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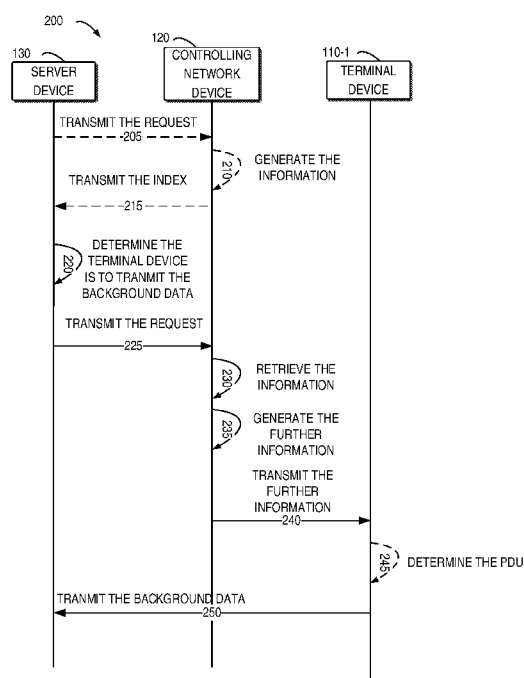


Fig. 2

(57) Abstract: Embodiments of the present disclosure relate to mechanism for transmitting background data in uplink. According to embodiments of the present disclosure, if the server device initiates the process of Background Data transfer negotiation, the server device transmits the request for transmitting information for transmitting background data in uplink to the terminal device. The controlling network device transmits information for transmitting background data in uplink to the terminal device. In this way, the transmission of background in uplink is managed and is more efficient.



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MECHANISM FOR TRANSMITTING BACKGROUND DATA IN UPLINK

FIELD

5 [0001] Embodiments of the present disclosure generally relate to the field of communications and in particular, to a method, device, apparatus and computer readable storage medium for transmitting background data in uplink.

BACKGROUND

10 [0002] In recent communication networks, volume of data has dramatically increased. For example, in the fifth generation (5G) communication systems, capacity of available radio access node (RAN) is much greater than the capacity in the fourth generation (4G) communication systems. Some data, for example background data, may not be necessary to be transmitted immediately. The background data transfer is expected to be used to
15 utilize both the wireless resources and core network resources in an efficient manner.

SUMMARY

[0003] Generally, embodiments of the present disclosure relate to a method for transmitting background data in uplink and the corresponding communication devices.

20 [0004] In a first aspect, there is provided a controlling network device. The controlling network device comprises at least one processor; and at least one memory including computer program codes; the at least one memory and the computer program codes are configured to, with the at least one processor, cause the controlling network device to receive, at the controlling network device, a request from a server device. The request
25 comprises identity information of a terminal device and an index associated with information for data transmission. The controlling network device is also caused to retrieve the information for data transmission based on the index. The controlling network device is further caused to generate further information for transmitting background data in uplink based on the information for data transmission. The controlling network device is
30 yet caused to transmit the further information to the terminal device.

[0005] In a second aspect, there is provided a server device. The server device comprises at least one processor; and at least one memory including computer program codes; the at least one memory and the computer program codes are configured to, with the at least one processor, cause the server device to determine that a terminal device is to transmit data in uplink. The server device is also caused to transmit, to a controlling network device and at the server device, a request comprising identity information of a terminal device and an index associated with information for data transmission. The network device is further caused to receive the data in uplink from the terminal device, the data being transmitted based on further information for transmitting data in uplink which is generated based on the information for data transmission.

[0006] In a third aspect, there is provided a terminal device. The terminal device comprises at least one processor; and at least one memory including computer program codes; the at least one memory and the computer program codes are configured to, with the at least one processor, cause the terminal device to receive information for transmitting background data in uplink from a network device. The terminal device is further caused to transmit the background data in uplink to a server device based on the information.

[0007] In a fourth aspect, there is provided a method. The method comprises receiving, at a controlling network device, a request from a server device. The request comprises identity information of a terminal device and an index associated with information for data transmission. The method also comprises retrieving the information for data transmission based on the index. The method further comprises generating further information for transmitting background data in uplink based on the information for data transmission. The method yet comprises transmitting the further information to the terminal device.

[0008] In a fifth aspect, there is provided a method. The method comprises determining that a terminal device is to transmit data in uplink. The method also comprises transmitting, to a controlling network device and at a server device, a request comprising identity information of a terminal device and an index associated with information for data transmission. The method also comprises receiving the data in uplink from the terminal device, the data being transmitted based on further information for transmitting data in uplink which is generated based on the information for data transmission.

[0009] In a sixth aspect, there is provided a method. The method comprises receiving, at a terminal device, information for transmitting background data in uplink from a

controlling network device. The method further comprises transmitting the background data in uplink to a server device based on the information.

[0010] In a seventh aspect, there is provided an apparatus comprising means for receiving, at a controlling network device, a request from a server device, the request comprising identity information of a terminal device and an index associated with information for data transmission; means for retrieving the information for data transmission based on the index; means for generating further information for transmitting background data in uplink based on the information for data transmission; and means for transmitting the further information to the terminal device.

[0011] In an eighth aspect, there is provided an apparatus comprising means for determining that a terminal device is to transmit data in uplink; means for transmitting, to a controlling network device and at a server device, a request comprising identity information of a terminal device and an index associated with information for data transmission; and means for receiving the data in uplink from the terminal device, the data being transmitted based on further information for transmitting data in uplink which is generated based on the information for data transmission.

[0012] In a ninth aspect, there is provided an apparatus comprising means for receiving, at a terminal device, information for transmitting background data in uplink from a controlling network device; and means for transmitting the background data in uplink to a server device based on the information.

[0013] In a tenth aspect, there is provided a non-transitory computer readable medium comprising program instructions for causing an apparatus to perform at least the method according to any one of the above fourth to sixth aspects.

[0014] It is to be understood that the summary section is not intended to identify key or essential features of embodiments of the present disclosure, nor is it intended to be used to limit the scope of the present disclosure. Other features of the present disclosure will become easily comprehensible through the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] Some example embodiments will now be described with reference to the accompanying drawings, where:

[0016] Fig. 1 illustrates a schematic diagram of a communication system according to embodiments of the present disclosure;

[0017] Fig. 2 illustrates a schematic diagram of interactions among devices according to embodiments of the present disclosure;

5 [0018] Fig. 3 illustrates a flow chart of a method implemented at a controlling network device according to embodiments of the present disclosure;

[0019] Fig. 4 illustrates a flow chart of a method implemented at a server device according to embodiments of the present disclosure;

10 [0020] Fig. 5 illustrates a flow chart of a method implemented at a terminal device according to embodiments of the present disclosure;

[0021] Fig. 6 illustrates a schematic diagram of a device according to embodiments of the present disclosure; and

[0022] Fig. 7 shows a block diagram of an example computer readable medium in accordance with some embodiments of the present disclosure.

15 [0023] Throughout the drawings, the same or similar reference numerals represent the same or similar element.

DETAILED DESCRIPTION

20 [0024] Principle of the present disclosure will now be described with reference to some example embodiments. It is to be understood that these embodiments are described only for the purpose of illustration and help those skilled in the art to understand and implement the present disclosure, without suggesting any limitation as to the scope of the disclosure. The disclosure described herein can be implemented in various manners other than the ones described below.

25 [0025] In the following description and claims, unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skills in the art to which this disclosure belongs.

[0026] References in the present disclosure to “one embodiment,” “an embodiment,” “an example embodiment,” and the like indicate that the embodiment described may include a
30 particular feature, structure, or characteristic, but it is not necessary that every embodiment

includes the particular feature, structure, or characteristic. Moreover, such phrases are not necessarily referring to the same embodiment. Further, when a particular feature, structure, or characteristic is described in connection with an embodiment, it is submitted that it is within the knowledge of one skilled in the art to affect such feature, structure, or characteristic in connection with other embodiments whether or not explicitly described.

[0027] It shall be understood that although the terms “first” and “second” etc. may be used herein to describe various elements, these elements should not be limited by these terms. These terms are only used to distinguish one element from another. For example, a first element could be termed a second element, and similarly, a second element could be termed a first element, without departing from the scope of example embodiments. As used herein, the term “and/or” includes any and all combinations of one or more of the listed terms.

[0028] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of example embodiments. As used herein, the singular forms “a”, “an” and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms “comprises”, “comprising”, “has”, “having”, “includes” and/or “including”, when used herein, specify the presence of stated features, elements, and/or components etc., but do not preclude the presence or addition of one or more other features, elements, components and/or combinations thereof.

[0029] As used in this application, the term “circuitry” may refer to one or more or all of the following:

(a) hardware-only circuit implementations (such as implementations in only analog and/or digital circuitry) and

(b) combinations of hardware circuits and software, such as (as applicable):

(i) a combination of analog and/or digital hardware circuit(s) with software/firmware and

(ii) any portions of hardware processor(s) with software (including digital signal processor(s)), software, and memory(ies) that work together to cause an apparatus, such as a mobile phone or server, to perform various functions) and

(c) hardware circuit(s) and or processor(s), such as a microprocessor(s) or a portion of a microprocessor(s), that requires software (e.g., firmware) for operation, but the software may not be present when it is not needed for operation.

[0030] This definition of circuitry applies to all uses of this term in this application, including in any claims. As a further example, as used in this application, the term circuitry also covers an implementation of merely a hardware circuit or processor (or multiple processors) or portion of a hardware circuit or processor and its (or their) accompanying software and/or firmware. The term circuitry also covers, for example and if applicable to the particular claim element, a baseband integrated circuit or processor integrated circuit for a mobile device or a similar integrated circuit in server, a cellular network device, or other computing or network device.

[0031] As used herein, the term “communication network” refers to a network following any suitable communication standards, such as Long Term Evolution (LTE), LTE-Advanced (LTE-A), Wideband Code Division Multiple Access (WCDMA), High-Speed Packet Access (HSPA), Narrow Band Internet of Things (NB-IoT) and so on. Furthermore, the communications between a user equipment and a network device in the communication network may be performed according to any suitable generation communication protocols, including, but not limited to, the first generation (1G), the second generation (2G), 2.5G, 2.75G, the third generation (3G), the fourth generation (4G), 4.5G, the future fifth generation (5G) communication protocols, and/or any other protocols either currently known or to be developed in the future. Embodiments of the present disclosure may be applied in various communication systems. Given the rapid development in communications, there will of course also be future type communication technologies and systems with which the present disclosure may be embodied. It should not be seen as limiting the scope of the present disclosure to only the aforementioned system.

[0032] As used herein, the term “network device” refers to a node in a communication network via which a user equipment accesses the network and receives services therefrom. The network device may refer to a base station (BS) or an access point (AP), for example, a node B (NodeB or NB), an evolved NodeB (eNodeB or eNB), a NR NB (also referred to as a gNB), a Remote Radio Unit (RRU), a radio header (RH), a remote radio head (RRH), a relay, a low power node such as a femto, a pico, and so forth, depending on the applied terminology and technology.

[0033] The term “terminal device” refers to any end device that may be capable of wireless communication. By way of example rather than limitation, a terminal device may also be referred to as a communication device, user equipment (UE), a Subscriber Station (SS), a Portable Subscriber Station, a Mobile Station (MS), or an Access Terminal (AT).

5 The terminal device may include, but not limited to, a mobile phone, a cellular phone, a smart phone, voice over IP (VoIP) phones, wireless local loop phones, a tablet, a wearable terminal device, a personal digital assistant (PDA), portable computers, desktop computer, image capture terminal devices such as digital cameras, gaming terminal devices, music storage and playback appliances, vehicle-mounted wireless terminal devices, wireless endpoints, mobile stations, laptop-embedded equipment (LEE), laptop-mounted equipment (LME), USB dongles, smart devices, wireless customer-premises equipment (CPE), an Internet of Things (IoT) device, a watch or other wearable, a head-mounted display (HMD), a vehicle, a drone, a medical device and applications (e.g., remote surgery), an industrial device and applications (e.g., a robot and/or other wireless devices operating in an industrial and/or an automated processing chain contexts), a consumer electronics device, a device operating on commercial and/or industrial wireless networks, and the like. In the following description, the terms “terminal device”, “communication device”, “terminal”, “user equipment” and “UE” may be used interchangeably.

[0034] As mentioned above, the background data may not be necessary to be transmitted immediately. The core network in third generation partnership project (3GPP) should support a 3rd party service provider request for background data transfer for a set of terminal devices that are served by the 3rd party service provider.

[0035] Additionally, the 3rd party application server should be able to indicate to the 3GPP System when the background data transfer (a) exceeds the agreed maximum data volume or (b) continues beyond the agreed time window or (c) happens outside the agreed areas.

[0036] The 3GPP Core Network should be able to inform the 3rd party service provider in one coordinated response, based on locally available information (e.g. congestion level) over the geographic area, about: one or more recommended time windows for the data transfer and for each time window the maximum aggregated bitrate for the set of UEs in the geographical area indicated by the 3rd party service provider.

[0037] Further, the 3GPP Core Network should be able to inform the 3rd party service provider about the charging policy that will be applied to the 3rd party service provider if the data are transferred within the recommended time window and if transmission rates stay below the limits of the respective maximum aggregated bitrate.

5 [0038] The aim of providing the time window is to favor transfer of more traffic during non-busy hours and reason for providing the maximum aggregate bitrate is to spread out traffic during that time. The aim of multiple time windows is to allow the 3rd party provider to choose one appropriate time window based on its preference like the expected charging regime and bitrate.

10 [0039] In conventional technologies, the convention UE Route Selection Policy (URSP) framework may be used for delivery of policy information related to background data transfer from 5G core network to the terminal device. The policy information content may define time window and location criteria that need to be met for background data transfer.

15 [0040] There is a single dedicated protocol data unit (PDU) session that is used for background data transfer which is established and released based on the background data transfer policies. In conventional solutions, the network device (for example, an application server) may connect with the policy control function (PCF) via the network exposure function (NEF) to request a time window and related conditions for future background data transfer.

20 [0041] The application server request may contain an automatic site positioning (ASP) identifier, the volume of data to be transferred per terminal device, the expected amount of terminal devices, the desired time window and optionally, network area information. The application server provides as Network Area Information either a geographical area, or an area of interest that includes a list of time advances (TAs) or list of NG-RAN nodes and/or
25 a list of cell identifiers. When the application server provides a geographical area, then the NEF maps it based on local configuration into of a short list of TAs and/or NG-RAN nodes and/or cells identifiers that is provided to the PCF.

[0042] The PCF may first retrieve all existing transfer policies stored for any ASP from the UDR. Afterwards, the PCF shall determine, based on the information provided by the
30 AF and other available information (e.g. network policy, level information in a S-NSSAI and load status estimation for the required time window, network area, and existing transfer

policies) one or more transfer policies. The PCF may be configured to map the ASP identifier into a target DNN and slicing information.

[0043] In some embodiments, a transfer policy may comprise a recommended time window for the background data transfer, a reference to a charging rate for this time window and optionally a maximum aggregated bitrate (indicating that the charging according to the referenced charging rate is only applicable for the aggregated traffic of all involved UEs that stays below this value).

[0044] Finally, the PCF may provide a list of candidate transfer policies or the selected transfer policy to the application server via NEF together with the Background Data Transfer reference ID. If the application server receives more than one transfer policy, the application server may select one of them and inform the PCF about the selected transfer policy.

[0045] The selected transfer policy is finally stored by the PCF in the unified data repository (UDR) together with the Background Data Transfer reference ID and the network area information. The same or a different PCF MAY retrieve this transfer policy and the corresponding network area information from the UDR and take them into account for future decisions about transfer policies for background data related to the same or other ASPs.

[0046] At the time the background data transfer is about to start, the AF provides for each UE the Background Data Transfer reference ID together with the AF session information to the PCF (via the N5 interface). The PCF retrieves the corresponding transfer policy from the UDR and derives the PCC rules for the background data transfer according to this transfer policy. However, the current background data transfer policy only comprises the attributes for downlink data transfer.

[0047] According to embodiments of the present disclosure, if the server device initiates the process of Background Data transfer negotiation, the server device transmits the request for transmitting information for transmitting background data in uplink to the terminal device. The controlling network device transmits information for transmitting background data in uplink to the terminal device. In this way, the transmission of background in uplink is managed and is more efficient.

[0048] Fig. 1 illustrates a schematic diagram of a communication system 100 in which embodiments of the present disclosure can be implemented. The communication system

400, which is a part of a communication network, comprises terminal devices 110-1, 110-2, . . . , 110-N (collectively referred to as “terminal device(s) 110” where N is an integer number). The communication system 100 comprises one or more network devices, for example, a network device 120 (also referred to as “the controlling network device 120”) and a network device 130 (also referred to as “the server device 130”). It should be understood that the communication system 100 may also comprise other elements which are omitted for the purpose of clarity. It is to be understood that the numbers of terminal devices and network devices shown in Fig. 1 are given for the purpose of illustration without suggesting any limitations. The server device 130 and the controlling network device 120 may communicate with the terminal devices 110.

[0049] It is to be understood that the number of network devices and terminal devices is only for the purpose of illustration without suggesting any limitations. The system 100 may include any suitable number of network devices and terminal devices adapted for implementing embodiments of the present disclosure.

[0050] Communications in the communication system 100 may be implemented according to any proper communication protocol(s), comprising, but not limited to, cellular communication protocols of the first generation (1G), the second generation (2G), the third generation (3G), the fourth generation (4G) and the fifth generation (5G) and on the like, wireless local network communication protocols such as Institute for Electrical and Electronics Engineers (IEEE) 802.11 and the like, and/or any other protocols currently known or to be developed in the future. Moreover, the communication may utilize any proper wireless communication technology, comprising but not limited to: Code Division Multiple Access (CDMA), Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Frequency Division Duplex (FDD), Time Division Duplex (TDD), Multiple-Input Multiple-Output (MIMO), Orthogonal Frequency Division Multiple (OFDM), Discrete Fourier Transform spread OFDM (DFT-s-OFDM) and/or any other technologies currently known or to be developed in the future.

[0051] Fig. 2 illustrates a schematic diagram of interactions 200 in accordance with embodiments of the present disclosure. The interactions 200 may be implemented at any suitable devices. Only for the purpose of illustrations, the interactions 200 are described to be implemented at the terminal device 110-1, the controlling network device 120 and the server device 130.

[0052] In some embodiments, the server device 130 may transmit 205 a request to generate the information for data transmission. For example, the server device 130 may invoke the Nnef_BDTPNegotiation_Create service. In some embodiments, the request may comprise one or more of: an ASP identifier, the amount of data to be transferred per terminal device, the expected number of terminal devices, the desired time window, network area information, an identity of a group of terminal devices. In some embodiments, the server device 130 may provide as network area information either a geographical area, or an area of interest that includes a list of TAs or list of NG-RAN nodes and/or a list of cell identifiers. The request may also comprise the trigger condition for transmitting the further information to the terminal device. For example, the trigger condition may indicate that the further information needs to be transmitted to the terminal device if the terminal device registers with the network.

[0053] The controlling network device 120 may generate 210 the information for data transmission. For example, based on the request, the controlling network device 120 may invoke the Npcf_BDTPolicyControl_Create service to authorize the creation of the policy regarding the background data transfer. In some embodiments, the PCF may determine the information for data transmission based on the request. In some embodiments, the information may also be determined based on other information, for example, network policy, level information in a Single Network Slice Selection Assistance Information (S-NSSAI) and load status estimation for the required time window, network area, and current transfer policies. The controlling network device 120 may be configured to map the ASP identifier into a target DNN and slicing information, that is, S-NSSAI.

[0054] In some embodiments, the controlling network device 120 may generate the candidate lists of information and transmit the candidate list of information to the server device 130. If the server device 130 receives more than candidate lists of information, the server device 130 may select one of them and inform the PCF about the selected list of information. The controlling network device 120 may also generate the index (for example, Background Data Transfer Reference ID) of the information and transmit 215 the index to the server device 130.

[0055] The controlling network device 120 may store the information with the index. For example, the information with the index may be stored in the UDR. The same or a different PCF may retrieve this information and the corresponding network area information from the UDR.

[0056] In some embodiments, the server device 130 may transmit another request to update the information. The other request may comprise an ASP identifier, the information and the index of the information. Alternatively, the other request may also comprise an indication for delivering the updated information to the terminal device 110-1.

5 [0057] The server device 130 determines that the terminal device 110-1 is to transmit the background data in uplink. In some embodiments, if the terminal device 110-1 initiates to transmit the background data in uplink, the server device 130 determines whether the terminal device 110-1 is allowed to transmit the background data in uplink. In some
10 embodiments, if the terminal device 110-1 starts to register with the server device 130, the server device 130 determines whether the terminal device 110-1 is allowed to transmit the background data in uplink.

[0058] The server device 130 transmits 225 the request for the information for data transmission. For example, if the server device 130 determines that the terminal device 110-1 is allowed to transmit the background data in uplink, the server device 130 may
15 transmit the request to the controlling network device 120 for the information for data transmission. Alternatively, if the terminal device 110-1 starts to register with the server device 130, the server device 130 may transmit the request to the controlling network device 120 for the information for data transmission. The server device 130 may transmit the index together with the AF session information to the controlling network device 120
20 via an N5 interface.

[0059] The request comprises identity information of the terminal device 110-1. For example, the request may comprise an identity of the terminal device 110-1. Alternatively, the request may comprise an identity of a group of terminal devices to which the terminal device 110-1 belongs. In some embodiments, the request may also comprise identity of
25 application and/or identity of operation system (OS).

[0060] The request also comprises the index of the information for data transmission. The request may also comprise one or more of: a time window in which the terminal device 110-1 is allowed to transmit the background data in uplink, an amount of background data allowed to be transmitted by the terminal device in uplink or information of network area in
30 which the terminal device is allowed to transmit the background data in uplink.

[0061] The controlling network device 120 retrieves 230 the information for data transmission based on the index. For example, the controlling network device 120 may

retrieve the all information stored in the UDR to obtain the information. The controlling network device 120 generates 235 the further information for transmitting data in uplink. The further information may comprise at least one of: volume of data to be transferred per terminal device for uplink, desired time window for uplink or network area information for uplink.

[0062] The controlling network device 120 transmits the further information to the terminal device 110-1. In some embodiments, the controlling network device 120 may generate information of route selection and traffic transfer on a selected route for the terminal device 110-1, for example, the URSP. The controlling network device 120 may transmit the further information together with the URSP. The controlling network device 120 may combine the URSP with the further information. Table 1 below shows an example of extended URSP rule. It should be noted that Table 1 is only an example, not limitation.

Table 1

Information name	Description	Category	PCF permitted to modify in a UE context	Scope
Rule Precedence	Determines the order the URSP rule is enforced in the UE.	Mandatory	Yes	UE context
Traffic descriptor	<i>This part defines the Traffic descriptor components for the URSP rule.</i>	Mandatory		
Application descriptors	It consists of OSId and OSAppId(s). (NOTE 2)	Optional	Yes	UE context

Information name	Description	Category	PCF permitted to modify in a UE context	Scope
Rule Precedence	Determines the order the URSP rule is enforced in the UE.	Mandatory	Yes	UE context
IP descriptors	Destination IP 3 tuple(s) (IP address or IPv6 network prefix, port number, protocol ID of the protocol above IP).	Optional	Yes	UE context
Domain descriptors	Destination FQDN(s)	Optional	Yes	UE context
Non-IP descriptors	Descriptor(s) for destination information of non-IP traffic	Optional	Yes	UE context
DNN	This is matched against the DNN information provided by the application.	Optional	Yes	UE context
Connection Capabilities	This is matched against the information provided by a UE application when it requests a network connection with certain capabilities. (NOTE 4)	Optional	Yes	UE context

Information name	Description	Category	PCF permitted to modify in a UE context	Scope
Rule Precedence	Determines the order the URSP rule is enforced in the UE.	Mandatory	Yes	UE context
List of Route Selection Descriptors	A list of Route Selection Descriptors. The components of a Route Selection Descriptor are described in table 6.6.2.1-3.	Mandatory		
Background Data Transfer Policy	The components of a Background Data Transfer Policy are described in Table 2	Optional	Yes	UE context

Table 2 below shows an example of the further information. It should be noted that Table 2 is only an example, not limitation.

Table 2

Information name	Description	Category	PCF permitted to modify in URSP	Scope
volume of data to be transferred per UE for uplink	The total volume of data that can be transferred within the time window and the network area for the AF session identified by the traffic descriptor.	Optional	Yes	UE context

desired time window for uplink	The time window in which the UE is allowed to transfer uplink data for the AF session identified by the traffic descriptor.	Optional	Yes	UE context
network area information for uplink	The network area in which the UE is allowed to transfer uplink data for the AF session identified by the traffic descriptor.	Optional	Yes	UE context

[0063] In this way, since the further information is only applied to the session of the server device 130 (for example, the AF session) that can be identified by any of the traffic descriptor used for URSP, the URSP and the further information may share the same traffic description, then extending URSP to include the further information can reduce the size of the UE policy when they are provided together, thus the N1 signaling can be reduced. For application traffic subject to the further information, quite likely the URSP and the further information policy are provided together, for example, when the server device 130 is about to start the traffic transfer, it triggers the controlling network device 120 to deliver the required policy.

[0064] In addition, there is a single dedicated PDU session that is used for transmitting background data in uplink which is established and released based on the further information. It means that when associating applications to PDU Sessions, it needs to consider both URSP and the further information and it is easier for the terminal device to perform PDU session association.

[0065] In some embodiments, the controlling network device 120 may generate a separate table for the further information. The further information and the URSP may be transmitted separately. In this way, the further information may be more backward compatible to the convention communication system. Table 3 below shows an example of the further information. It should be noted that Table 3 is only an example, not limitation.

Table 3

Information name	Description	Category	PCF permitted to modify in a UE context	Scope
Rule Precedence	Determines the order the URSP rule is enforced in the UE.	Mandatory	Yes	UE context
Traffic descriptor	<i>This part defines the Traffic descriptor components for the URSP rule.</i>	Mandatory		
Application descriptors	It consists of OSId and OSAppId(s). (NOTE 2)	Optional	Yes	UE context
IP descriptors	Destination IP 3 tuple(s) (IP address or IPv6 network prefix, port number, protocol ID of the protocol above IP).	Optional	Yes	UE context
Domain descriptors	Destination FQDN(s)	Optional	Yes	UE context
Non-IP descriptors	Descriptor(s) for destination information of non-IP traffic	Optional	Yes	UE context
DNN	This is matched against the DNN information provided by the application.	Optional	Yes	UE context

Information name	Description	Category	PCF permitted to modify in a UE context	Scope
Rule Precedence	Determines the order the URSP rule is enforced in the UE.	Mandatory	Yes	UE context
Connection Capabilities	This is matched against the information provided by a UE application when it requests a network connection with certain capabilities.	Optional	Yes	UE context
Background Data Transfer Policy				
volume of data to be transferred per UE for uplink	The total volume of data that can be transferred within the time window and the network area for the AF session identified by the traffic descriptor.	Optional	Yes	UE context
desired time window for uplink	The time window in which the UE is allowed to transfer uplink data for the AF session identified by the traffic descriptor.	Optional	Yes	UE context

Information name	Description	Category	PCF permitted to modify in a UE context	Scope
Rule Precedence	Determines the order the URSP rule is enforced in the UE.	Mandatory	Yes	UE context
network area information for uplink	The network area in which the UE is allowed to transfer uplink data for the AF session identified by the traffic descriptor.	Optional	Yes	UE context

[0066] The terminal device 110-1 may determine 245 the PDU to transmit the background data in uplink to the server device 130. The terminal device 110-1 transmits 250 the background data in uplink based on the further information. In an example embodiment, if the terminal device 110-1 determines that there is a PDU session that matches the further information. The terminal device 110-1 may determine the existing PDU session to transmit the background data in uplink based on the further information. In that way, the total number of PDU sessions per terminal device can be reduced.

[0067] Alternatively, if the terminal device 110-1 determines that all PDU session mismatches with the further information, the terminal device 110-1 may transmit an establishing request to establish a further protocol data unit to transmit the background data in uplink. The establishing request may comprise an indication for transmitting the background data in uplink. Only as an example, the indication or transmitting the background data in uplink may be a background data transferring (BDT) indicator.

[0068] In some embodiments, there may be two PDU sessions, one for background data transferring and one for non-BDT, and the terminal device 110-1 may only select the one subject to BDT control if BDT is required for the AF session. The same AF sessions may be bound to 2 different PDU sessions in uplink and in downlink. However, the server device 130 may usually expect to have a single PDU session for both uplink and in

downlink to reduce the complexity of its service logic. Hence an indication of BDT, which is referred to as BDT indicator, is introduced as an attribute of the PDU session to allow either the terminal device 110-1 or the controlling network device 120 to bind the AF session to the same PDU session.

5 [0069] When an establishment of a new PDU session is triggered by the terminal device 110-1 and the new PDU is for BDT, the BDT indicator needs to be contained in the request to establish the new PDU session, and the BDT indicator is then passed to a Session Management Function (SMF) for session establishment. The SMF may establish the PDU and transmit the configuration of the PDU to the controlling network device 120. The
10 configuration of the PDU may comprise the indication for the background data (namely, BDT indicator). The configuration of the PDU may further comprise one or more of as Access Type, the IPv4 address and/or IPv6 prefix, PEI, GPSI, User Location Information, UE Time Zone, Serving Network, RAT type, Charging Characteristics information, Session AMBR, subscribed default QoS information, Trace Requirements and Internal Group
15 Identifier (see TS 23.501 [2], clause 5.9.7), NSI ID, DN Authorization Profile Index, Frame Routes. The controlling network device 120 may combine the session of the server device 130 to the session of the PDU which comprises the BDT indicator.

[0070] For every newly detected application, the terminal device 110-1 evaluates the combined URSP and BDT rules and determines if the application is matching the Traffic
20 descriptor of any combined URSP and BDT rule. When a combined URSP and BDT rule is determined to be applicable for a given application, the terminal device 110-1 may select a Route Selection Descriptor within this rule in the order of the Route Selection Descriptor Precedence.

[0071] When a valid Route Selection Descriptor is found, the terminal device 110-1 may
25 determine if there is an existing PDU Session that matches all components in the selected Route Selection Descriptor. If BDT policy is contained, the terminal device 110-1 selects an existing PDU session which can transfer data based on BDT policy.

[0072] If none of the existing PDU Sessions matches, the terminal device 110-1 may try to establish a new PDU Session using the values specified by the selected Route Selection
30 Descriptor. If BDT policy is contained, the UE requests to establish a PDU session which can transfer data based on BDT policy, the request contains a BDT indicator. When the controlling network device 120 receives configuration of the new PDU which comprises the indication for the BDT indicator, the controlling network device 120 may bind the AF

session to a PDU session which can transfer data based on the further information with the consideration of the BDT indicator.

[0073] Fig. 3 illustrates a flow chart of a method 300 in accordance with embodiments of the present disclosure. The method 300 may be implemented at any suitable devices.

5 Only for the purpose of illustrations, the method 300 is described to be implemented at the controlling network device 120.

[0074] In some embodiments, the controlling network device 120 may receive a request to generate the information for data transmission. For example, the server device 130 may invoke the Nnef_BDTPNegotiation_Create service. In some embodiments, the request
10 may comprise one or more of: an ASP identifier, the amount of data to be transferred per terminal device, the expected number of terminal devices, the desired time window, network area information, a trigger condition for transmitting the further information, and an identity of a group of terminal devices. In some embodiments, the server device 130 may provide as network area information either a geographical area, or an area of interest
15 that includes a list of TAs or list of NG-RAN nodes and/or a list of cell identifiers. In some embodiments, the trigger condition indicates to transmit the further information to the terminal device in response to the terminal device being registering with a network.

[0075] The controlling network device 120 may generate the information for data transmission. For example, based on the request, the controlling network device 120 may
20 invoke the Npcf_BDTPolicyControl_Create service to authorize the creation of the policy regarding the background data transfer. In some embodiments, the PCF may determine the information for data transmission based on the request. In some embodiments, the information may also be determined based on other information, for example, network policy, level information in a Single Network Slice Selection Assistance Information
25 (S-NSSAI) and load status estimation for the required time window, network area, and current transfer policies. The controlling network device 120 may be configured to map the ASP identifier into a target DNN and slicing information.

[0076] In some embodiments, the controlling network device 120 may generate the candidate lists of information and transmit the candidate list of information to the server
30 device 130. If the server device 130 receives more than candidate lists of information, the server device 130 may select one of them and inform the PCF about the selected list of information. The controlling network device 120 may also generate the index of the information and transmit the index to the server device 130.

[0077] The controlling network device 120 may store the information with the index. For example, the information with the index may be stored in the UDR. The same or a different PCF may retrieve this information and the corresponding network area information from the UDR.

5 [0078] In some embodiments, the controlling network device 120 may transmit another request to update the information. The other request may comprise an ASP identifier, the information and the index of the information. Alternatively, the other request may also comprise an indication for delivering the updated information to the terminal device 110-1.

10 [0079] At block 310, the controlling network device 120 receives the request from the server device 130. The request comprises identity information of the terminal device 110-1. For example, the request may comprise an identity of the terminal device 110-1. Alternatively, the request may comprise an identity of a group of terminal devices to which the terminal device 110-1 belongs. In some embodiments, the request may also comprise identity of application and/or identity of operation system (OS).

15 [0080] The request also comprises the index of the information for data transmission. The request may also comprise one or more of: a time window in which the terminal device 110-1 is allowed to transmit the background data in unlink, an amount of background data allowed to be transmitted by the terminal device in uplink or information of network area in which the terminal device is allowed to transmit the background data in uplink.

20 [0081] At block 320, the controlling network device 120 retrieves the information for data transmission based on the index. For example, the controlling network device 120 may retrieve the all information stored in the UDR to obtain the information.

25 [0082] At block 330, the controlling network device 120 generates the further information for transmitting data in uplink. The further information may comprise at least one of: volume of data to be transferred per terminal device for uplink, desired time window for uplink or network area information for uplink.

30 [0083] At block 340, the controlling network device 120 transmits the further information to the terminal device 110-1. In some embodiments, the controlling network device 120 may generate information of route selection and traffic transfer on a selected route for the terminal device 110-1, for example, the URSP. The controlling network device 120 may transmit the further information together with the URSP. The controlling network device 120 may combine the URSP with the further information. Alternatively, the controlling network device 120 may generate a separate table for the further information. In some

embodiments, the controlling network device 120 may transmit the further information in response to the terminal device 110-1 registering in the network.

[0084] Fig. 4 illustrates a flow chart of a method 400 in accordance with embodiments of the present disclosure. The method 400 may be implemented at any suitable devices.
5 Only for the purpose of illustrations, the method 400 is described to be implemented at the server device 130.

[0085] In some embodiments, the server device 130 may transmit 205 a request to generate the information for data transmission. In some embodiments, the request may comprise one or more of: an ASP identifier, the amount of data to be transferred per
10 terminal device, the expected number of terminal devices, the desired time window, network area information, a trigger condition for transmitting the second information, and an identity of a group of terminal devices. In some embodiments, the server device 130 may provide as network area information either a geographical area, or an area of interest that includes a list of TAs or list of NG-RAN nodes and/or a list of cell identifiers.

15 [0086] In some embodiments, the server device 130 may transmit the candidate list of information. If the server device 130 receives more than candidate lists of information, the server device 130 may select one of them and inform the PCF about the selected list of information.

[0087] In some embodiments, the server device 130 may transmit another request to
20 update the information. The other request may comprise an ASP identifier, the information and the index of the information. Alternatively, the other request may also comprise an indication for delivering the updated information to the terminal device 110-1.

[0088] At block 410, the server device 130 determines that the terminal device 110-1 is to transmit the background data in uplink. In some embodiments, if the terminal device
25 110-1 initiates to transmit the background data in uplink, the server device 130 determines whether the terminal device 110-1 is allowed to transmit the background data in uplink. In some embodiments, if the terminal device 110-1 starts to register with the server device 130, the server device 130 determines whether the terminal device 110-1 is allowed to transmit the background data in uplink.

30 [0089] At block 420, the server device 130 transmits the request for the information for data transmission. For example, if the server device 130 determines that the terminal device 110-1 is allowed to transmit the background data in uplink, the server device 130 may transmit the request to the controlling network device 120 for the information for data

transmission. Alternatively, if the terminal device 110-1 starts to register with the server device 130, the server device 130 may transmit the request to the controlling network device 120 for the information for data transmission. The server device 130 may transmit the index together with the AF session information to the controlling network device 120 via an N5 interface.

[0090] The request comprises identity information of the terminal device 110-1. For example, the request may comprise an identity of the terminal device 110-1. Alternatively, the request may comprise an identity of a group of terminal devices to which the terminal device 110-1 belongs. In some embodiments, the request may also comprise identity of application and/or identity of operation system (OS).

[0091] The request also comprises the index of the information for data transmission. The request may also comprise one or more of: a time window in which the terminal device 110-1 is allowed to transmit the background data in uplink, an amount of background data allowed to be transmitted by the terminal device in uplink or information of network area in which the terminal device is allowed to transmit the background data in uplink.

[0092] Fig. 5 illustrates a flow chart of a method 500 in accordance with embodiments of the present disclosure. The method 500 may be implemented at any suitable devices. Only for the purpose of illustrations, the method 500 is described to be implemented at the terminal device 110-1.

[0093] At block 510, the terminal device 110-1 receives the further information for transmitting background data in uplink from the server device 130-1. In some embodiments, the terminal device 110-1 may receive the further information with the URSP.

[0094] At block 520, the terminal device 110-1 transmits the background data in uplink based on the further information. The terminal device 110-1 may determine the PDU to transmit the background data in uplink to the server device 130. In an example embodiment, if the terminal device 110-1 determines that there is a PDU session that matches the further information. The terminal device 110-1 may determine the existing PDU session to transmit the background data in uplink based on the further information. In that way, the total number of PDU sessions per terminal device can be reduced.

[0095] Alternatively, if the terminal device 110-1 determines that all PDU session mismatches with the further information, the terminal device 110-1 may establish a new PDU session to transmit the background data in uplink based on the further information.

The terminal device 110-1 may transmit an establishing request to establish a further protocol data unit to transmit the background data in uplink. The establishing request may comprise an indication for transmitting the background data in uplink.

[0096] In some embodiments, an apparatus for performing the method 300 (for example, the controlling network device 120) may comprise respective means for performing the corresponding steps in the method 300. These means may be implemented in any suitable manners. For example, it can be implemented by circuitry or software modules.

[0097] In some embodiments, the apparatus comprises: means for receiving, at a controlling network device, a request from a server device, the request comprising identity information of a terminal device and an index associated with information for data transmission; means for retrieving the information for data transmission based on the index; means for generating further information for transmitting background data in uplink based on the information for data transmission; and means for transmitting the further information to the terminal device.

[0098] In some embodiments, the further information for transmitting the background data in uplink comprises at least one of: a time window in which the terminal device is allowed to transmit the background data in uplink, an amount of background data allowed to be transmitted by the terminal device in uplink, or information of network area in which the terminal device is allowed to transmit the background data in uplink.

[0099] In some embodiments, the means for transmitting the further information comprises: means for generating information of route selection and traffic transfer on a selected route for the terminal device; means for combining the information of route selection and traffic transfer on the selected route with the further information; and means for transmitting the combined information of route selection and traffic transfer on the selected route and the further information.

[00100] In some embodiments, the apparatus further comprises: means for generating information of route selection and traffic transfer on a selected route for the terminal device; means for transmitting the information of route selection and traffic transfer on a selected route for the terminal device; and means for transmitting the further information.

[00101] In some embodiments, the apparatus comprises means for receiving a further request to generate the information for data transmission, the further request comprising at least one of: a time window in which the terminal device is allowed to transmit the

background data in uplink, an amount of background data transmitting in uplink, information of network area in which the terminal device is allowed to transmit the background data in uplink, an identity of a group of terminal devices, or a trigger condition for transmitting the further information; means for generating the first information for data transmission based on the further request; means for generating the index associated with the information for data transmission; means for transmitting the index to the controlling network device; and means for storing the first information for data transmission with the index.

[00102] In some embodiments, the trigger condition indicates to transmit the further information to the terminal device in response to the terminal device being registering with a network.

[00103] In some embodiments, the apparatus comprises: means for in response to receiving an update request comprising the index of the information for data transmission, updating the information for data transmission; and means for storing the updated information for data transmission.

[00104] In some embodiments, the apparatus comprises: means for in response to the terminal device triggering an establishment of a protocol data unit, receiving configuration of the protocol data unit from a session management device which establishes the protocol data unit, the configuration comprising an indication for the background data.

[00105] In some embodiments, the apparatus comprises: means for in response to the request comprising the index of the information, binding a session of the server device to a further session of the protocol data unit on which the background data in uplink is transmitted based on the further information.

[00106] In some embodiments, an apparatus for performing the method 400 (for example, the server device 130) may comprise respective means for performing the corresponding steps in the method 400. These means may be implemented in any suitable manners. For example, it can be implemented by circuitry or software modules.

[00107] In some embodiments, the apparatus comprises: means for determining that a terminal device is to transmit data in uplink; means for transmitting, to a controlling network device and at a server device, a request comprising identity information of a terminal device and an index associated with information for data transmission; and means for receiving the data in uplink from the terminal device, the data being transmitted based

on further information for transmitting data in uplink which is generated based on the information for data transmission.

[00108] In some embodiments, the means for transmitting the request to the controlling network device comprises: means for in response to determining the terminal device is
5 allowed to transmit data in uplink, transmitting the request to the controlling network device.

[00109] In some embodiments, the means for transmitting the request to the controlling network device comprises: means in response to determining the terminal device is allowed
10 to transmit data in uplink after the terminal device being registered in a network, transmitting the request to the further network device.

[00110] In some embodiments, the apparatus comprises means for transmitting a further request to generate the information for data transmission, the further request comprising at least one of: a time window for transmitting the background data in uplink, an amount of background data transmitting in uplink, information of network area in which allowing to
15 transmit the background data in uplink, an identity of a group of terminal devices, or a trigger condition for transmitting the second information; and means for receiving the index associated with the information for data transmission.

[00111] In some embodiments, the trigger condition indicates to transmit the further information to the terminal device in response to the terminal device being registering with
20 a network.

[00112] In some embodiments, the apparatus comprises: means for transmitting an update request comprising the index of the information for data transmission.

[00113] In some embodiments, an apparatus for performing the method 500 (for example, the terminal device 110-1) may comprise respective means for performing the
25 corresponding steps in the method 500. These means may be implemented in any suitable manners. For example, it can be implemented by circuitry or software modules.

[00114] In some embodiments, the apparatus comprises: means for receiving, at a terminal device, information for transmitting background data in uplink from a controlling network device; and means for transmitting the background data in uplink to a server device based
30 on the information.

[00115] In some embodiments, the information for transmitting the background data in uplink comprises at least one of: a time window in which allowing the terminal device to transmit the background data in uplink, an amount of background data allowed to be

transmitted by the terminal device, or information of network area in which allowing the terminal device to transmit the background data.

[00116] In some embodiments, the means for receiving the information comprises: means for receiving information of route selection updated with the information.

5 [00117] In some embodiments, the means for transmitting the background data in uplink: means for determining whether a protocol data unit matches with the information; and means for in response to the protocol data unit matching with the information, transmitting the background data in uplink on the protocol data unit.

10 [00118] In some embodiments, the means for transmitting the background data in uplink comprises: means for determining whether a protocol data unit matches with the information; and means for in response to the protocol data unit mismatching with the information, transmitting a request to establish a further protocol data unit to transmit the background data in uplink, the request comprising an indication for transmitting the background data in uplink.

15 [00119] FIG. 6 is a simplified block diagram of a device 600 that is suitable for implementing embodiments of the present disclosure. The device 600 may be provided to implement the communication device, for example the network devices 120, 130 or the terminal device 110-1 as shown in Fig. 1. As shown, the device 600 includes one or more processors 610, one or more memories 620 coupled to the processor 610, and one or more
20 communication module (for example, transmitters and/or receivers (TX/RX)) 640 coupled to the processor 610.

[00120] The communication module 640 is for bidirectional communications. The communication module 640 has at least one antenna to facilitate communication. The communication interface may represent any interface that is necessary for communication
25 with other network elements.

[00121] The processor 610 may be of any type suitable to the local technical network and may include one or more of the following: general purpose computers, special purpose computers, microprocessors, digital signal processors (DSPs) and processors based on multicore processor architecture, as non-limiting examples. The device 600 may have
30 multiple processors, such as an application specific integrated circuit chip that is slaved in time to a clock which synchronizes the main processor.

[00122] The memory 620 may include one or more non-volatile memories and one or more volatile memories. Examples of the non-volatile memories include, but are not limited to, a Read Only Memory (ROM) 624, an electrically programmable read only memory (EPROM), a flash memory, a hard disk, a compact disc (CD), a digital video disk (DVD), and other magnetic storage and/or optical storage. Examples of the volatile memories include, but are not limited to, a random access memory (RAM) 622 and other volatile memories that will not last in the power-down duration.

[00123] A computer program 630 includes computer executable instructions that are executed by the associated processor 610. The program 630 may be stored in the ROM 624. The processor 610 may perform any suitable actions and processing by loading the program 630 into the RAM 622.

[00124] The embodiments of the present disclosure may be implemented by means of the program 630 so that the device 600 may perform any process of the disclosure as discussed with reference to Figs. 2 to 5. The embodiments of the present disclosure may also be implemented by hardware or by a combination of software and hardware.

[00125] In some embodiments, the program 630 may be tangibly contained in a computer readable medium which may be included in the device 600 (such as in the memory 620) or other storage devices that are accessible by the device 600. The device 600 may load the program 630 from the computer readable medium to the RAM 622 for execution. The computer readable medium may include any types of tangible non-volatile storage, such as ROM, EPROM, a flash memory, a hard disk, CD, DVD, and the like. Fig. 7 shows an example of the computer readable medium 700 in form of CD or DVD. The computer readable medium has the program 630 stored thereon.

[00126] Generally, various embodiments of the present disclosure may be implemented in hardware or special purpose circuits, software, logic or any combination thereof. Some aspects may be implemented in hardware, while other aspects may be implemented in firmware or software which may be executed by a controller, microprocessor or other computing device. While various aspects of embodiments of the present disclosure are illustrated and described as block diagrams, flowcharts, or using some other pictorial representations, it is to be understood that the block, apparatus, system, technique or method described herein may be implemented in, as non-limiting examples, hardware,

software, firmware, special purpose circuits or logic, general purpose hardware or controller or other computing devices, or some combination thereof.

[00127] The present disclosure also provides at least one computer program product tangibly stored on a non-transitory computer readable storage medium. The computer
5 program product includes computer-executable instructions, such as those included in program modules, being executed in a device on a target real or virtual processor, to carry out the methods 500 and 600 as described above with reference to Figs. 2-6. Generally, program modules include routines, programs, libraries, objects, classes, components, data structures, or the like that perform particular tasks or implement particular abstract data
10 types. The functionality of the program modules may be combined or split between program modules as desired in various embodiments. Machine-executable instructions for program modules may be executed within a local or distributed device. In a distributed device, program modules may be located in both local and remote storage media.

[00128] Program code for carrying out methods of the present disclosure may be written in
15 any combination of one or more programming languages. These program codes may be provided to a processor or controller of a general purpose computer, special purpose computer, or other programmable data processing apparatus, such that the program codes, when executed by the processor or controller, cause the functions/operations specified in the flowcharts and/or block diagrams to be implemented. The program code may execute
20 entirely on a machine, partly on the machine, as a stand-alone software package, partly on the machine and partly on a remote machine or entirely on the remote machine or server.

[00129] In the context of the present disclosure, the computer program codes or related data may be carried by any suitable carrier to enable the device, apparatus or processor to perform various processes and operations as described above. Examples of the carrier
25 include a signal, computer readable medium, and the like.

[00130] The computer readable medium may be a computer readable signal medium or a computer readable storage medium. A computer readable medium may include but not limited to an electronic, magnetic, optical, electromagnetic, infrared, or semiconductor system, apparatus, or device, or any suitable combination of the foregoing. More specific
30 examples of the computer readable storage medium would include an electrical connection having one or more wires, a portable computer diskette, a hard disk, a random access memory (RAM), a read-only memory (ROM), an erasable programmable read-only

memory (EPROM or Flash memory), an optical fiber, a portable compact disc read-only memory (CD-ROM), an optical storage device, a magnetic storage device, or any suitable combination of the foregoing.

[00131] Further, while operations are depicted in a particular order, this should not be understood as requiring that such operations be performed in the particular order shown or in sequential order, or that all illustrated operations be performed, to achieve desirable results. In certain circumstances, multitasking and parallel processing may be advantageous. Likewise, while several specific implementation details are contained in the above discussions, these should not be construed as limitations on the scope of the present disclosure, but rather as descriptions of features that may be specific to particular embodiments. Certain features that are described in the context of separate embodiments may also be implemented in combination in a single embodiment. Conversely, various features that are described in the context of a single embodiment may also be implemented in multiple embodiments separately or in any suitable sub-combination.

[00132] Although the present disclosure has been described in languages specific to structural features and/or methodological acts, it is to be understood that the present disclosure defined in the appended claims is not necessarily limited to the specific features or acts described above. Rather, the specific features and acts described above are disclosed as example forms of implementing the claims.

WHAT IS CLAIMED IS:

1. A controlling network device comprising:

at least one processor; and

at least one memory including computer program codes;

5 the at least one memory and the computer program codes are configured to, with the at least one processor, cause the controlling network device to:

receive, at the controlling network device, a request from a server device, the request comprising identity information of a terminal device and an index associated with information for data transmission;

10 retrieve the information for data transmission based on the index;

generate further information for transmitting background data in uplink based on the information for data transmission; and

transmit the further information to the terminal device.

15 2. The controlling network device of claim 1, wherein the further information for transmitting the background data in uplink comprises at least one of:

a time window in which the terminal device is allowed to transmit the background data in uplink,

20 an amount of background data allowed to be transmitted by the terminal device in uplink, or

information of network area in which the terminal device is allowed to transmit the background data in uplink.

25 3. The controlling network device of claim 1, wherein the controlling network device is caused to transmit the further information by:

generating information of route selection and traffic transfer on a selected route for the terminal device;

combining the information of route selection and traffic transfer on the selected route with the further information; and

30 transmitting the combined information of route selection and traffic transfer on the selected route and the further information.

4. The controlling network device of claim 1, wherein the controlling network device is further caused to:

receive a further request to generate the information for data transmission, the further request comprising at least one of:

5 a time window in which the terminal device is allowed to transmit the background data in uplink,

an amount of background data transmitting in uplink,

information of network area in which the terminal device is allowed to transmit the background data in uplink,

10 an identity of a group of terminal devices, or

a trigger condition for transmitting the further information;

generate the information for data transmission based on the further request;

generate the index associated with the information for data transmission;

transmit the index to the network device; and

15 store the first information for data transmission with the index.

5. The controlling network device of claim 4, wherein the trigger condition indicates to transmit the further information to the terminal device in response to the terminal device being registering with a network.

20

6. The controlling network device of claim 4, wherein the controlling network device is further caused to:

in response to receiving an update request comprising the index of the information for data transmission, update the information for data transmission; and

25 store the updated information for data transmission.

7. The controlling network device of claim 1, wherein the controlling network device is further caused to:

30 in response to the terminal device triggering an establishment of a protocol data unit, receive configuration of the protocol data unit from a session management device which establishes the protocol data unit, the configuration comprising an indication for the background data.

8. The controlling network device of claim 7, wherein the controlling network device is further caused to:

in response to the request comprising the index of the information, bind a session of the server device to a further session of the protocol data unit on which the background data
5 in uplink is transmitted based on the further information.

9. A server device comprising:

at least one processor; and

at least one memory including computer program codes;

10 the at least one memory and the computer program codes are configured to, with the at least one processor, cause the server device to:

determine that a terminal device is to transmit data in uplink;

transmit, to a controlling network device and at the server device, a request comprising identity information of a terminal device and an index associated with
15 information for data transmission; and

receive the data in uplink from the terminal device, the data being transmitted based on further information for transmitting data in uplink which is generated based on the information for data transmission.

20 10. The server device of claim 9, wherein the server device is caused to transmit the request to the further network device by:

in response to determining the terminal device is allowed to transmit data in uplink, transmit the request to the controlling network device.

25 11. The server device of claim 9, wherein the server device is caused to transmit the request to the further network device by:

in response to determining the terminal device is allowed to transmit data in uplink after the terminal device being registered in a network, transmitting the request to the controlling network device.

30 12. The server device of claim 9, wherein the server device is further caused to:

transmit a further request to generate the information for data transmission, the further request comprising at least one of:

a time window for transmitting the background data in uplink,

an amount of background data transmitting in uplink,
information of network area in which allowing to transmit the background data
in uplink,

an identity of a group of terminal devices, or

5 a trigger condition for transmitting the further information; and
receive the index associated with the information for data transmission.

13. The server device of claim 9, wherein the trigger condition indicates to transmit
the further information to the terminal device in response to the terminal device being
10 registering with a network.

14. The server device of claim 12, wherein the server device is further caused to:
transmit an update request comprising the index of the information for data
transmission.

15

15. A terminal device comprising:

at least one processor; and

at least one memory including computer program codes;

the at least one memory and the computer program codes are configured to, with the
20 at least one processor, cause the terminal device to:

receive information for transmitting background data in uplink from a network
device; and

transmit the background data in uplink to a server device based on the
information.

25

16. The terminal device of claim 15, wherein the information for transmitting the
background data in uplink comprises at least one of:

a time window in which the terminal device is allowed to transmit the background
data in uplink,

30 an amount of background data allowed to be transmitted by the terminal device in
uplink, or

information of network area in which the terminal device is allowed to transmit the
background data in uplink.

17. The terminal device of claim 15, wherein the terminal device is caused to transmit the background data in uplink by:

determining whether a protocol data unit matches with the information; and

5 in response to the protocol data unit matching with the information, transmitting the background data in uplink on the protocol data unit.

18. The terminal device of claim 15, wherein the terminal device is caused to transmit the background data in uplink by:

10 determining whether a protocol data unit matches with the information; and

in response to the protocol data unit mismatching with the information, transmitting an establishing request to establish a further protocol data unit to transmit the background data in uplink, the request comprising an indication for transmitting the background data in uplink.

15 19. A method comprising:

receiving, at a controlling network device, a request from a server device, the request comprising identity information of a terminal device and an index associated with information for data transmission;

20 retrieving the information for data transmission based on the index;

generating further information for transmitting background data in uplink based on the information for data transmission; and

transmitting the further information to the terminal device.

25 20. The method of claim 19, wherein the further information for transmitting the background data in uplink comprises at least one of:

a time window in which the terminal device is allowed to transmit the background data in uplink,

30 an amount of background data allowed to be transmitted by the terminal device in uplink, or

information of network area in which the terminal device is allowed to transmit the background data in uplink.

21. The method of claim 19, wherein transmitting the further information comprises:

generating information of route selection and traffic transfer on a selected route for the terminal device;

combining the information of route selection and traffic transfer on the selected route with the further information; and

5 transmitting the combined information of route selection and traffic transfer on the selected route and the further information.

22. The method of claim 19, further comprising:

10 receiving a further request to generate the information for data transmission, the further request comprising at least one of:

a time window in which the terminal device is allowed to transmit the background data in uplink,

an amount of background data allowed to be transmitted by the terminal device in uplink,

15 information of network area in which the terminal device is allowed to transmit the background data in uplink,

an identity of a group of terminal devices, or

a trigger condition for transmitting the further information;

generating the first information for data transmission based on the further request;

20 generating the index associated with the information for data transmission;

transmitting the index to the controlling network device; and

storing the information for data transmission with the index.

23. The method of claim 22, wherein the trigger condition indicates to transmit the further information to the terminal device in response to the terminal device being registering with a network.

24. The method of claim 19, further comprising:

30 in response to receiving an update request comprising the index of the information for data transmission, updating the information for data transmission; and storing the updated information for data transmission.

25. The method of claim 19, further comprising:

in response to the terminal device triggering an establishment of a protocol data unit, receiving configuration of the protocol data unit from a session management device which establishes the protocol data unit, the configuration comprising an indication for the background data.

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26. The method of claim 25, further comprising:

in response to the request comprising the index of the information, binding a session of the server device to a further session of the protocol data unit on which the background data in uplink is transmitted based on the further information.

10

27. A method comprising:

determining that a terminal device is to transmit data in uplink;

transmitting, to a controlling network device and at a server device, a request comprising identity information of a terminal device and an index associated with information for data transmission; and

15

receiving the data in uplink from the terminal device, the data being transmitted based on further information for transmitting data in uplink which is generated based on the information for data transmission.

20

28. The method of claim 27, wherein transmitting the request to the controlling network device comprises:

in response to determining the terminal device is allowed to transmit data in uplink, transmitting the request to the controlling network device.

25

29. The method of claim 27, wherein transmitting the request to the controlling network device comprises:

in response to determining the terminal device is allowed to transmit data in uplink after the terminal device is registered in a network where the terminal device locates, transmitting the request to the controlling network device.

30

30. The method of claim 27, further comprising:

transmitting a further request to generate the information for data transmission, the further request comprising at least one of:

a time window for transmitting the background data in uplink,

an amount of background data transmitting in uplink,
information of network area in which allowing to transmit the background data
in uplink,

an identity of a group of terminal devices, or
5 a trigger condition for transmitting the second information; and
receiving the index associated with the information for data transmission.

31. The method of claim 30, wherein the trigger condition indicates to transmit the
further information to the terminal device in response to the terminal device being
10 registering with a network.

32. The method of claim 30, further comprising:
transmitting an update request comprising the index of the information for data
transmission.

15

33. A method comprising:
receiving, at a terminal device, information for transmitting background data in
uplink from a controlling network device; and
transmitting the background data in uplink to a server device based on the
20 information.

34. The method of claim 33, wherein the information for transmitting the
background data in uplink comprises at least one of:

a time window in which allowing the terminal device to transmit the background
25 data in uplink,

an amount of background data allowed to be transmitted by the terminal device, or
information of network area in which allowing the terminal device to transmit the
background data.

35. The method of claim 33, wherein transmitting the background data in uplink:
determining whether a protocol data unit matches with the information; and
in response to the protocol data unit matching with the information, transmitting the
background data in uplink on the protocol data unit.

36. The method of claim 33, wherein transmitting the background data in uplink comprises:

determining whether a protocol data unit matches with the information; and

in response to the protocol data unit mismatching with the information, transmitting
5 a request to establish a further protocol data unit to transmit the background data in uplink,
the request comprising an indication for transmitting the background data in uplink.

37. An apparatus comprising:

means for receiving, at a controlling network device, a request from a server device,
10 the request comprising identity information of a terminal device and an index associated
with information for data transmission;

means for retrieving the information for data transmission based on the index;

means for generating further information for transmitting background data in uplink
based on the information for data transmission; and

15 means for transmitting the further information to the terminal device.

38. An apparatus comprising:

means for determining that a terminal device is to transmit data in uplink;

means for transmitting, to a controlling network device and at a server device, a
20 request comprising identity information of a terminal device and an index associated with
information for data transmission; and

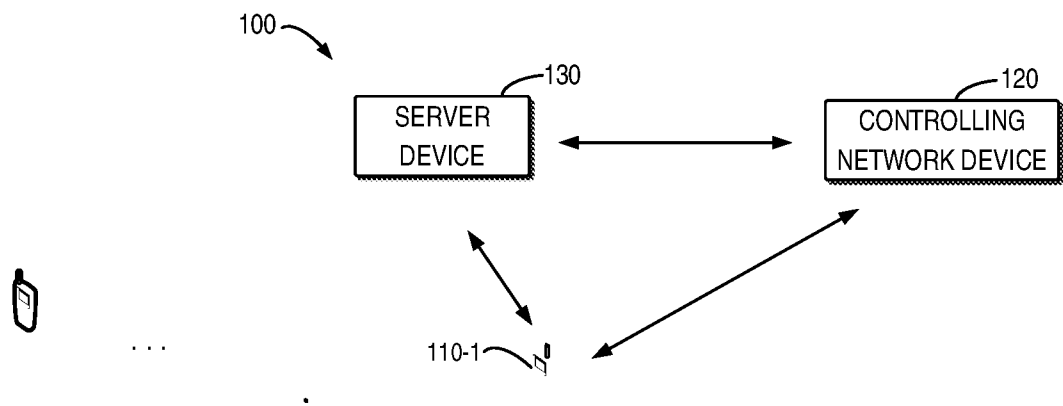
means for receiving the data in uplink from the terminal device, the data being
transmitted based on further information for transmitting data in uplink which is generated
based on the information for data transmission.

25 39. An apparatus comprising:

means for receiving, at a terminal device, information for transmitting background
data in uplink from a controlling network device; and

means for transmitting the background data in uplink to a server device based on the
30 information.

40. A computer readable medium storing instructions thereon, the instructions,
when executed by at least one processing unit of a machine, causing the machine to
perform the method according to any one of claims 19-36.



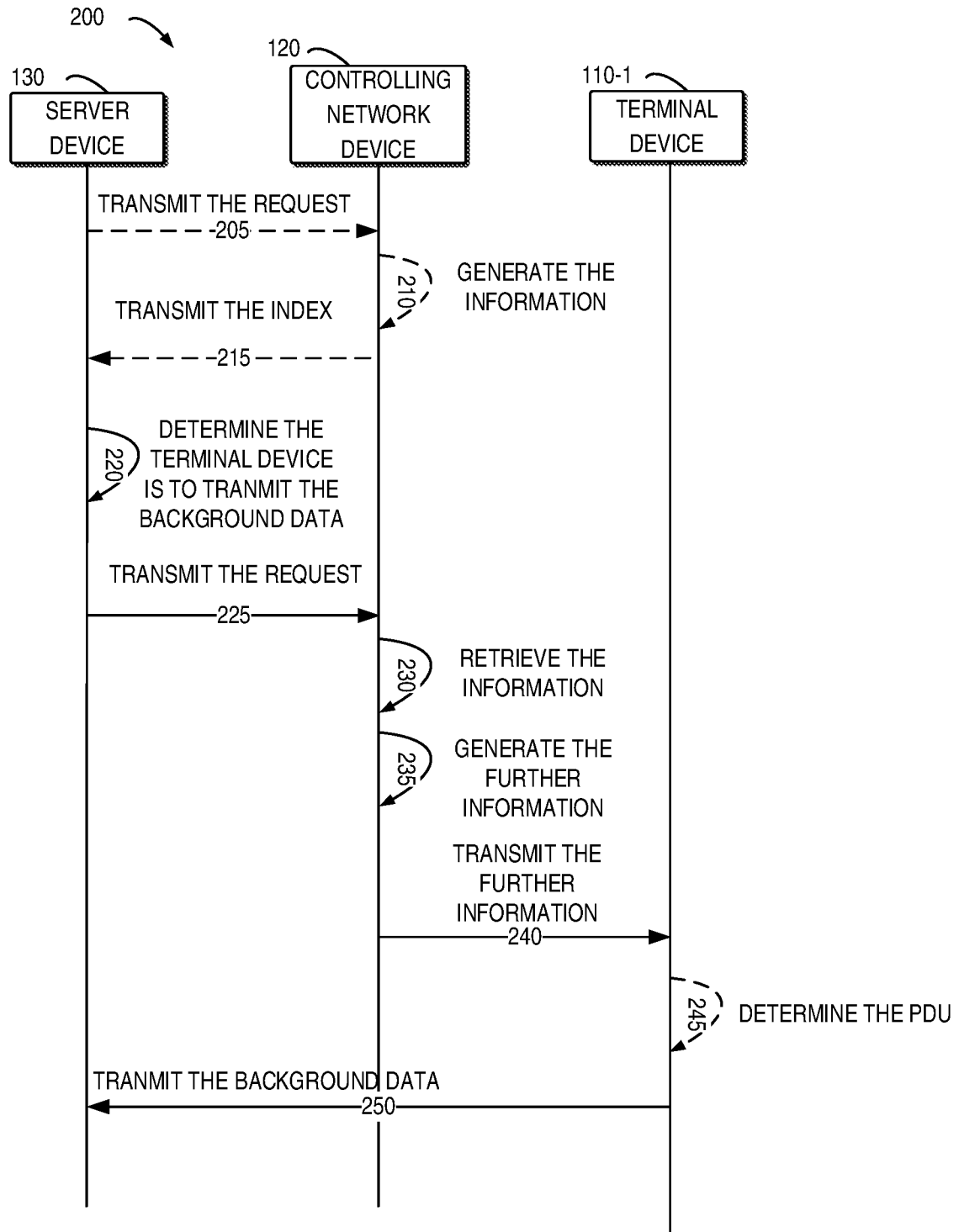


Fig. 2

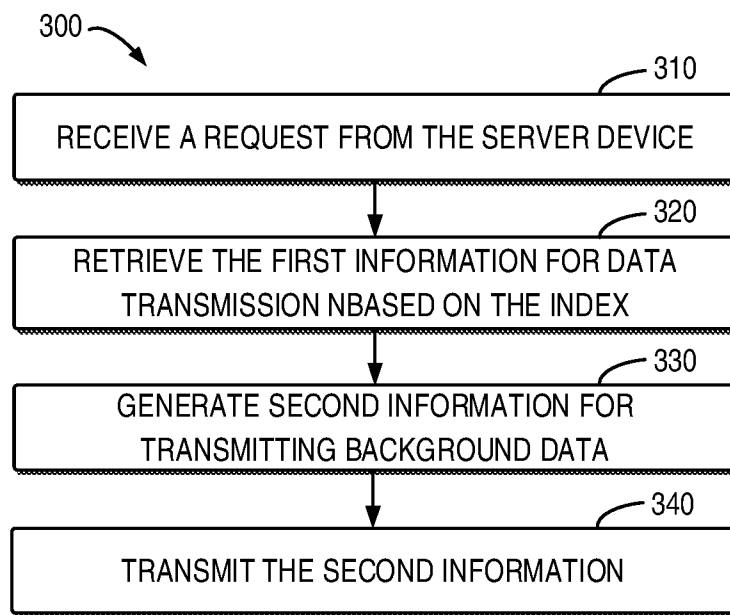


Fig. 3

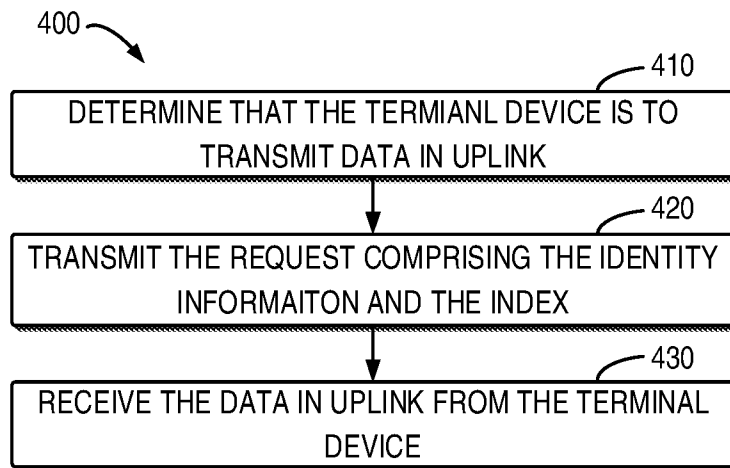


Fig. 4

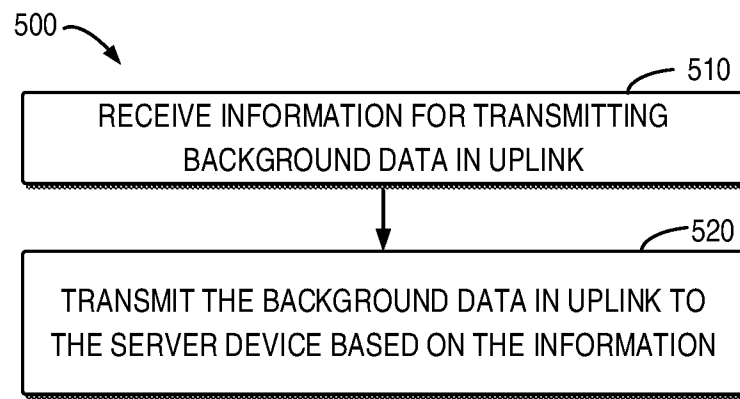


Fig. 5

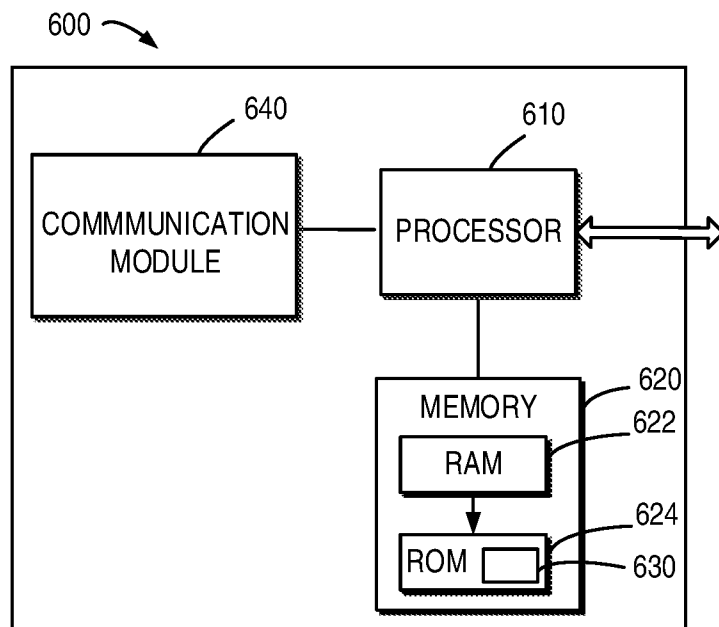


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2019/081038

A. CLASSIFICATION OF SUBJECT MATTER

H04W 24/02(2009.01)i

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; H04Q

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)

WPI,EPODOC,CNKI,CNPAT:background,data,uplink,identity,traffic,transfer,route,information,configuration

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2018302805 A1 (SAMSUNG ELECTRONICS CO., LTD.) 18 October 2018 (2018-10-18) description, paragraphs [0150]-[0154]	15-18, 33-36, 39, 40
A	CN 107277793 A (ALCATEL LUCENT) 20 October 2017 (2017-10-20) the whole document	1-40
A	US 10219316 B2 (HUAWEI TECHNOLOGIES CO., LTD.) 26 February 2019 (2019-02-26) the whole document	1-40
A	US 2013182623 A1 (RENESAS MOBILE CORPORATION) 18 July 2013 (2013-07-18) the whole document	1-40



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

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“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

16 December 2019

Date of mailing of the international search report

30 December 2019

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Telephone No. 86-(10)-53961640

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2019/081038

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				WO	2013108178	A1	25 July 2013