



(51) International Patent Classification:

H04W 72/04 (2009.01) H04W 72/02 (2009.01)
H04L 5/14 (2006.01)

(21) International Application Number:

PCT/SE2018/050330

(22) International Filing Date:

28 March 2018 (28.03.2018)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

62/480,840 03 April 2017 (03.04.2017) US

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ,

(54) Title: CONFIGURATION-DEPENDENT DCI TIMING

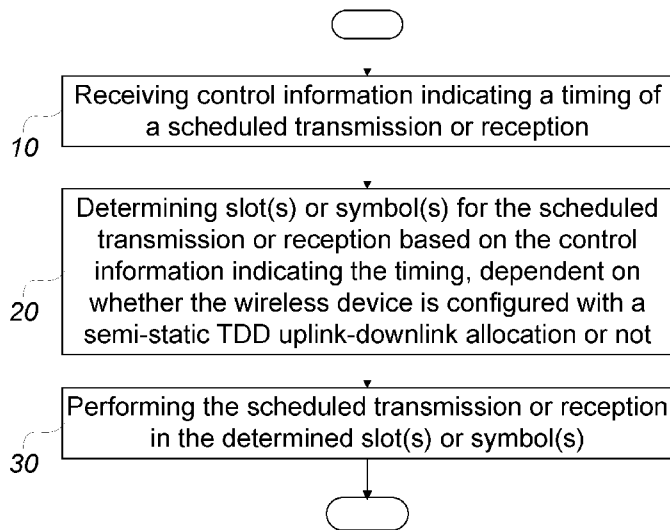


Figure 4

(57) Abstract: The disclosure relates to a method of operating a wireless device. The method comprises receiving (10), from a network node, control information indicating a timing of a scheduled transmission or reception. The method further comprises determining (20) at least one slot or symbol for the scheduled transmission or reception based on the control information indicating the timing, wherein the determining is dependent on whether the wireless device is configured with a semi-static time division duplex, TDD, uplink-downlink allocation or not. The method also comprises performing (30) the scheduled transmission or reception in the determined at least one slot or symbol.



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, 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))*
- *in black and white; the international application as filed contained color or greyscale and is available for download from PATENTSCOPE*

CONFIGURATION-DEPENDENT DCI TIMING

TECHNICAL FIELD

The invention relates to methods for scheduling, as well as to a wireless device, a network node, computer programs, and computer program products.

5 BACKGROUND

The fifth generation (5G) of mobile telecommunications and wireless technology is not yet fully defined but in an advanced draft stage within 3rd Generation Partnership Project (3GPP). It includes work on 5G New Radio (NR) Access Technology. Long term evolution (LTE) terminology is used in this disclosure in a forward looking sense, to include equivalent 5G entities or functionalities although a different term is specified in 5G. A general description of the agreements on the physical layer aspects of 5G NR Access
10 Technology so far is contained in 3GPP Technical Report 38.802 v1.2.0 (2017-02). Final specifications may be published inter alia in the future 3GPP TS 38.2** series.

Figure 1 schematically illustrates a wireless communication network, where a wireless device, also referred to as a user equipment (UE) UE 1 is wirelessly connectable to a base station BS 2. The BS 2 is
15 connected to a core network (CN) 3. In an NR access network, the BS may be referred to as a gNB, and the corresponding terminology for an LTE access network is an eNB. The BS 2 serves the UE 1 located within the BS's geographical area of service, called a cell.

NR uses scheduled transmission where the scheduler (which may be a part of or a functionality of the gNB), provides information to the UE related to - among other things - when to transmit or receive
20 data. This information from the scheduler is typically provided as part of the Downlink Control Information (DCI). The information sent to the UE relating to when to transmit or receive data as part of the DCI, may indicate the slot number where the transmission or reception will or should occur. As one example, the DCI received in slot n could contain information i used to indicate that transmission of the corresponding uplink data, or reception of the corresponding downlink data, occurs in slot $n+i$.

NR supports dynamic Time Division Duplex (TDD), which means that it is part of the scheduling
25 decision whether a UE should receive or transmit in a slot. As illustrated in **Figure 2a**, NR slots can be freely used for uplink or downlink as part of the scheduling decisions (but not uplink and downlink at the same time). However, for TDD coexistence reasons, NR may need to use the same uplink/downlink allocation as a neighboring LTE carrier is using. **Figure 2b** illustrates one example of such a scenario
30 where the upper part of the figure illustrates the NR carrier where a semi-static uplink-downlink allocation is configured for coexistence with the neighboring LTE carrier illustrated in the lower part of the figure. This could in principle be left as a choice for the scheduler, although it has been agreed that the network can use Radio Resource Control (RRC) signaling to inform the UE that the network will follow a semi-static uplink/downlink allocation.

SUMMARY

It is an object to provide a solution making it possible to limit the amount of DCI signaling at scheduling while allowing for both dynamic TDD and semi-static TDD uplink-downlink allocation.

According to a first aspect, a method of operating a wireless device, or a method performed by a wireless device is provided. The method comprises receiving, from a network node, control information indicating a timing of a scheduled transmission or reception and determining at least one slot or symbol for the scheduled transmission or reception based on the control information indicating the timing. The determining is dependent on whether the wireless device is configured with a semi-static time division duplex, TDD, uplink-downlink allocation or not. The method also comprises performing the scheduled transmission or reception in the determined at least one slot or symbol.

According to a second aspect, a method of operating a network node is provided. The method comprises scheduling the wireless device for transmission or reception in at least one set of slots or symbols and determining control information indicating a timing of the scheduled transmission or reception. The determining is dependent on whether the wireless device is configured with a semi-static time division duplex, TDD, uplink-downlink allocation or not. The method also comprises transmitting, to the wireless device, the control information indicating the timing.

According to further aspects, a wireless device, a network node, computer programs, and carriers or computer program products are provided.

One advantage of embodiments is an efficient usage of the limited DCI resources.

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

Other objects, advantages and features of embodiments will be explained in the following detailed description when considered in conjunction with the accompanying drawings and embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

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

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

Fig. 2a is a schematic illustration of an NR UL/DL carrier showing that NR slots can be freely used for uplink or downlink as part of the scheduling decisions (dynamic TDD);

Fig. 2b is a schematic diagram illustrating that the NR carrier is adapted to a semi-static uplink-downlink allocation for coexistence with the neighboring LTE carrier;

Fig. 3a-b are schematic diagrams illustrating scheduling according to embodiments;

Fig. 4 is a flowchart illustrating the method in a wireless device according to embodiments.

5 Fig. 5 is a block diagram schematically illustrating a wireless device according to embodiments.

Fig. 6 is a flowchart illustrating the method in a network node according to embodiments.

Fig. 7 is a block diagram schematically illustrating a network node according to embodiments.

DETAILED DESCRIPTION

In the following, different aspects will be described in more detail with references to certain
10 embodiments and to accompanying drawings. For purposes of explanation and not limitation, details are set forth, such as particular scenarios and techniques, in order to provide a thorough understanding of the different embodiments. However, other embodiments that depart from these details may also exist.

Furthermore, in some instances detailed descriptions of well-known methods, nodes, interfaces, circuits, and devices are omitted so as not obscure the description with unnecessary detail. Those skilled
15 in the art will appreciate that the functions described may be implemented in one or in several nodes. Some or all of the functions described may be implemented using hardware circuitry, such as analog and/or discrete logic gates interconnected to perform a specialized function, or ASICs. Likewise, some or all of the functions may be implemented using software programs and data in conjunction with one or more digital microprocessors or general purpose computers. Where nodes that communicate using the air
20 interface are described, it will be appreciated that those nodes also have suitable radio communications circuitry. Moreover, the technology may be embodied entirely within any form of computer-readable memory, including non-transitory embodiments such as solid-state memory, magnetic disk, or optical disk containing an appropriate set of computer instructions or computer program code that would cause a processor to carry out the techniques described herein.

25 Hardware implementations of the present invention may include or encompass, without limitation, digital signal processor (DSP) hardware, a reduced instruction set processor, hardware (e.g., digital or analog) circuitry including but not limited to application specific integrated circuit(s) (ASIC) and/or field programmable gate array(s) (FPGA(s)), and where appropriate state machines capable of performing such functions.

30 In terms of computer implementation, a computer is generally understood to comprise one or more processors or one or more controllers, and the terms computer, processor, and controller may be employed interchangeably. When provided by a computer, processor, or controller, the functions may be provided by a single dedicated computer or processor or controller, by a single shared computer or processor or controller, or by a plurality of individual computers or processors or controllers, some of
35 which may be shared or distributed. Moreover, the term “processor” or “controller” also refers to other

hardware capable of performing such functions and/or executing software, such as the example hardware recited above.

Herein the terms user equipment (UE), terminal, and wireless device are used interchangeably to denote a device that communicates with a network infrastructure, a wireless communication network, or a radio access network. The term should not be construed as to mean any specific type of device, i.e. it applies to them all, and the embodiments described herein are applicable to all devices that use the concerned solution to solve the problems as described. Wireless devices are referred to as UE in 3GPP terminology, and may comprise, for example, cellular telephones, personal digital assistants, smart phones, laptop computers, handheld computers, machine-type communication/machine-to-machine (MTC/M2M) devices or other devices or terminals with wireless communication capabilities. Wireless devices may refer to terminals that are installed in fixed configurations, such as in certain machine-to-machine applications, as well as to portable devices, or devices installed in motor vehicles.

Similarly, a network node is intended to denote the node in the network infrastructure that communicates with the UE, sometimes also referred to as a base station (BS). Different names may be applicable depending on the radio access technology, such as eNB, and gNB. The functionality of the network node may be distributed in various ways. For example, there could be a radio head terminating parts of the radio protocols and a centralized unit that terminates other parts of the radio protocols. The term network node will refer to all alternative architectures that can implement the concerned invention, and no distinction between such implementations will be made.

Embodiments are described in a non-limiting general context in relation to an example scenario in an NR wireless communication network or system, such as the network illustrated in **Figure 1**, in which a gNB sends timing information as part of the DCI to the UE for scheduling. However, embodiments of the invention may also be applied in a Device to Device (D2D) scenario, where it is a wireless device that schedules and thus sends scheduling control information comprising timing information to another wireless device.

An object of embodiments is to make the interpretation by the UE or wireless device of the timing information in the DCI dependent on whether the UE has been configured with a semi-static uplink/downlink allocation or not. If the UE is not configured with a semi-static uplink/downlink allocation, it means that dynamic TDD is used, as illustrated in **Figure 2a**. The timing information, which may also be referred to as information indicating a timing of a scheduled transmission or reception, may e.g. be the information or variable i described in the background section.

In the description, hereinafter, the timing information is discussed in relation to data transmission in the downlink (DL), i.e., the timing information provided to the UE in the DCI is used by the UE to determine when the UE is scheduled to receive a downlink transmission. However, the same principle can be applied to other uplink (UL) or DL channels. As one example, timing information provided to the UE in the DCI or some other DL control channel may be used by the UE to determine when the UE is

scheduled to transmit UL control signaling or UL data. In some cases, a physical uplink control channel (PUCCH) spans multiple symbols or even slots. Therefore, also timing information received by the UE in the DCI related to the PUCCH can be handled in the same way as timing information related to a data transmission as described herein.

5 It may be assumed that the DCI received by the UE comprises timing information, such as information indicating in which slot or Orthogonal frequency-division multiplexing (OFDM) symbol a data transmission starts. This could e.g. be the information, parameter or variable i described in the background section. Timing information indicating in which slot or symbol a transmission or reception starts may be denoted t_{start} . The timing information could also include a length of the transmission, 10 denoted t_{length} , or information where the transmission ends, t_{end} , e.g. indicating whether it is a single slot or a multi-slot transmission. The complete set of timing information in the DCI, i.e. one or more of t_{start} , t_{length} , t_{end} , or the variable i described in the background, may be denoted T .

The set of actual slots or symbols (in embodiments comprising single or multiple slots or symbols) used or scheduled for the data transmission is denoted S . How to determine the set S based on the 15 received timing information T depends on whether the UE has been configured with a semi-static TDD uplink/downlink allocation or not.

If the UE is not configured with a semi-static uplink-downlink allocation, and thus is configured with dynamic TDD, the set S of slots or OFDM symbols used for the data transmission is given by a first function $f1$ according to $S=f1(T)$. For example, a typical function when scheduling 20 downlink transmissions could be such that the timing information T refers to the actual slots, i.e. the data transmission starts in the same slot as the DCI was received in, $t_{start}=0$, and spans t_{length} contiguous slots. This embodiment is illustrated in **Figure 3a**. The arrow 301 illustrates that the DCI is received in slot #0. The timing information T in DCI indicates that t_{start} is equal to 0, i.e. that the DL data transmission starts in the slot that the DCI was received in, which is in slot #0. The DCI also indicates 25 that the DL transmission spans four slots, i.e. t_{length} is equal to four. The set S is thus determined to comprise slots #0 to slot #4 (indicated by reference numeral 302) in this case where the UE is configured to use dynamic TDD and not semi-static uplink-downlink allocation. It should be noted that timing information may very well indicate non-contiguous slots in another embodiment. If $t_{start} \neq 0$ is provided in the DCI, the DL transmission would extend from slot $n+t_{start}$ to $n+t_{start}+t_{length}-1$ with n being 30 the slot in which the DCI is received.

If the UE is configured with a semi-static uplink-downlink allocation, the set S is given by a second function $f2$ according to $S=f2(T)$. For example, a typical function when scheduling downlink transmissions could be such that the timing information T only refers to semi-statically configured 35 downlink slots, i.e. the data starts in the same slot as the DCI was received in, $t_{start}=0$, and spans t_{length} downlink slots, i.e. slots allocated to be downlink slots in the semi-static uplink-downlink allocation. This embodiment is illustrated in **Figure 3b**. The arrow 303 illustrates that the DCI is received

in slot #0. The timing information T in DCI indicates that t_{start} is equal to 0, i.e. that the DL data transmission starts in the slot that the DCI was received in, which is in slot #0. The DCI also indicates that the DL transmission spans four slots, i.e. t_{length} is equal to four. The set S is thus determined to comprise slots #0, slot #1, slot#3, and slot#4 (indicated by reference numeral 304) in this case where the UE is configured to use semi-static uplink-downlink allocation. If $t_{start} \neq 0$ is provided in the DCI, the DL transmission would extend from downlink slot $n+t_{start}$ to $n+t_{start}+t_{length}-1$ with n being the downlink slot in which the DCI is received.

The network node or gNB signaling the DCI needs to take the configuration of the TDD uplink-downlink allocation of the UE into account when determining the timing information T in DCI relating to scheduled slots or symbols. In the example embodiment illustrated in **Figure 3b**, the gNB could send a Physical Downlink Control Channel (PDCCH) comprising DCI in slot #1 for a scheduled DL slot #3 on a Physical Downlink Shared Channel (PDSCH). If the UE is configured with a semi-static uplink-downlink allocation, the timing information would be determined to indicate one "1" as the slot offset between PDCCH and PDSCH. Although the slot difference is two "2", slot #2, 305, is UL and should therefore not be counted. Without a semi-static uplink-downlink TDD allocation, the gNB would determine the timing information to indicate "2", as all slots are counted. A more general way of describing the functionality of the gNB, is that the gNB may determine a slot offset of K slots for the case when the UE is not configured with a semi-static uplink-downlink TDD allocation. On the other hand, when the UE is configured with a semi-static uplink-downlink TDD allocation, K is reduced by the number of UL slots configured between the PDCCH slot and the PDSCH slot.

The example embodiments described with reference to **Figures 3a-b** are multi-slot examples. However, the determination of the set S dependent on whether the UE is configured with a semi-static uplink-downlink allocation or not is also applicable if the length is only one slot or symbol. In one example of a single slot embodiment applicable for UL, the timing information T received by the UE in DCI indicates $n+2$, where n is the slot in which the UL grant is received. The UE determines the set S to comprise either the single slot $n+2$, when the UE is not configured with a semi-static uplink-downlink allocation, or the second-next UL slot otherwise.

The time units used in **Figures 3a-b** and in other example embodiments described herein are slots. However, in other embodiments the timing information may relate to symbol timing.

In embodiments, the gNB or BS may configure the UE with a table which maps control information in the DCI to a certain set S of slots or symbols. The gNB may then e.g. signal an index pointing at an entry in the table that indicates what slot(s) or symbol(s) to use for the scheduled transmission or reception, the index thus corresponding to the timing information T .

Embodiments of methods described with reference to **Figure 4** and **Figure 6**

Figure 4 is a flowchart illustrating one embodiment of a method of operating a wireless device, which may also be understood as a method performed by a wireless device.

The method comprises:

- 10: Receiving, from a network node, control information indicating a timing T of a scheduled transmission or reception. In embodiments, the network node may be a gNB of an NR access network.
- 5 - 20: Determining at least one slot or symbol S for the scheduled transmission or reception based on the control information indicating the timing, wherein the determining is dependent on whether the wireless device is configured with a semi-static time division duplex, TDD, uplink-downlink allocation or not.
- 30: Performing the scheduled transmission or reception in the determined at least one slot or
10 symbol.

In embodiments, the received control information may indicate in which slot or symbol the scheduled transmission or reception starts (see t_{start} described above). The received control information may also indicate a length of the scheduled transmission or reception (see t_{length} described above). The received control information may also indicate in which slot or symbol the scheduled transmission or
15 reception ends (see t_{end} described above). The received control information may indicate the timing by reference to a slot or symbol in which the control information is received (see parameter i and n described above).

The determining 20 of at least one slot or symbol may comprise:

- when the wireless device is not configured with a semi-static TDD uplink-downlink
20 allocation, determining a set of slots or symbols according to a first function (see function $f1$ above) of the control information,
- when the wireless device is configured with a semi-static TDD uplink-downlink allocation, determining the set of slots or symbols according to a second function (see function $f2$ above) of the control information different from the first function.

The determining 20 of slots or symbols may comprise:

- when the wireless device is not configured with a semi-static TDD uplink-downlink allocation, determining a set of slots or symbols in accordance with the indicated timing. In one
25 embodiment, the slots or symbols may be contiguous as illustrated in **Figure 3a**.
- when the wireless device is configured with a semi-static TDD uplink-downlink allocation,
30 determining the set of slots or symbols in accordance with the indicated timing while taking the semi-static TDD uplink-downlink allocation into account (see e.g. **Figure 3b**).

In one embodiment of the method, the control information indicates a timing of a scheduled transmission, and the determining of the set of slots or symbols in accordance with the indicated timing while taking the semi-static TDD uplink-downlink allocation into account comprises determining the set
35 of slots or symbols depending on certain properties of the semi-static TDD uplink-downlink allocation. The properties may e.g. be what slots or symbols that are allocated to UL in the configuration.

Therefore, in one embodiment the determining of the set of slots or symbols comprises determining the set of slots or symbols only among uplink slots or symbols of the semi-static TDD uplink-downlink allocation. In another embodiment, the control information indicates a timing of a scheduled reception, and determining the set of slots or symbols in accordance with the indicated timing while taking the semi-static TDD uplink-downlink allocation into account comprises determining the set of slots or symbols only among downlink slots or symbols of the semi-static TDD uplink-downlink allocation.

In one embodiment, the determining of the at least one slot or symbol comprises when the wireless device is not configured with a semi-static TDD uplink-downlink allocation:

- determining a set of contiguous slots or symbols among slots or symbols of the configured uplink-downlink allocation, wherein the control information indicates a start slot or start symbol and a length of the set.

Also the network should take the configuration of the TDD uplink-downlink allocation of the UE into account when determining the control information indicating the timing of the scheduled slots or symbols, i.e. the determining would be dependent on whether the configuration of the TDD uplink-downlink allocation of the UE is semi-static or dynamic. **Figure 6** is a flowchart illustrating one embodiment of a method of operating a network node to schedule a wireless device for transmission or reception, which may also be understood as a method performed by a network node. The network node may be a gNB of an NR wireless communication network.

The method comprises:

110: Scheduling the wireless device for transmission or reception in at least one slot or symbol.

120: Determining control information indicating a timing of the scheduled transmission or reception, wherein the determining is dependent on whether the wireless device is configured with a semi-static time division duplex, TDD, uplink-downlink allocation or not.

130: Transmitting, to the wireless device, the control information indicating the timing.

In embodiments, the control information may be determined to indicate at least one of the following:

- in which slot or symbol the scheduled transmission or reception starts;
- a length of the scheduled transmission or reception;
- in which slot or symbol the scheduled transmission or reception ends.

In one embodiment, the control information is determined to indicate the timing by reference to a slot or symbol in which the control information is received by the wireless device.

As a consequence, the transmitted control information may indicate: in which slot or symbol the scheduled transmission or reception starts; a length of the scheduled transmission or reception; and/or in which slot or symbol the scheduled transmission or reception ends. Further, the transmitted control information may indicate the timing by reference to a slot or symbol in which the control information is transmitted.

The determining 120 may comprise, when the wireless device is configured with a semi-static TDD uplink-downlink allocation:

- determining the control information taking the semi-static TDD uplink-downlink allocation into account, such that the control information indicates a timing that corresponds to the scheduled set of slots or symbols.

In embodiments, the determining 120 of the control information indicating the timing comprises:

- when the wireless device is not configured with a semi-static TDD uplink-downlink allocation, determining the control information such that the scheduled at least one slot or symbol can be determined by the wireless device according to a first function of the control information, and

- when the wireless device is configured with a semi-static TDD uplink-downlink allocation, determining the control information such that the scheduled at least one slot or symbol can be determined by the wireless device according to a second function of the control information different from the first function.

In embodiments, the wireless device may be configured with a semi-static TDD uplink-downlink allocation and may be scheduled 110 for transmission. The control information may then be determined 120 such that the wireless device determines the scheduled at least one slot or symbol only among uplink slots or symbols of the semi-static TDD uplink-downlink allocation based on the control information.

In embodiments, the wireless device may be configured with a semi-static TDD uplink-downlink allocation and may be scheduled 110 for reception. The control information may then be determined 120 such that the wireless device determines the scheduled at least one slot or symbol only among downlink slots or symbols of the semi-static TDD uplink-downlink allocation based on the control information.

Embodiments of apparatus described with reference to **Figure 5** and **Figure 7**

An embodiment of the wireless device 500 is schematically illustrated in the block diagram in **Figure 5**. The wireless device 500 is configured to:

- receive, from a network node, control information indicating a timing of a scheduled transmission or reception,

- determine at least one slot or symbol for the scheduled transmission or reception based on the control information indicating the timing, wherein the determining is dependent on whether the wireless device is configured with a semi-static time division duplex, TDD, uplink-downlink allocation or not,

- perform the scheduled transmission or reception in the determined at least one slot or symbol.

The wireless device may be configured to perform any of the methods previously described e.g. the ones described with reference to **Figure 4**.

The wireless device may be configured to receive control information indicating in which slot or symbol the scheduled transmission or reception starts, configured to receive control information

indicating a length of the scheduled transmission or reception, configured to receive control information indicating in which slot or symbol the scheduled transmission or reception ends, and/or configured to receive control information indicating the timing by reference to a slot or symbol in which the control information is received.

5 In embodiments, the wireless device may be configured to determine the at least one slot or symbol by:

- determining a set of slots or symbols according to a first function of the control information, when the wireless device is not configured with a semi-static TDD uplink-downlink allocation,

- determining the set of slots or symbols according to a second function of the control information different from the first function, when the wireless device is configured with a semi-static TDD uplink-downlink allocation.

10

In embodiments, the wireless device may be configured to determine the at least one slot or symbol by:

- determining a set of slots or symbols in accordance with the indicated timing while taking the semi-static TDD uplink-downlink allocation into account, when the wireless device is configured with a semi-static TDD uplink-downlink allocation.

15

In embodiments, when the control information indicates a timing of a scheduled transmission, the wireless device may be configured to determine the set of slots or symbols in accordance with the indicated timing while taking the semi-static TDD uplink-downlink allocation into account comprises determining the set of slots or symbols only among uplink slots or symbols of the semi-static TDD uplink-downlink allocation.

20

In embodiments, when the control information indicates a timing of a scheduled reception, the wireless device may be configured to determine the set of slots or symbols in accordance with the indicated timing while taking the semi-static TDD uplink-downlink allocation into account comprises determining the set of slots or symbols only among downlink slots or symbols of the semi-static TDD uplink-downlink allocation.

25

In further embodiments, when the wireless device is not configured with a semi-static TDD uplink-downlink allocation, the wireless device may be configured to determine the at least one slot or symbol by determining a set of contiguous slots or symbols among slots or symbols of the configured uplink-downlink allocation, wherein the control information indicates a start slot or start symbol and a length of the set.

30

As illustrated in **Figure 5**, the wireless device 500 may comprise at least one processing circuitry 510 and optionally also a memory 530. In embodiments, the memory 530 may be placed in some other node or unit or at least separately from the wireless device 500. The wireless device 500 may also comprise one or more input/output (I/O) units 520 configured to communicate with a network node such as an gNodeB. The input/output (I/O) unit 520 may in embodiments comprise a transceiver connected to

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one or more antennas over antenna ports for wireless communication with network nodes in the network. The memory 530 may contain instructions executable by said at least one processing circuitry 510, whereby the wireless device 500 may be configured to perform any of the methods previously described herein, .g. the ones described with reference to **Figure 4**.

5 In another embodiment also illustrated in **Figure 5**, the wireless device 500 may comprise a receiving module 511, a determining module 512, and a performing module 513, adapted to respectively perform the method steps of **Figure 4**.

The wireless device 500 may contain further modules adapted to perform any of the methods previously described herein. The modules described above are functional units which may be
10 implemented in hardware, software, firmware or any combination thereof. In one embodiment, the modules are implemented as a computer program running on the at least one processing circuitry 510.

In still another alternative way to describe the embodiment in **Figure 5**, the wireless device 500 may comprise a Central Processing Unit (CPU) which may be a single unit or a plurality of units. Furthermore, the wireless device 500 may comprise at least one computer program product (CPP) with a
15 computer readable medium 541, e.g. in the form of a non-volatile memory, e.g. an EEPROM (Electrically Erasable Programmable Read-Only Memory), a flash memory or a disk drive. The CPP may comprise a computer program 540 stored on the computer readable medium 541, which comprises code means which when run on the CPU of the wireless device 500 causes the wireless device 500 to perform the methods described earlier in conjunction with **Figure 4**. In other words, when said code means are run on the CPU,
20 they correspond to the at least one processing circuitry 510 of the wireless device 500 in **Figure 5**.

An embodiment of the network node 600 is schematically illustrated in the block diagram in **Figure 7**. The network node 600 is configured to:

- schedule the wireless device for transmission or reception in a set of slots or symbols,
- determine control information indicating a timing of the scheduled transmission or reception,
25 wherein the determining is dependent on whether the wireless device is configured with a semi-static time division duplex, TDD, uplink-downlink allocation or not,
- transmit, to the wireless device, the control information indicating the timing.

The network node 600 may be configured to perform any of the methods previously described e.g. the ones described with reference to **Figure 6**.

30 The network node may be configured to determine the control information to indicate: in which slot or symbol the scheduled transmission or reception starts, a length of the scheduled transmission or reception, in which slot or symbol the scheduled transmission or reception ends, the timing by reference to a slot or symbol in which the control information is received by the wireless device.

In embodiments, the network node may be configured to determine the control information
35 indicating the timing by:

- when the wireless device is not configured with a semi-static TDD uplink-downlink allocation, determining the control information such that the scheduled at least one slot or symbol can be determined by the wireless device according to a first function of the control information,

- when the wireless device is configured with a semi-static TDD uplink-downlink allocation,
5 determining the control information such that the scheduled at least one slot or symbol can be determined by the wireless device according to a second function of the control information different from the first function.

In other embodiments, wherein the wireless device is configured with a semi-static TDD uplink-downlink allocation, the network node may be configured to schedule the wireless device for
10 transmission, and to determine the control information such that the wireless device determines the scheduled at least one slot or symbol only among uplink slots or symbols of the semi-static TDD uplink-downlink allocation based on the control information.

In embodiments, wherein the wireless device is configured with a semi-static TDD uplink-downlink allocation, the network node may be configured to schedule the wireless device for reception,
15 and to determine the control information such that the wireless device determines the scheduled at least one slot or symbol only among downlink slots or symbols of the semi-static TDD uplink-downlink allocation based on the control information.

As illustrated in **Figure 7**, the network node 600 may comprise at least one processing circuitry 610 and optionally also a memory 630. In embodiments, the memory 630 may be placed in some other
20 node or unit or at least separately from the network node 600. The network node 600 may also comprise one or more input/output (I/O) units 620 configured to communicate with a wireless device or UE. The input/output (I/O) unit 620 may in embodiments comprise a transceiver connected to one or more antennas over antenna ports for wireless communication with wireless devices. The memory 630 may contain instructions executable by said at least one processing circuitry 610, whereby the network node
25 600 may be configured to perform any of the methods previously described herein, e.g. the ones described with reference to **Figure 6**.

In another embodiment also illustrated in **Figure 7**, the network node 600 may comprise a scheduling module 611, a determining module 612, and a transmitting module 613, adapted to respectively perform the method steps of **Figure 6**.

30 The network node 600 may contain further modules adapted to perform any of the methods previously described herein. The modules described above are functional units which may be implemented in hardware, software, firmware or any combination thereof. In one embodiment, the modules are implemented as a computer program running on the at least one processing circuitry 610.

In still another alternative way to describe the embodiment in **Figure 7**, the network node 600 may
35 comprise a Central Processing Unit (CPU) which may be a single unit or a plurality of units. Furthermore, the network node 600 may comprise at least one computer program product (CPP) with a computer

readable medium 641, e.g. in the form of a non-volatile memory, e.g. an EEPROM (Electrically Erasable Programmable Read-Only Memory), a flash memory or a disk drive. The CPP may comprise a computer program 640 stored on the computer readable medium 641, which comprises code means which when run on the CPU of the network node 600 causes the network node 600 to perform the methods described earlier in conjunction with **Figure 6**. In other words, when said code means are run on the CPU, they correspond to the at least one processing circuitry 610 of the network node 600 in **Figure 7**.

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

10

List of further example embodiments

E1. A method of operating a wireless device, the method comprising:

- receiving (10), from a network node, control information indicating a timing of a scheduled transmission or reception,
- determining (20) slots or symbols for the scheduled transmission or reception based on the control information indicating the timing, wherein the determining is dependent on whether the wireless device is configured with a semi-static time division duplex, TDD, uplink-downlink allocation or not,
- performing (30) the scheduled transmission or reception in the determined slots or symbols.

20

E2. The method according to embodiment E1, wherein the received control information indicates in which slot or symbol the scheduled transmission or reception starts.

25

E3. The method according to any of the preceding embodiments, wherein the received control information indicates a length of the scheduled transmission or reception.

E4. The method according to any of the preceding embodiments, wherein the received control information indicates in which slot or symbol the scheduled transmission or reception ends.

30

E5. The method according to any of the preceding embodiments, wherein the received control information indicates the timing by reference to a slot or symbol in which the control information is received.

35

E6. The method according to any of the preceding embodiments, wherein the determining (20) of slots or symbols comprises:

- when the wireless device is not configured with a semi-static TDD uplink-downlink allocation, determining the set of slots or symbols according to a first function of the control information,
 - when the wireless device is configured with a semi-static TDD uplink-downlink allocation, determining the set of slots or symbols according to a second function of the control information
- 5 different from the first function.

E7. The method according to any of the preceding embodiments, wherein the determining (20) of slots or symbols comprises:

- when the wireless device is not configured with a semi-static TDD uplink-downlink allocation, determining a set of slots or symbols in accordance with the indicated timing,
 - when the wireless device is configured with a semi-static TDD uplink-downlink allocation, determining the set of slots or symbols in accordance with the indicated timing while taking the semi-static TDD uplink-downlink allocation into account.
- 10

E8. The method according to embodiment E7, wherein the control information indicates a timing of a scheduled transmission, and wherein determining the set of slots or symbols in accordance with the indicated timing while taking the semi-static TDD uplink-downlink allocation into account comprises determining the set of slots or symbols depending on certain properties of the semi-static TDD uplink-downlink allocation.

15

E9. The method according to embodiment E7, wherein the control information indicates a timing of a scheduled transmission, and wherein determining the set of slots or symbols in accordance with the indicated timing while taking the semi-static TDD uplink-downlink allocation into account comprises determining the set of slots or symbols only among uplink slots or symbols of the semi-static TDD uplink-downlink allocation.

20

E10. The method according to embodiment E7, wherein the control information indicates a timing of a scheduled reception, and wherein determining the set of slots or symbols in accordance with the indicated timing while taking the semi-static TDD uplink-downlink allocation into account comprises determining the set of slots or symbols only among downlink slots or symbols of the semi-static TDD uplink-downlink allocation.

25

E11. A method of operating a network node to schedule a wireless device for transmission or reception, the method comprising:

- scheduling (110) the wireless device for transmission or reception in a set of slots or symbols,
- 30

- determining (120) control information indicating a timing of the scheduled transmission or reception, wherein the determining is dependent on whether the wireless device is configured with a semi-static time division duplex, TDD, uplink-downlink allocation or not,
- transmitting (130), to the wireless device, the control information indicating the timing.

5

E12. The method according to embodiment E11, wherein the transmitted control information indicates in which slot or symbol the scheduled transmission or reception starts.

10

E13. The method according to any of embodiments E11-E12, wherein the transmitted control information indicates a length of the scheduled transmission or reception.

E14. The method according to any of embodiments E11-E13, wherein the transmitted control information indicates in which slot or symbol the scheduled transmission or reception ends.

15

E15. The method according to any of embodiments E11-E14, wherein the transmitted control information indicates the timing by reference to a slot or symbol in which the control information is transmitted.

20

E16. The method according to any of embodiments E11-E15, wherein the determining (120) comprises when the wireless device is configured with a semi-static TDD uplink-downlink allocation:

- determining the control information taking the semi-static TDD uplink-downlink allocation into account, such that the control information indicates a timing that corresponds to the scheduled set of slots or symbols.

25

E17. A wireless device (500) configured to:

30

- receive, from a network node, control information indicating a timing of a scheduled transmission or reception,
- determine slots or symbols for the scheduled transmission or reception based on the control information indicating the timing, wherein the determining is dependent on whether the wireless device is configured with a semi-static time division duplex, TDD, uplink-downlink allocation or not,
- perform the scheduled transmission or reception in the determined slots or symbols.

35

E18. The wireless device of embodiment E17, further configured to perform the method of any of embodiments E2-E10.

E19. A wireless device (500) comprising a processing circuitry (610) and a memory (630), the memory containing instructions executable by the processing circuitry whereby the wireless device is configured to:

- 5 – receive, from a network node, control information indicating a timing of a scheduled transmission or reception,
- determine slots or symbols for the scheduled transmission or reception based on the control information indicating the timing, wherein the determining is dependent on whether the wireless device is configured with a semi-static time division duplex, TDD, uplink-downlink allocation or not,
- 10 – perform the scheduled transmission or reception in the determined slots or symbols.

E20. The wireless device of embodiment E19, wherein the memory contains instructions executable by the processing circuitry, whereby the wireless device is configured to perform the method of any of embodiments E2-E10.

- 15
- E21. A wireless device (500) comprising:
- a receiving module (511) adapted to receive, from a network node, control information indicating a timing of a scheduled transmission or reception,
 - a determining module (512) adapted to determine slots or symbols for the scheduled transmission or reception based on the control information indicating the timing, wherein the determining is dependent on whether the wireless device is configured with a semi-static time division duplex, TDD, uplink-downlink allocation or not,
 - 20 – a performing module (513) adapted to perform the scheduled transmission or reception in the determined slots or symbols.

25

E22. The wireless device of embodiment E21, comprising further modules adapted to perform the method of any of embodiments E2-E10.

E23. A computer program comprising instructions which, when executed by at least one processor of a wireless device, causes the wireless device to carry out the method of any of embodiments E1-E10.

E24. A carrier containing the computer program of embodiment E23, wherein the carrier is one of an electronic signal, optical signal, radio signal, or computer readable storage medium.

35

E25. A network node (600) configured to schedule a wireless device for transmission or reception, the network node being further configured to:

- schedule the wireless device for transmission or reception in a set of slots or symbols,
- determine control information indicating a timing of the scheduled transmission or reception, wherein the determining is dependent on whether the wireless device is configured with a semi-static time division duplex, TDD, uplink-downlink allocation or not,
- 5 – transmit, to the wireless device, the control information indicating the timing.

E26. The network node of embodiment E25, further configured to perform the method of any of embodiments E12-E16.

10 E27. A network node (600) configured to schedule a wireless device for transmission or reception, comprising a processing circuitry (610) and a memory (630), the memory containing instructions executable by the processing circuitry whereby the network node is configured to:

- schedule the wireless device for transmission or reception in a set of slots or symbols,
- determine control information indicating a timing of the scheduled transmission or reception,
- 15 wherein the determining is dependent on whether the wireless device is configured with a semi-static time division duplex, TDD, uplink-downlink allocation or not,
- transmit, to the wireless device, the control information indicating the timing.

20 E28. The network node of embodiment E27, wherein the memory contains instructions executable by the processing circuitry, whereby the network node is configured to perform the method of any of embodiments E12-E16.

E29. A network node (600) comprising:

- a scheduling module (611) adapted to schedule the wireless device for transmission or reception in
- 25 a set of slots or symbols,
- a determining module (612) adapted to determine control information indicating a timing of the scheduled transmission or reception, wherein the determining is dependent on whether the wireless device is configured with a semi-static time division duplex, TDD, uplink-downlink allocation or not,
- 30 – a transmitting module (613) adapted to transmit, to the wireless device, the control information indicating the timing.

E30. The network node of embodiment E29, comprising further modules adapted to perform the method of any of embodiments E12-E16.

E31. A computer program comprising instructions which, when executed by at least one processor of a network node, causes the network node to carry out the method of any of embodiments E11-E16.

5 E32. A carrier containing the computer program of embodiment 31, wherein the carrier is one of an electronic signal, optical signal, radio signal, or computer readable storage medium.

CLAIMS

1. A method of operating a wireless device, the method comprising:
 - receiving (10), from a network node, control information indicating a timing of a scheduled transmission or reception,
 - determining (20) at least one slot or symbol for the scheduled transmission or reception based on the control information indicating the timing, wherein the determining is dependent on whether the wireless device is configured with a semi-static time division duplex, TDD, uplink-downlink allocation or not,
 - performing (30) the scheduled transmission or reception in the determined at least one slot or symbol.
2. The method according to claim 1, wherein the received control information indicates in which slot or symbol the scheduled transmission or reception starts.
3. The method according to any of the preceding claims, wherein the received control information indicates a length of the scheduled transmission or reception.
4. The method according to any of the preceding claims, wherein the received control information indicates in which slot or symbol the scheduled transmission or reception ends.
5. The method according to any of the preceding claims, wherein the received control information indicates the timing by reference to a slot or symbol in which the control information is received.
6. The method according to any of the preceding claims, wherein the determining (20) of at least one slot or symbol comprises:
 - when the wireless device is not configured with a semi-static TDD uplink-downlink allocation, determining a set of slots or symbols according to a first function of the control information,
 - when the wireless device is configured with a semi-static TDD uplink-downlink allocation, determining the set of slots or symbols according to a second function of the control information different from the first function.
7. The method according to any of the preceding claims, wherein the determining (20) of the at least one slot or symbol comprises:

- when the wireless device is configured with a semi-static TDD uplink-downlink allocation, determining a set of slots or symbols in accordance with the indicated timing while taking the semi-static TDD uplink-downlink allocation into account.
- 5 8. The method according to claim 7, wherein the control information indicates a timing of a scheduled transmission, and wherein determining the set of slots or symbols in accordance with the indicated timing while taking the semi-static TDD uplink-downlink allocation into account comprises determining the set of slots or symbols only among uplink slots or symbols of the semi-static TDD uplink-downlink allocation.
- 10
9. The method according to claim 7, wherein the control information indicates a timing of a scheduled reception, and wherein determining the set of slots or symbols in accordance with the indicated timing while taking the semi-static TDD uplink-downlink allocation into account comprises determining the set of slots or symbols only among downlink slots or symbols of the semi-static TDD uplink-downlink allocation.
- 15
10. The method according to any of the preceding claims, wherein the determining (20) of the at least one slot or symbol comprises:
- when the wireless device is not configured with a semi-static TDD uplink-downlink allocation, determining a set of contiguous slots or symbols among slots or symbols of the configured uplink-downlink allocation, wherein the control information indicates a start slot or start symbol and a length of the set.
- 20
11. A method of operating a network node to schedule a wireless device for transmission or reception, the method comprising:
- 25
- scheduling (110) the wireless device for transmission or reception in at least one slot or symbol,
 - determining (120) control information indicating a timing of the scheduled transmission or reception, wherein the determining is dependent on whether the wireless device is configured with a semi-static time division duplex, TDD, uplink-downlink allocation or not,
- 30
- transmitting (130), to the wireless device, the control information indicating the timing.
12. The method according to claim 11, wherein the control information is determined to indicate in which slot or symbol the scheduled transmission or reception starts.
- 35
13. The method according to any of claims 11-12, wherein the control information is determined to indicate a length of the scheduled transmission or reception.

14. The method according to any of claims 11-13, wherein the control information is determined to indicate in which slot or symbol the scheduled transmission or reception ends.
- 5 15. The method according to any of claims 11-14, wherein the control information is determined to indicate the timing by reference to a slot or symbol in which the control information is received by the wireless device.
- 10 16. The method according to any of claims 11-15, wherein the determining (120) of the control information indicating the timing comprises:
- when the wireless device is not configured with a semi-static TDD uplink-downlink allocation, determining the control information such that the scheduled at least one slot or symbol can be determined by the wireless device according to a first function of the control information,
 - when the wireless device is configured with a semi-static TDD uplink-downlink allocation,
15 determining the control information such that the scheduled at least one slot or symbol can be determined by the wireless device according to a second function of the control information different from the first function.
- 20 17. The method according to any of claims 11-16, wherein the wireless device is configured with a semi-static TDD uplink-downlink allocation and is scheduled (110) for transmission, and wherein the control information is determined (120) such that the wireless device determines the scheduled at least one slot or symbol only among uplink slots or symbols of the semi-static TDD uplink-downlink allocation based on the control information.
- 25 18. The method according to any of claims 11-16, wherein the wireless device is configured with a semi-static TDD uplink-downlink allocation and is scheduled (110) for reception, and wherein the control information is determined (120) such that the wireless device determines the scheduled at least one slot or symbol only among downlink slots or symbols of the semi-static TDD uplink-downlink allocation based on the control information.
- 30 19. A wireless device (500) configured to:
- receive, from a network node, control information indicating a timing of a scheduled transmission or reception,
 - determine at least one slot or symbol for the scheduled transmission or reception based on the
35 control information indicating the timing, wherein the determining is dependent on whether the

wireless device is configured with a semi-static time division duplex, TDD, uplink-downlink allocation or not,

- perform the scheduled transmission or reception in the determined at least one slot or symbol.

5 20. The wireless device according to claim 19, configured to receive control information indicating in which slot or symbol the scheduled transmission or reception starts.

21. The wireless device according to any of claims 19-20, configured to receive control information indicating a length of the scheduled transmission or reception.

10 22. The wireless device according to any of claims 19-21, configured to receive control information indicating in which slot or symbol the scheduled transmission or reception ends.

15 23. The wireless device according to any of claims 19-22, configured to receive control information indicating the timing by reference to a slot or symbol in which the control information is received.

24. The wireless device according to any of claims 19-23, configured to determine the at least one slot or symbol by:
- when the wireless device is not configured with a semi-static TDD uplink-downlink allocation,
20 determining a set of slots or symbols according to a first function of the control information,
- when the wireless device is configured with a semi-static TDD uplink-downlink allocation, determining the set of slots or symbols according to a second function of the control information different from the first function.

25 25. The wireless device according to any of claims 19-24, configured to determine the at least one slot or symbol by:
- when the wireless device is configured with a semi-static TDD uplink-downlink allocation,
determining a set of slots or symbols in accordance with the indicated timing while taking the semi-static TDD uplink-downlink allocation into account.

30 26. The wireless device according to claim 25, wherein the control information indicates a timing of a scheduled transmission, the wireless device being configured to determine the set of slots or symbols in accordance with the indicated timing while taking the semi-static TDD uplink-downlink allocation into account comprises determining the set of slots or symbols only among uplink slots or symbols of
35 the semi-static TDD uplink-downlink allocation.

27. The wireless device according to claim 25, wherein the control information indicates a timing of a scheduled reception, the wireless device being configured to determine the set of slots or symbols in accordance with the indicated timing while taking the semi-static TDD uplink-downlink allocation into account comprises determining the set of slots or symbols only among downlink slots or symbols of the semi-static TDD uplink-downlink allocation.
28. The wireless device according to any of claims 19-27, configured to determine the at least one slot or symbol by:
- when the wireless device is not configured with a semi-static TDD uplink-downlink allocation, determining a set of contiguous slots or symbols among slots or symbols of the configured uplink-downlink allocation, wherein the control information indicates a start slot or start symbol and a length of the set.
29. A wireless device (500) comprising a processing circuitry (610) and a memory (630), the memory containing instructions executable by the processing circuitry whereby the wireless device is configured to:
- receive, from a network node, control information indicating a timing of a scheduled transmission or reception,
 - determine at least one slot or symbol for the scheduled transmission or reception based on the control information indicating the timing, wherein the determining is dependent on whether the wireless device is configured with a semi-static time division duplex, TDD, uplink-downlink allocation or not,
 - perform the scheduled transmission or reception in the determined at least one slot or symbol.
30. The wireless device of claim 29, wherein the memory contains instructions executable by the processing circuitry, whereby the wireless device is configured to perform the method of any of claims 2-10.
31. A computer program comprising instructions which, when executed by at least one processor of a wireless device, causes the wireless device to carry out the method of any of claims 1-10.
32. A carrier containing the computer program of claim 31, wherein the carrier is one of an electronic signal, optical signal, radio signal, or computer readable storage medium.
33. A network node (600) configured to schedule a wireless device for transmission or reception, the network node being further configured to:

- schedule the wireless device for transmission or reception in at least one slot or symbol,
 - determine control information indicating a timing of the scheduled transmission or reception, wherein the determining is dependent on whether the wireless device is configured with a semi-static time division duplex, TDD, uplink-downlink allocation or not,
 - 5 – transmit, to the wireless device, the control information indicating the timing.
34. The network node according to claim 33, configured to determine the control information to indicate in which slot or symbol the scheduled transmission or reception starts.
- 10 35. The network node according to any of claims 33-34, configured to determine the control information to indicate a length of the scheduled transmission or reception.
36. The network node according to any of claims 33-35, configured to determine the control information to indicate in which slot or symbol the scheduled transmission or reception ends.
- 15 37. The network node according to any of claims 33-36, configured to determine the control information to indicate the timing by reference to a slot or symbol in which the control information is received by the wireless device.
- 20 38. The network node according to any of claims 33-37, configured to determine the control information indicating the timing by:
- when the wireless device is not configured with a semi-static TDD uplink-downlink allocation, determining the control information such that the scheduled at least one slot or symbol can be determined by the wireless device according to a first function of the control information,
 - 25 – when the wireless device is configured with a semi-static TDD uplink-downlink allocation, determining the control information such that the scheduled at least one slot or symbol can be determined by the wireless device according to a second function of the control information different from the first function.
- 30 39. The network node according to any of claims 33-38, wherein the wireless device is configured with a semi-static TDD uplink-downlink allocation and wherein the network node is configured to schedule the wireless device for transmission, and to determine the control information such that the wireless device determines the scheduled at least one slot or symbol only among uplink slots or symbols of the semi-static TDD uplink-downlink allocation based on the control information.
- 35

40. The network node according to any of claims 33-38, wherein the wireless device is configured with a semi-static TDD uplink-downlink allocation and wherein the network node is configured to schedule the wireless device for reception, and to determine the control information such that the wireless device determines the scheduled at least one slot or symbol only among downlink slots or symbols of the semi-static TDD uplink-downlink allocation based on the control information.
- 5
41. A network node (600) configured to schedule a wireless device for transmission or reception, comprising a processing circuitry (610) and a memory (630), the memory containing instructions executable by the processing circuitry whereby the network node is configured to:
- 10
- schedule the wireless device for transmission or reception in at least one slot or symbol,
 - determine control information indicating a timing of the scheduled transmission or reception, wherein the determining is dependent on whether the wireless device is configured with a semi-static time division duplex, TDD, uplink-downlink allocation or not,
 - transmit, to the wireless device, the control information indicating the timing.
- 15
42. The network node of claim 41, wherein the memory contains instructions executable by the processing circuitry, whereby the network node is configured to perform the method of any of claims 12-18.
- 20
43. A computer program comprising instructions which, when executed by at least one processor of a network node, causes the network node to carry out the method of any of claims 11-18.
44. A carrier containing the computer program of claim 43, wherein the carrier is one of an electronic signal, optical signal, radio signal, or computer readable storage medium.

1/5

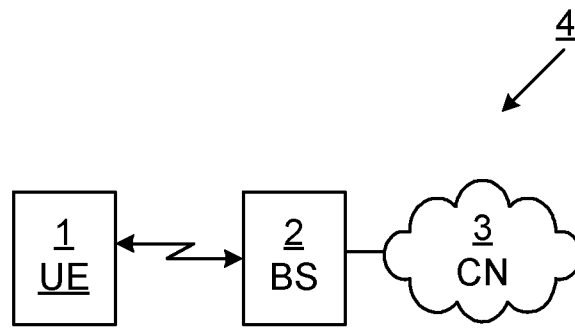


Figure 1

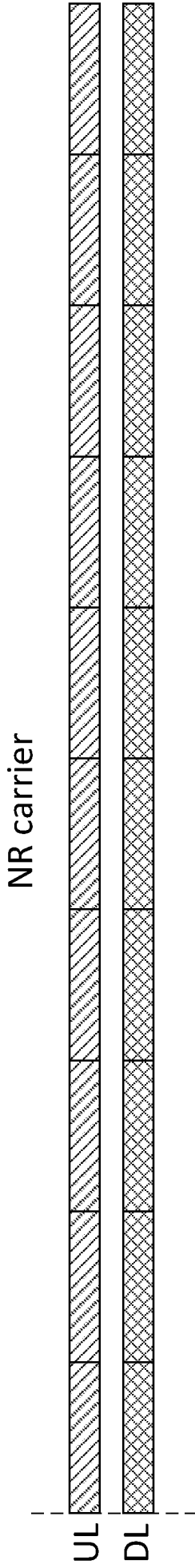


Figure 2a

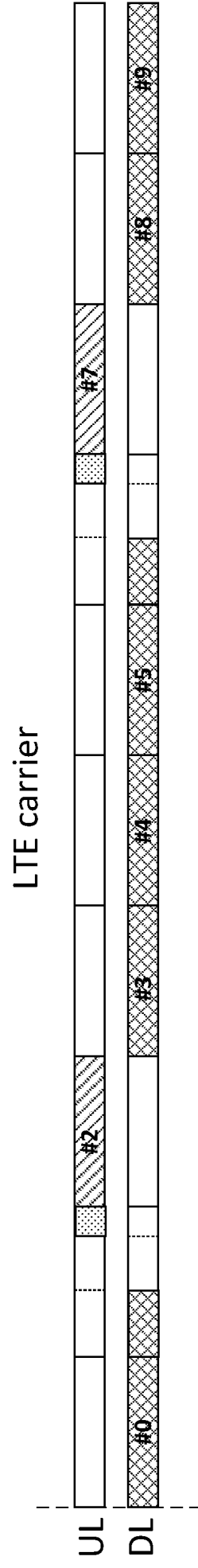
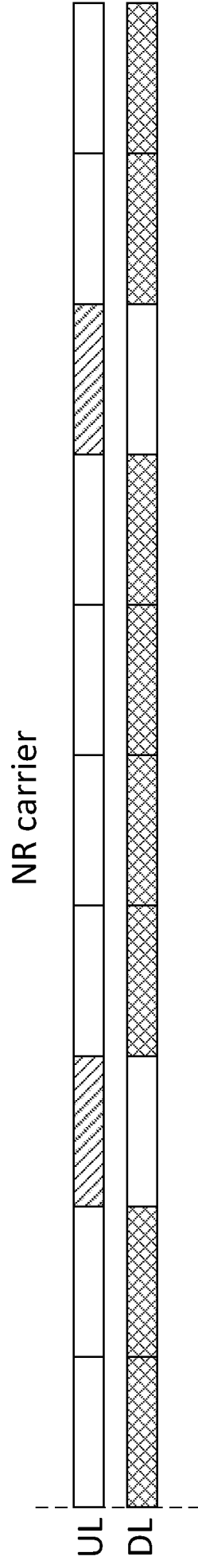


Figure 2b

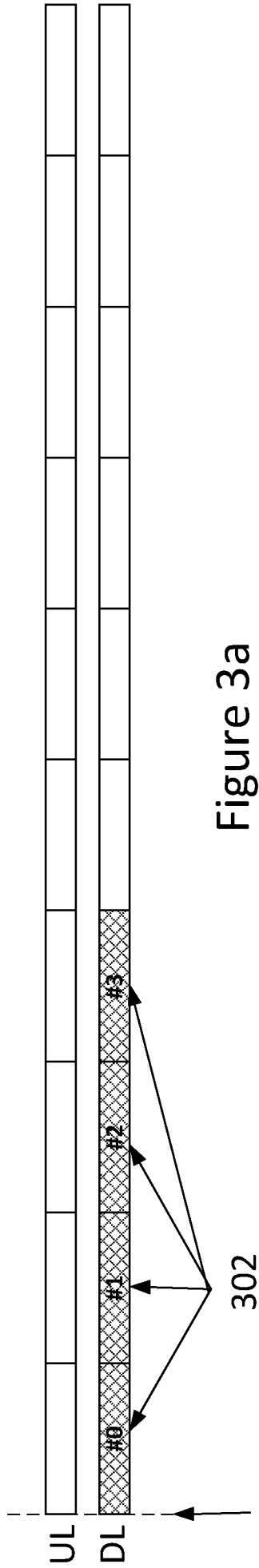


Figure 3a

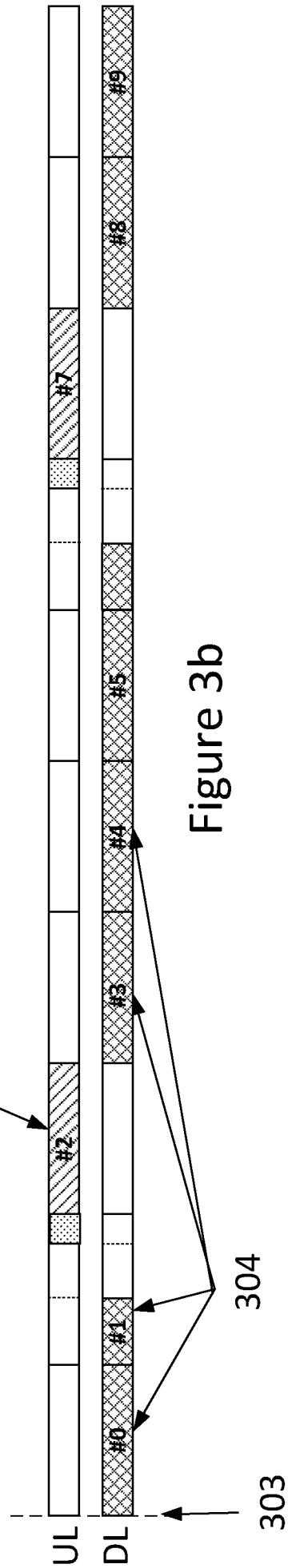


Figure 3b

4/5

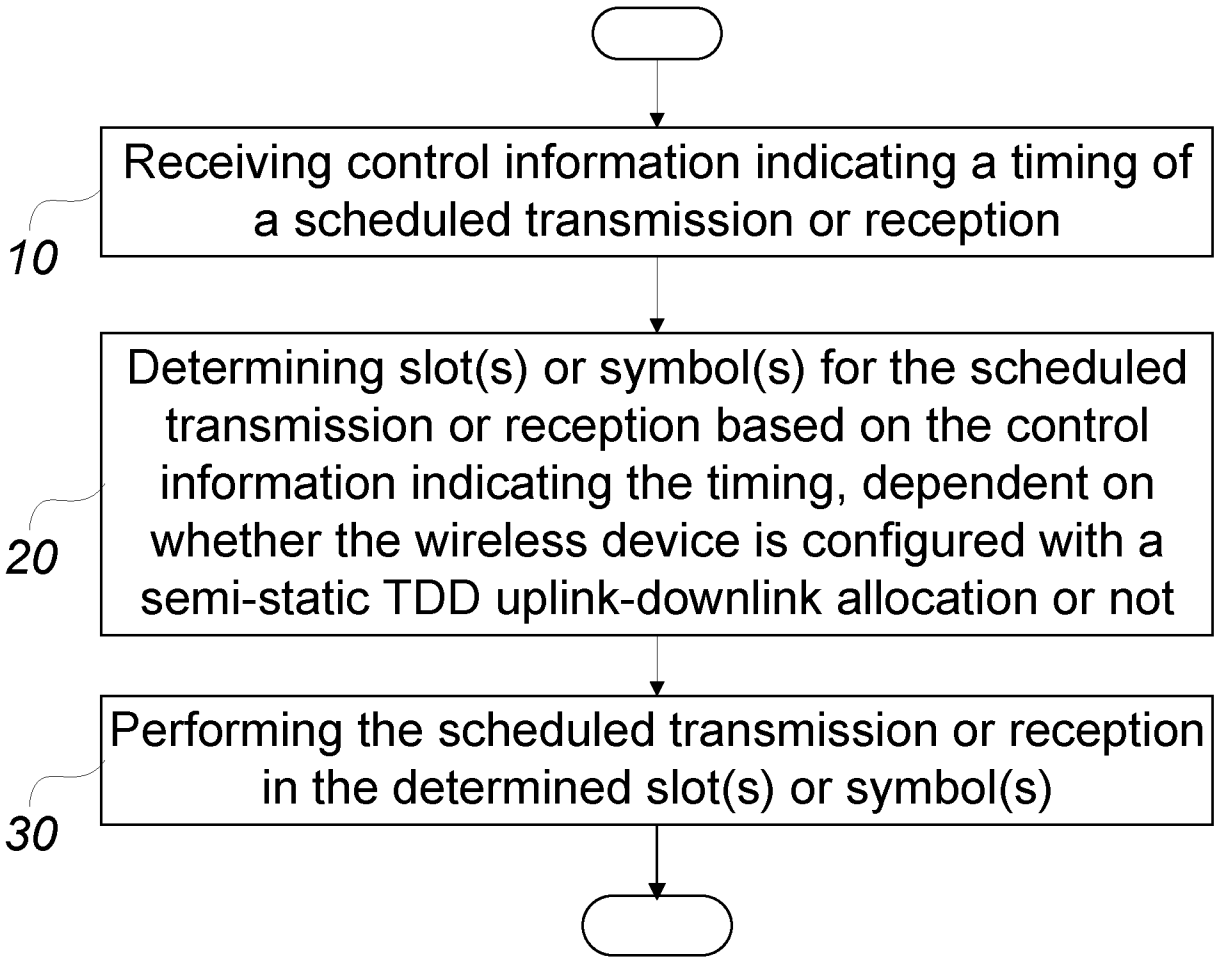


Figure 4

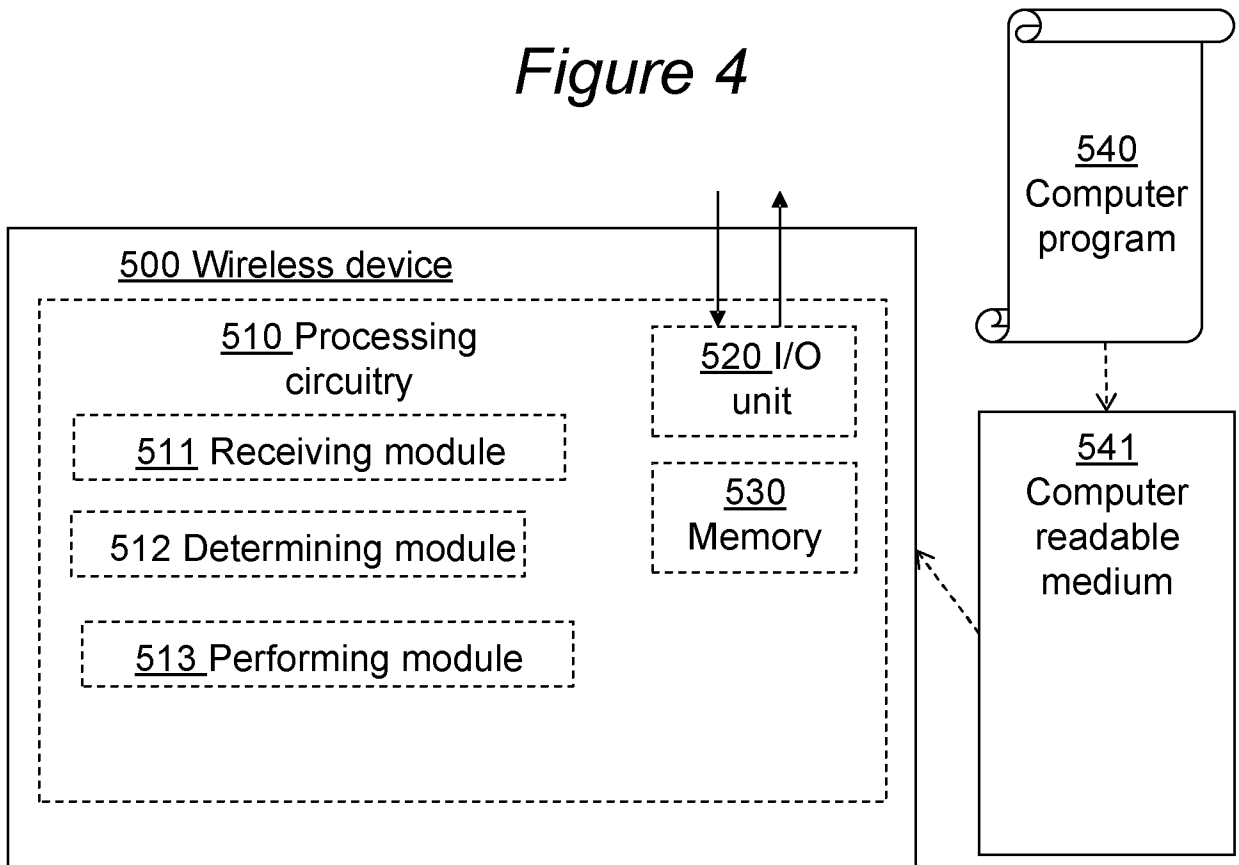


Figure 5

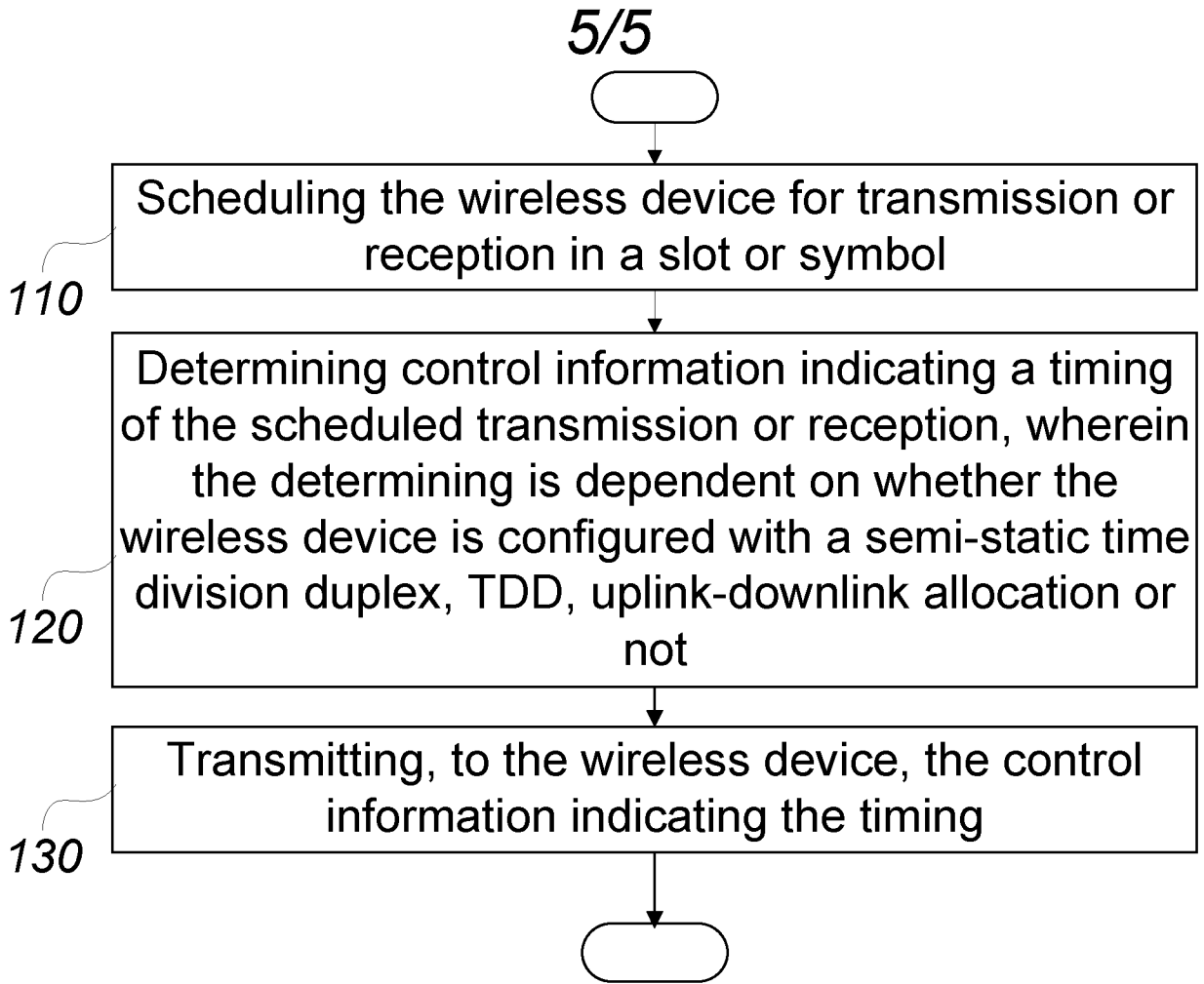


Figure 6

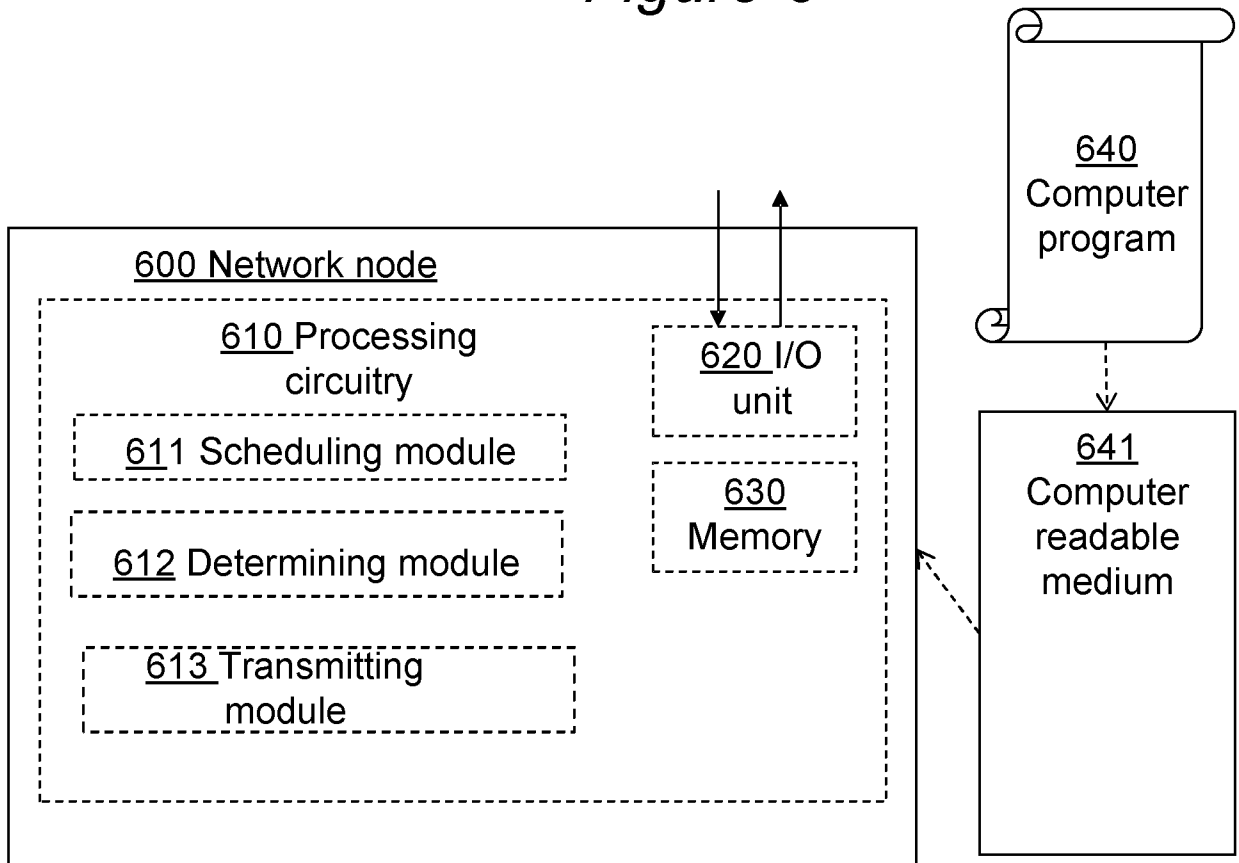


Figure 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2018/050330

A. CLASSIFICATION OF SUBJECT MATTER		
IPC: see extra sheet		
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)		
IPC: H04L, H04W		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
SE, DK, FI, NO classes as above		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
EPO-Internal, PAJ, WPI data, COMPENDEX, INSPEC, IBM-TDB		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 20160156454 A1 (KHORYAEV ALEXEY ET AL), 2 June 2016 (2016-06-02); paragraphs [0020]-[0039] --	1-44
A	US 20160323852 A1 (GOLITSHEK EDLER VON ELBWART ALEXANDER ET AL), 3 November 2016 (2016-11-03); abstract; paragraphs [0066]-[0085] --	1-44
A	3GPP Draft; R1-1705106; "Downlink HARQ-ACK feedback timing"; 2017-03-24; whole document -- -----	1-44
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> 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 04-06-2018		Date of mailing of the international search report 04-06-2018
Name and mailing address of the ISA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. + 46 8 666 02 86		Authorized officer Anders Edlund Telephone No. + 46 8 782 28 00

Continuation of: second sheet

International Patent Classification (IPC)

H04W 72/04 (2009.01)

H04L 5/14 (2006.01)

H04W 72/02 (2009.01)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

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