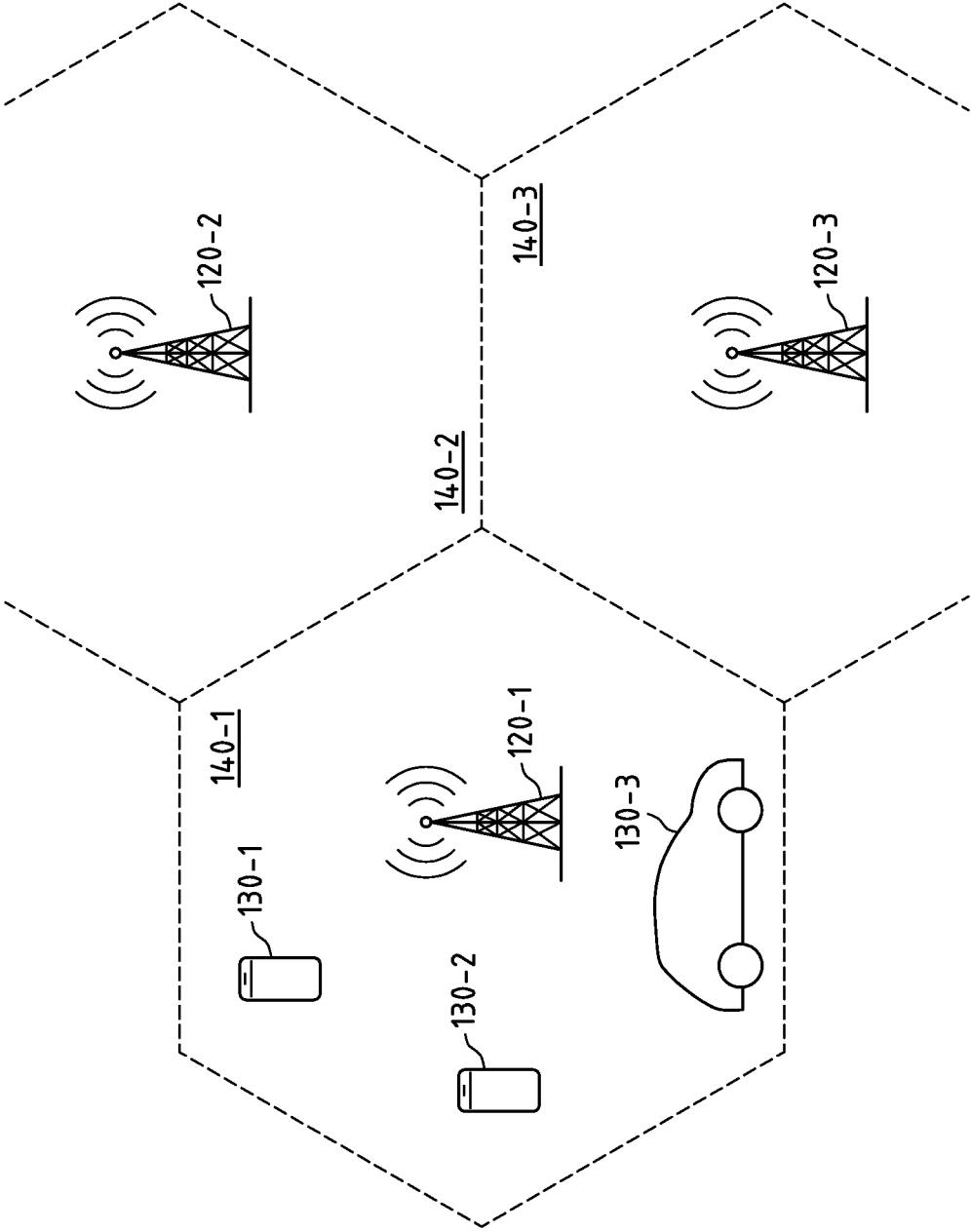


Fig.1

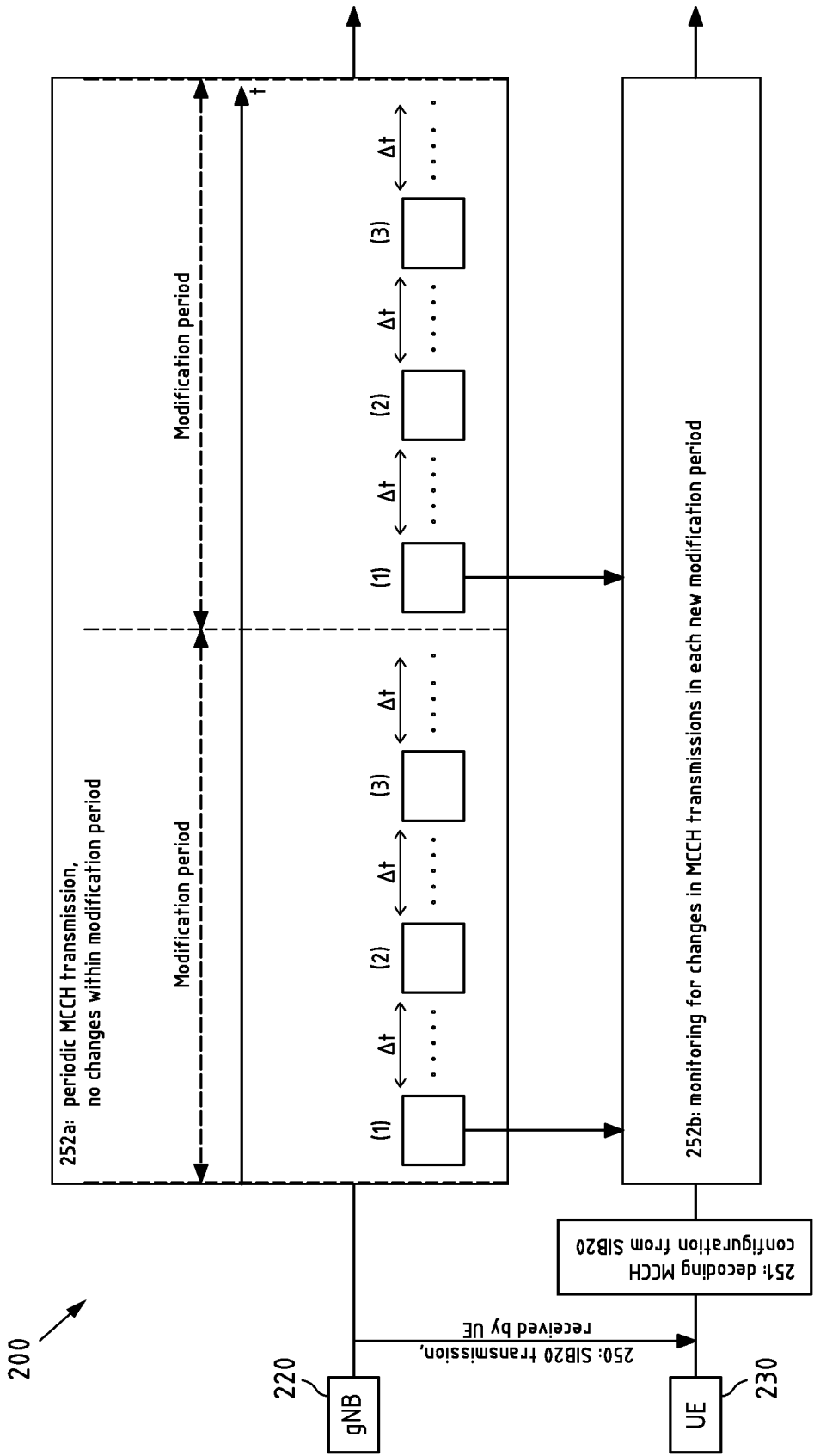


Fig.2

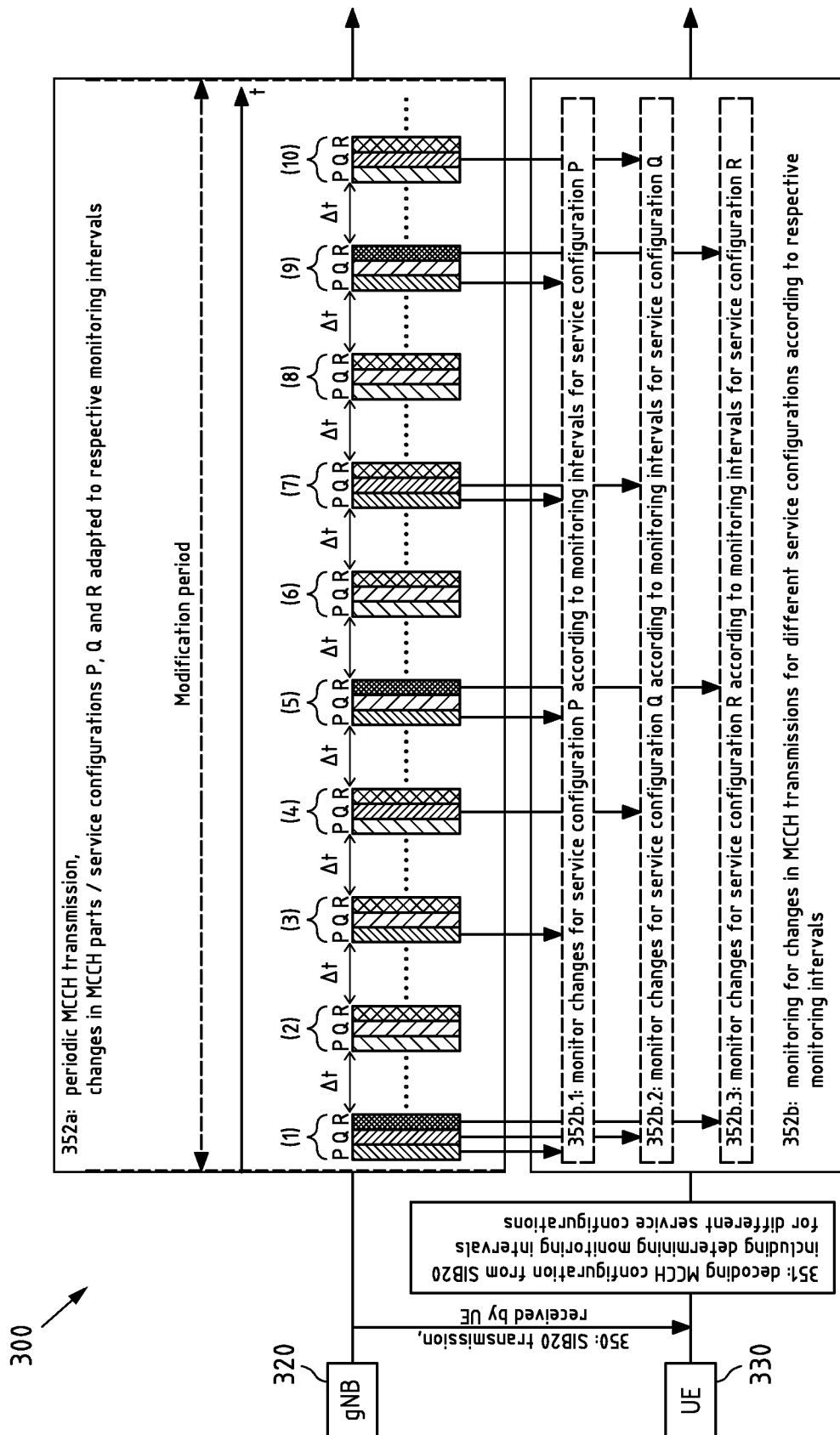


Fig. 3

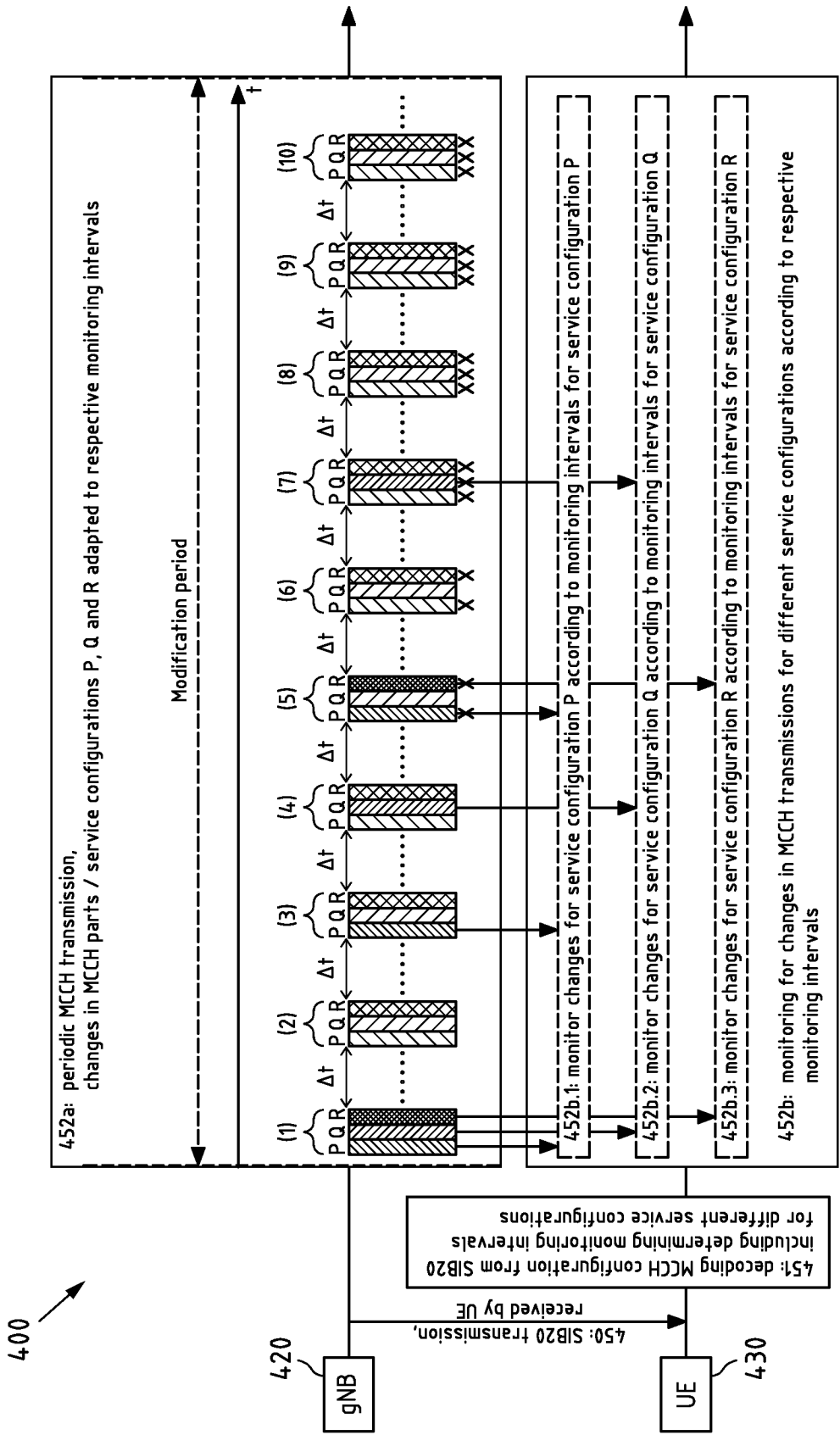


Fig.4

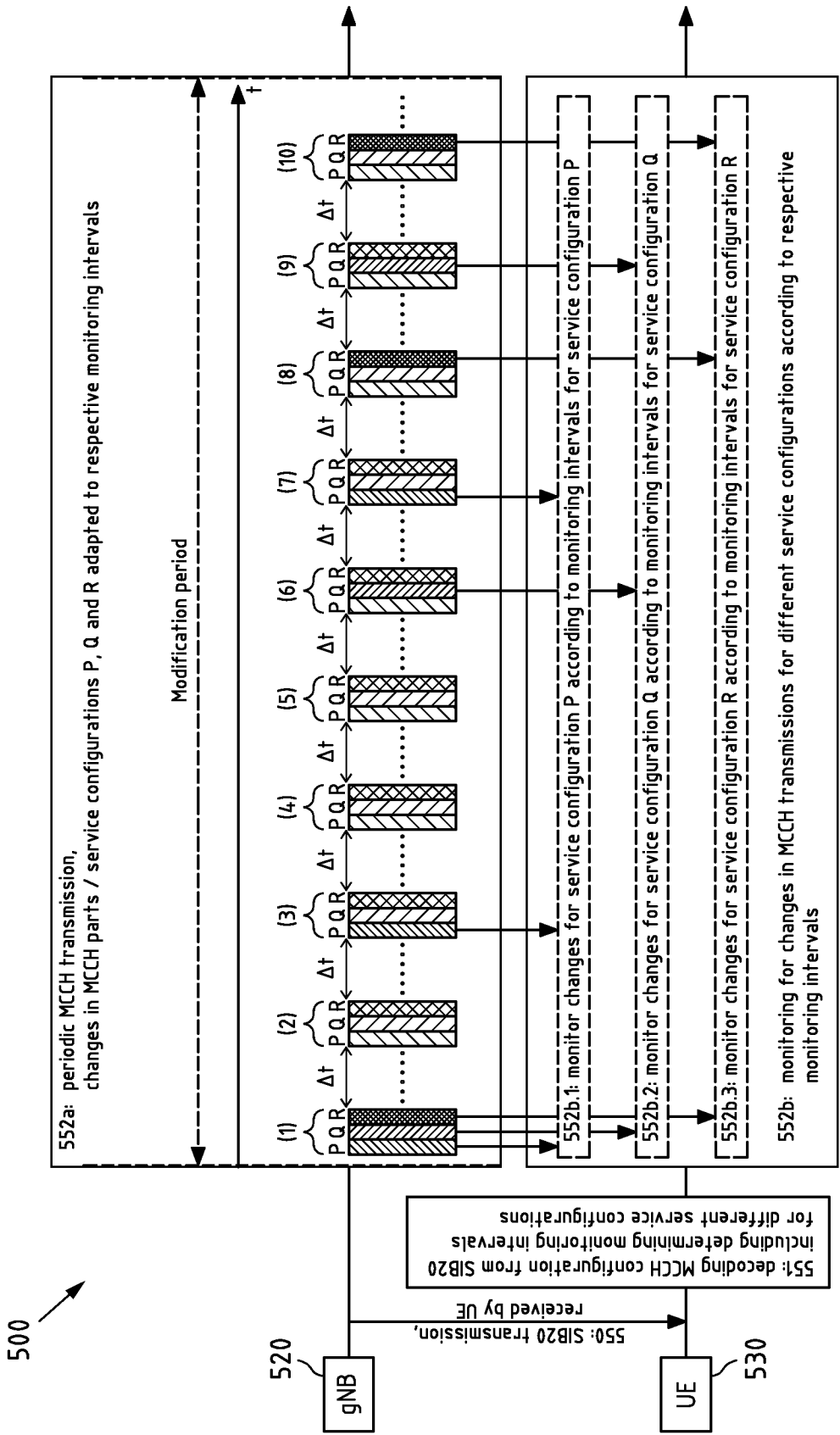


Fig.5

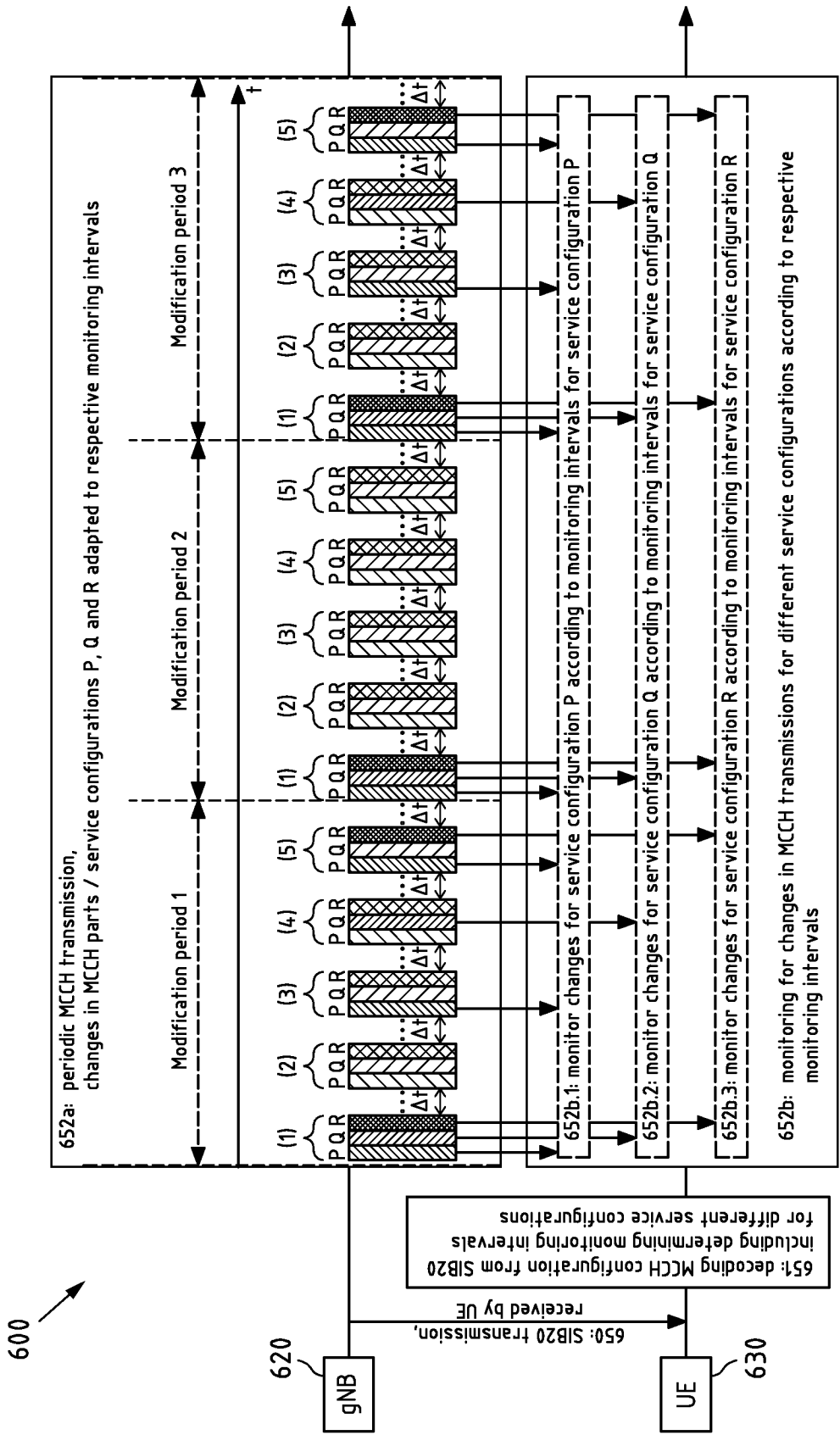


Fig.6

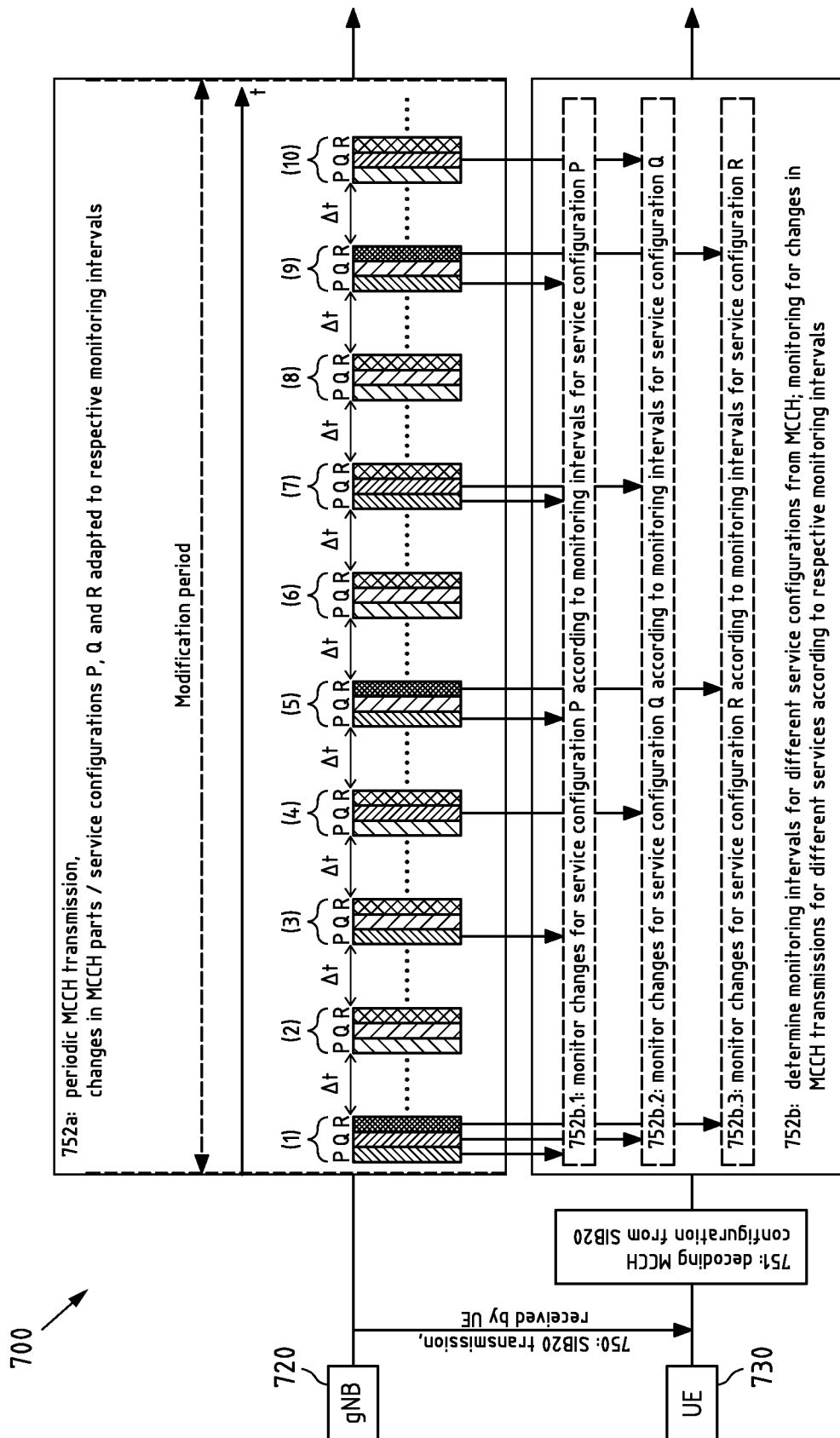


Fig. 7

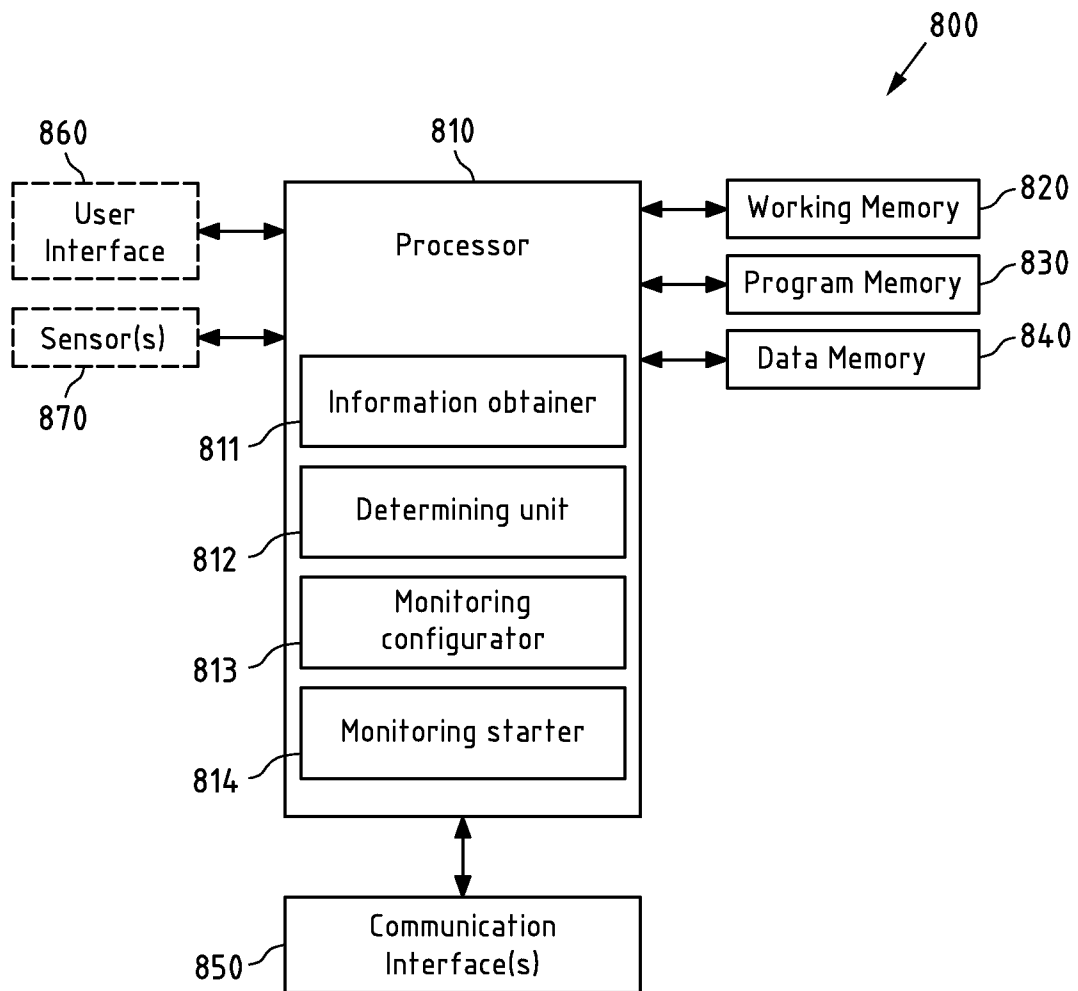


Fig.8

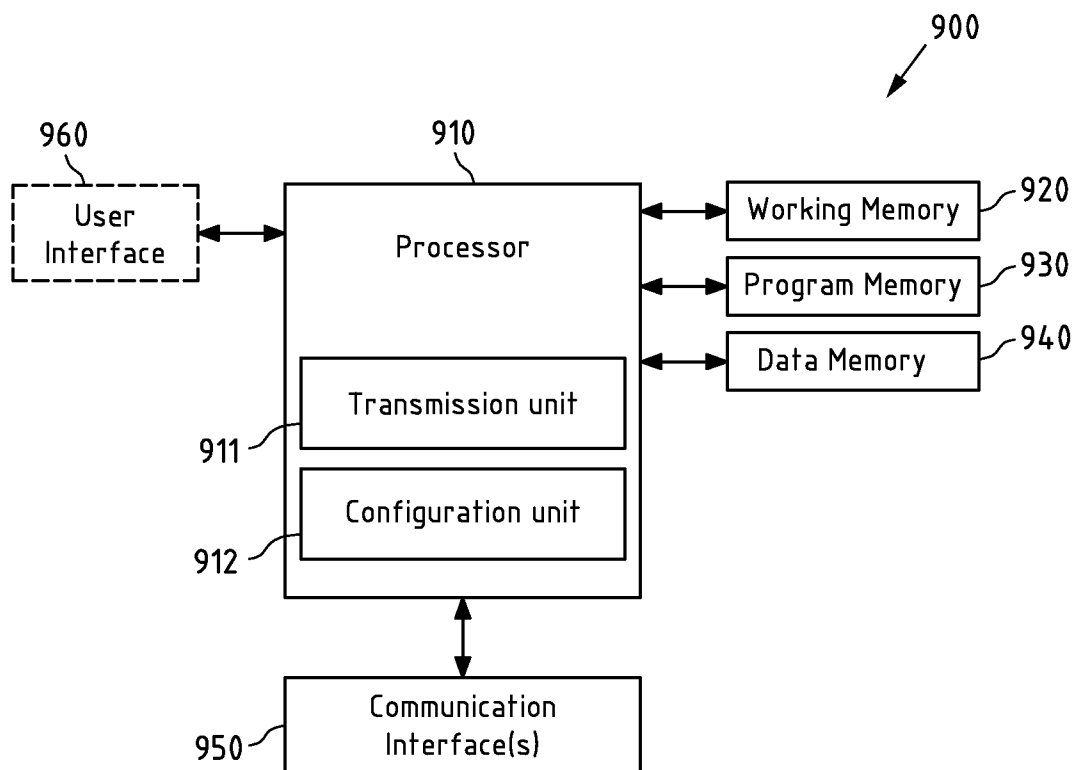


Fig.9

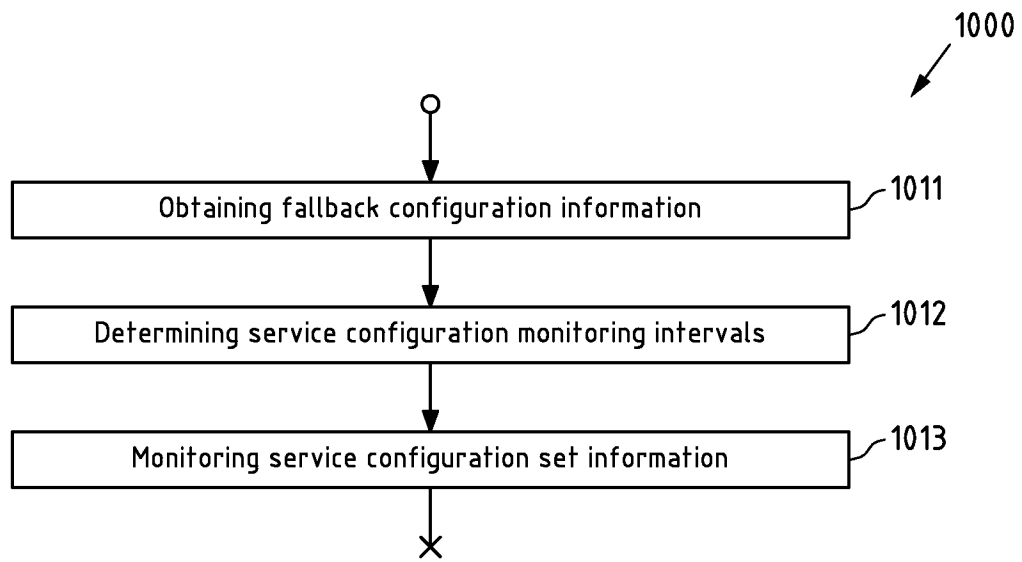


Fig.10

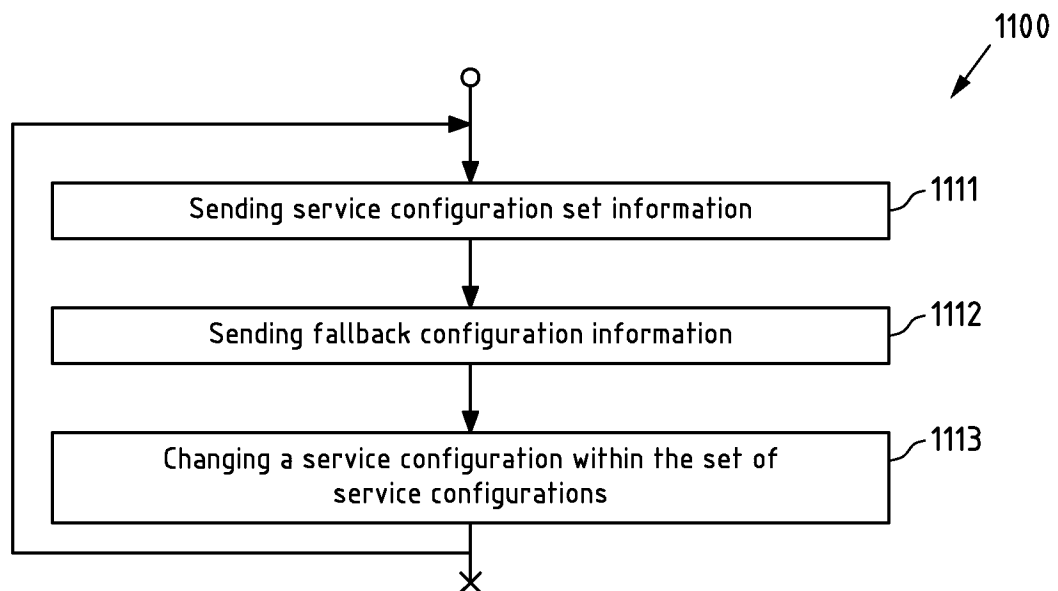


Fig.11

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2024/054266

A. CLASSIFICATION OF SUBJECT MATTER		
INV.	H04W24/00	H04L5/00
	H04W4/06	H04W72/00
	H04W72/23	
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 H04L		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
EPO-Internal		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 3 522 576 A1 (KYOCERA CORP [JP]) 7 August 2019 (2019-08-07)	1,4,11, 12,14, 21,22
Y	paragraph [0021] paragraphs [0057] - [0058] paragraphs [0075], [0078], [0079] paragraphs [0087] - [0089] paragraphs [0090], [0097] paragraphs [0061], [0064] -----	2,3, 5-10,13, 15-20
Y	EP 3 787 362 A1 (LG ELECTRONICS INC [KR]) 3 March 2021 (2021-03-03) paragraph [0118] paragraphs [0427] - [0434] paragraph [0533] -----	2,3,6-8, 13,16-18
Y	WO 2022/211499 A1 (SAMSUNG ELECTRONICS CO LTD [KR]) 6 October 2022 (2022-10-06) paragraphs [0090], [0091] -----	5,9,10, 15,19,20
☐ Further documents are listed in the continuation of Box C.		
☒ See patent family annex.		
* Special categories of cited documents :		
"A" document defining the general state of the art which is not considered to be of particular relevance		
"E" earlier application or patent but published on or after the international filing date		
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)		
"O" document referring to an oral disclosure, use, exhibition or other means		
"P" document published prior to the international filing date but later than the priority date claimed		
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention		
"X" document of particular relevance;; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone		
"Y" document of particular relevance;; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art		
"&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
16 July 2024		25/07/2024
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Mele, Marco

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2024/054266

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 3522576 A1	07-08-2019	EP 3522576 A1	07-08-2019
		JP 6766169 B2	07-10-2020
		JP WO2018084195 A1	25-07-2019
		US 2019261140 A1	22-08-2019
		WO 2018084195 A1	11-05-2018

EP 3787362 A1	03-03-2021	EP 3787362 A1	03-03-2021
		KR 20200132994 A	25-11-2020
		US 2021243731 A1	05-08-2021
		WO 2019209082 A1	31-10-2019

WO 2022211499 A1	06-10-2022	CN 115836558 A	21-03-2023
		EP 4150929 A1	22-03-2023
		US 2023269828 A1	24-08-2023
		WO 2022211499 A1	06-10-2022
