# COMMUNICATION METHOD AND APPARATUS

## CROSS-REFERENCE TO RELATED APPLICATIONS

**[0001]** This application claims priority to Chinese Patent Application No. 202410382677.X, filed with the China National Intellectual Property Administration on March 29, 2024 and entitled "COMMUNICATION METHOD AND APPARATUS", which is incorporated herein by reference in its entirety.

## TECHNICAL FIELD

**[0002]** This application relates to the field of communication technologies, and in particular, to a communication method and apparatus.

## BACKGROUND

**[0003]** In mobile communication technologies, if a terminal device has uplink data to transmit, the terminal device may first request a transmission resource grant from a base station by using a buffer status report (buffer status report, BSR), and the base station sends, to the terminal device based on the BSR, downlink control information (downlink control information, DCI) including an uplink (uplink, UL) grant (grant). The uplink grant may indicate resources scheduled for the terminal device. To reduce data latency and accelerate uplink data transmission, the base station may pre-schedule resources for the terminal device. Pre-scheduling means that the base station sends DCI including an uplink grant to the terminal device without receiving a BSR. When the terminal device has uplink data to transmit, the terminal device may directly use the pre-scheduled resource to send the uplink data.

**[0004]** Because the base station pre-schedules resources for the terminal device without receiving a resource scheduling request from the terminal device, the resources pre-scheduled by the base station may not match an amount of data actually to be transmitted by the terminal device. Consequently, data transmission efficiency is reduced.

## SUMMARY

**[0005]** This application provides a communication method and apparatus, to resolve a problem of how to improve data transmission efficiency in a data transmission process.

**[0006]** According to a first aspect, this application provides a communication method. The method is performed by a terminal device or a module or chip in the terminal device. An example in which the method is performed by the terminal device is used for description herein. The method includes: receiving first scheduling information from a network device, where the first scheduling information indicates a first resource; determining a resource from the first resource and a second resource based on an amount of to-be-transmitted data, and sending first data using the resource, where the first data includes at least one of the to-be-transmitted data and padding data, and an amount of data capable of being transmitted on the second resource is less than an amount of data capable of being transmitted on the first resource.

**[0007]** According to the method, before the data is sent, a resource is selected from the first resource and the second resource based on the amount of the to-be-transmitted data, so that the amount of the to-be-transmitted data can match the selected resource. This avoids transmission of a large amount of padding data when the amount of the to-be-transmitted data is small, thereby reducing power consumption of the terminal device, increasing an operating time of the device, improving resource utilization, and improving data transmission efficiency.

**[0008]** In a possible implementation, the determining the resource from the first resource and the second resource based on the amount of the to-be-transmitted data includes: if the amount of the to-be-transmitted data is less than or equal to a first data amount, the resource determined from the first resource and the second resource is the second resource; or if the amount of the to-be-transmitted data is greater than the first data amount, the resource determined from the first resource and the second resource is the first resource.

**[0009]** According to the method, when the amount of the to-be-transmitted data is small, the second resource that can be used to transmit a smaller amount of data is selected to transmit the to-be-transmitted data, thereby avoiding transmitting a large amount of padding data by the terminal device, reducing power consumption of the terminal device, and increasing an operating time of the device. When the amount of the to-be-transmitted data is large, the first resource that can be used to transmit a larger amount of data is selected, to ensure that data can be transmitted in time, thereby improving communication efficiency.

**[0010]** In a possible implementation, related parameters of the second resource include at least one of the following: frequency allocation information, time domain allocation information, modulation scheme information, and multiple input multiple output stream quantity information.

**[0011]** In a possible implementation, one or more of the related parameters of the second resource are determined in any one of the following manners: preset; determined based on the first resource; indicated by second scheduling information from the network device; indicated by the first scheduling information; and indicated by radio resource control signaling or layer 2 signaling

from the network device.

**[0012]** According to the method, flexibility of configuring the second resource can be improved.

**[0013]** In a possible implementation, the method further includes: receiving first information from the network device, where the first information indicates that selection of the resource from the first resource and the second resource is allowed.

**[0014]** In a possible implementation, when the second resource is determined from the first resource and the second resource, the method further includes: sending second information, where the second information indicates to ignore or skip the first resource scheduled by using the first scheduling information.

**[0015]** According to the method, the second information indicates to ignore or skip the first resource, so that the network device does not detect, in the first resource, whether the uplink data exists, thereby reducing power consumption of the network device.

**[0016]** According to a second aspect, this application provides a communication method. The method is performed by a network device or a module or a chip in the network device. An example in which the method is performed by the network device is used for description herein. The method includes: sending first scheduling information, where the first scheduling information indicates a first resource; and receiving first data from a terminal device by using the first resource or a second resource, where an amount of data capable of being transmitted on the second resource is less than an amount of data capable of being transmitted on the first resource.

**[0017]** In a possible implementation, related parameters of the second resource include at least one of the following: frequency allocation information, time domain allocation information, modulation scheme information, and multiple input multiple output stream quantity information.

**[0018]** In a possible implementation, one or more of the related parameters of the second resource are determined in any one of the following manners:

preset; determined based on the first resource; indicated by second scheduling information from the network device; indicated by the first scheduling information; and indicated by radio resource control signaling or layer 2 signaling from the network device.

**[0019]** In a possible implementation, the method further includes: sending first information, where the first information indicates that selection of the resource from the first resource and the second resource is allowed.

**[0020]** In a possible implementation, the method further includes: receiving second information, where the second information indicates to ignore the first resource scheduled by using the first scheduling information.

**[0021]** According to a third aspect, this application provides a communication method. The

method is performed by a terminal device or a module or chip in the terminal device. An example in which the method is performed by the terminal device is used for description herein. The method includes: receiving first scheduling information from a network device, where the first scheduling information indicates a first resource; and based on an amount of to-be-transmitted data, sending first data using the first resource or sending a first sequence, where the first data includes a part or all of the to-be-transmitted data, and the first sequence indicates the amount of the to-be-transmitted data.

**[0022]** According to the method, before the data is sent, a resource is selected from the first resource and a second resource based on the amount of the to-be-transmitted data, so that the amount of the to-be-transmitted data can match the selected resource. This avoids transmission of a large amount of padding data when the amount of the to-be-transmitted data is small, thereby reducing power consumption of the terminal device, increasing an operating time of the device, and improving resource utilization.

**[0023]** In a possible implementation, based on the amount of the to-be-transmitted data, sending the first data using the first resource or sending the first sequence includes: when the amount of the to-be-transmitted data is equal to 0, sending the first sequence using the second resource; or when the amount of the to-be-transmitted data is greater than 0, sending the first data using the first resource.

**[0024]** According to the method, when the amount of the to-be-transmitted data is small, the first sequence is transmitted using the second resource, to avoid transmission of a large amount of padding data, reduce power consumption of the terminal device, increase operating duration, and improve resource utilization. When the amount of the to-be-transmitted data is large, the first resource that can be used to transmit a larger amount of data is selected, to ensure that data can be transmitted in time, thereby improving communication efficiency.

**[0025]** In a possible implementation, related parameters of the second resource include at least one of the following: the first sequence, frequency allocation information, and time domain allocation information.

**[0026]** In a possible implementation, at least one of the related parameters of the second resource is determined in any one of the following manners:

preset; determined based on the first resource; indicated by second scheduling information from the network device; indicated by the first scheduling information; and indicated by radio resource control signaling or layer 2 signaling from the network device.

**[0027]** According to a fourth aspect, this application provides a communication method. The method is performed by a network device or a module or a chip in the network device. An example in which the method is performed by the network device is used for description herein. The method

includes: sending first scheduling information, where the first scheduling information indicates a first resource; receiving first data from a terminal device by using the first resource, or receiving a first sequence from the terminal device using a second resource, where the first sequence indicates an amount of to-be-transmitted data.

**[0028]** In a possible implementation, related parameters of the second resource include at least one of the following: the first sequence, frequency allocation information, and time domain allocation information.

**[0029]** In a possible implementation, at least one of the related parameters of the second resource is determined in any one of the following manners:

preset; determined based on the first resource; indicated by second scheduling information from the network device; indicated by the first scheduling information; and indicated by radio resource control signaling or layer 2 signaling from the network device.

**[0030]** According to a fifth aspect, this application provides a communication method. The method is performed by a terminal device or a module or chip in the terminal device. An example in which the method is performed by the terminal device is used for description herein. The method includes: generating first indication information, where the first indication information includes X pieces of transmission information, the X pieces of transmission information are in a one-to-one correspondence with X time units, X is an integer greater than 0, and one piece of transmission information indicates any one of the following: resource indication information is received in a time unit corresponding to the transmission information, and an uplink transmission resource indicated by using the resource indication information is ignored; the resource indication information is received in the time unit corresponding to the transmission information, and the uplink transmission resource indicated by using the resource indication information is used to transmit uplink data; and the resource indication information is not received in the time unit corresponding to the transmission information; and sending the first indication information to a network device.

**[0031]** According to the method, the first indication information indicates whether the resource indication information transmitted in each of X time units is ignored. When the network device does not receive uplink data on an uplink transmission resource, the network device may determine, based on the first indication information, whether the uplink data is not received on the uplink transmission resource or the terminal device does not send the uplink data. In addition, the network device can determine, based on the first indication information, whether there is uplink data that fails to be transmitted, to determine whether to schedule a retransmission resource for the terminal device, thereby improving communication efficiency.

**[0032]** In a possible implementation, a transmission period of the first indication information

is Y time units, and Y is an integer greater than 0.

**[0033]** In a possible implementation, the method further includes: receiving trigger information from the network device, where the trigger information indicates to report the first indication information.

**[0034]** In a possible implementation, the method further includes: determining that a quantity of pieces of received resource indication information is N, or determining that a quantity of pieces of ignored resource indication information is M, where M and N are integers greater than 0.

**[0035]** In a possible implementation, the first indication information is carried in layer 2 signaling or RRC signaling.

**[0036]** According to a sixth aspect, this application provides a communication method. The method is performed by a network device or a module or a chip in the network device. An example in which the method is performed by the network device is used for description herein. The method includes: receiving first indication information from a terminal device, where the first indication information includes X pieces of transmission information, the X pieces of transmission information are in a one-to-one correspondence with X time units, X is an integer greater than 0, and one piece of transmission information indicates any one of the following: resource indication information is received in a time unit corresponding to the transmission information, and an uplink transmission resource indicated by using the resource indication information is ignored; the resource indication information is received in the time unit corresponding to the transmission information, and the uplink transmission resource indicated by using the resource indication information is used to transmit uplink data; and the resource indication information is not received in the time unit corresponding to the transmission information; and

sending second resource indication information if first transmission information in the X pieces of transmission information indicates that a first uplink transmission resource indicated by first resource indication information transmitted in a first time unit is used to transmit uplink data but the uplink data is not received on the first uplink transmission resource, where the second resource indication information is used to schedule a second uplink transmission resource, and the second uplink transmission resource is used to retransmit the uplink data in the first uplink transmission resource.

**[0037]** In a possible implementation, a transmission period of the first indication information is Y time units, and Y is an integer greater than 0.

**[0038]** In a possible implementation, the method further includes: sending trigger information, where the trigger information indicates to report the first indication information.

**[0039]** According to a seventh aspect, this application further provides a communication apparatus. The communication apparatus can implement any method provided in any one of the

first aspect to the sixth aspect. The communication apparatus may be implemented by hardware, or may be implemented by executing corresponding software by the hardware. The hardware or the software includes one or more units or modules corresponding to the foregoing functions.

**[0040]** In a possible implementation, the communication apparatus includes a processor. The processor is configured to support the communication apparatus in performing a corresponding function of the network device or the terminal device in the foregoing method. The communication apparatus may further include a memory. The memory may be coupled to the processor, and the memory stores program instructions and data that are necessary for the communication apparatus. Optionally, the communication apparatus further includes an interface circuit. The interface circuit is configured to support communication between the communication apparatus and a device such as a terminal device.

**[0041]** In a possible implementation, the communication apparatus includes corresponding function modules configured to implement the steps in the foregoing method. The function may be implemented by hardware, or may be implemented by hardware executing corresponding software. The hardware or software includes one or more modules corresponding to the foregoing functions.

**[0042]** In a possible implementation, a structure of the communication apparatus includes a processing unit and a communication unit. These units may perform corresponding functions in the foregoing method examples. For details, refer to descriptions in the method provided in any one of the first aspect to the sixth aspect. Details are not described herein again.

**[0043]** According to an eighth aspect, a communication apparatus is provided, including a processor and an interface circuit. The interface circuit is configured to: receive a signal from a communication apparatus other than the communication apparatus and transmit the signal to the processor, or send a signal from the processor to a communication apparatus other than the communication apparatus. The processor is configured to implement a functional module of the method in any possible implementation of any one of the first aspect to the sixth aspect by using a logic circuit or by executing a computer program or instructions. Optionally, the communication apparatus further includes a memory, and the memory is configured to store the computer program or the instructions.

**[0044]** According to a ninth aspect, a computer-readable storage medium is provided. The computer-readable storage medium stores a computer program or instructions. When the computer program or the instructions are executed by a processor, the method in any possible implementation of any one of the first aspect to the sixth aspect is implemented.

**[0045]** According to a tenth aspect, a computer program product storing instructions is provided. When a computer or a communication apparatus reads and executes the computer

program product, the method in any possible implementation of any one of the first aspect to the sixth aspect is implemented.

**[0046]** According to an eleventh aspect, a circuit is provided. The circuit is configured to perform the method in any possible implementation of any one of the first aspect to the sixth aspect, and the circuit may include a chip circuit. Optionally, the circuit may be further coupled to a memory.

**[0047]** According to a twelfth aspect, a chip is provided. The chip includes a processor. When executing a computer program or instructions, the processor is configured to implement the method in any possible implementation of any one of the first aspect to the sixth aspect. Optionally, the chip may further include a memory. The chip may include a chip, or may include a chip and another discrete device.

**[0048]** According to a thirteenth aspect, a communication apparatus is provided, including a processor. The processor implements the method in any possible implementation of any one of the first aspect to the sixth aspect by using a logic circuit or by executing a computer program or instructions.

**[0049]** According to a fourteenth aspect, a communication apparatus is provided, including a unit or a module configured to perform the method in any possible implementation of any one of the first aspect to the sixth aspect.

**[0050]** According to a fifteenth aspect, an embodiment of this application further provides a communication system. The communication system includes a terminal device configured to implement the method according to any one of the first aspect and the possible implementations of the first aspect, and a network device configured to implement the method according to any one of the second aspect and the possible implementations of the second aspect. Alternatively, the communication system includes: a terminal device configured to implement the method in the third aspect and any possible implementation of the third aspect; and a network device configured to implement the method in the fourth aspect and any possible implementation of the fourth aspect. Alternatively, the communication system includes: a terminal device configured to implement the method in the fifth aspect and any possible implementation of the fifth aspect; and a network device configured to implement the method in the sixth aspect and any possible implementation of the sixth aspect.

## BRIEF DESCRIPTION OF DRAWINGS

**[0051]** FIG. 1 is a diagram of a network architecture applicable to an embodiment of this application;

**[0052]** FIG. 2 is a diagram of an architecture of a network device applicable to an embodiment of this application;

**[0053]** FIG. 3 is a schematic flowchart of a communication method according to an embodiment of this application;

**[0054]** FIG. 4 is a diagram of data transmission according to an embodiment of this application;

**[0055]** FIG. 5 is a schematic flowchart of a communication method according to an embodiment of this application;

**[0056]** FIG. 6 is a schematic flowchart of a communication method according to an embodiment of this application;

**[0057]** FIG. 7 is a diagram of a structure of a communication apparatus according to an embodiment of this application;

**[0058]** FIG. 8 is a diagram of a structure of a communication apparatus according to an embodiment of this application; and

**[0059]** FIG. 9 is a diagram of a structure of a communication apparatus according to an embodiment of this application.

## DESCRIPTION OF EMBODIMENTS

**[0060]** The following describes the technical solutions in embodiments of this application with reference to the accompanying drawings in embodiments of this application. It is clear that the described embodiments are merely some but not all of embodiments of this application. In this application, the terms "first" and "second" and corresponding term numbers are intended to distinguish between similar objects but do not necessarily describe a specific order or sequence. It should be understood that the terms used in such a way are interchangeable in proper circumstances, which is merely a discrimination manner that is used when objects having a same attribute are described in embodiments of this application. In addition, the terms "include", "contain" and any other variants mean to cover the non-exclusive inclusion, so that a process, method, system, product, or device that includes a series of units is not necessarily limited to those units, but may include other units not expressly listed or inherent to such a process, method, system, product, or device. The method and an apparatus provided in embodiments of this application are based on a same or similar technical concept. Because problem resolving principles of the method and the apparatus are similar, mutual reference may be made to implementations of the apparatus and the method. Repeated descriptions are not provided again.

**[0061]** The method provided in embodiments of this application may be applied to various mobile communication systems, for example, may be an internet of things (internet of things, IoT),

a narrow band internet of things (narrow band internet of things, NB-IoT), a 4th generation (4th generation, 4G) communication system (for example, a long term evolution (long term evolution, LTE)), may also be a 5th generation (5th generation, 5G) communication system (for example, a 5G new radio (new radio, NR)), or an LTE and NR hybrid architecture, may also be 6G or a new communication system emerging in future communication development, or the like. The communication system may further include a machine to machine (machine to machine, M2M) network, a machine type communication (machine type communication, MTC) network, or another network.

**[0062]** In this application, "at least one" means one or more, and "a plurality of" means two or more. "And/or" describes an association relationship between associated objects and represents that three relationships may exist. For example, A and/or B may represent the following three cases: Only A exists, both A and B exist, and only B exists.

**[0063]** FIG. 1 is a diagram of a 5G network architecture applicable to this application. The 5G network architecture shown in FIG. 1 may include user equipment (user equipment, UE), a radio access network (radio access network, RAN), a unified data management (unified data management, UDM) network element, and a network exposure function (network exposure function, NEF) network element, an application function (application function, AF) network element, a policy control function (policy control function, PCF) network element, an access and mobility management function (access and mobility management function, AMF) network element, a session management function (session management function, SMF) network element, a user plane function (user plane function, UPF) network element, a network repository function (network repository function, NRF) network element, or the like. The foregoing is merely an example. In actual application, the 5G network may further include other network elements. Examples are not described one by one herein again. The AMF network element may also be referred to as AMF for short, and other network elements may be deduced by analogy. Details are not described again.

**[0064]** The AMF is mainly responsible for mobility management in a mobile network, such as user location update, user network registration, and user switching.

**[0065]** The SMF is mainly responsible for session management in the mobile network, such as session establishment, modification, and release. Specific functions include, for example, allocating an IP address to a user or selecting a UPF that provides a packet forwarding function.

**[0066]** The PCF provides policies, such as QoS policies and slice selection policies, for the AMF and the SMF.

**[0067]** The UDM is configured to store user data such as subscription information and authentication/authorization information.

**[0068]** The AF is responsible for providing a service for a 3GPP network, for example, affecting service routing or interacting with the PCF to perform policy control.

**[0069]** The UPF is mainly responsible for performing processing such as forwarding and charging on a user packet.

**[0070]** The DN refers to an operator network that provides a data transmission service for a user, for example, an IMS (IP Multi-media Service, IP multimedia service) and the Internet.

**[0071]** Functions of the foregoing network elements are merely examples, and specific functions of the network elements are not limited in this application.

**[0072]** In embodiments of this application, the RAN may also be referred to as a network device, the network device may be a device in a wireless network, and the network device may also be referred to as a network apparatus, a radio access network device, or an access network device. For example, the network device may be a radio access network node that connects a terminal device to the wireless network, and may also be referred to as an access network device. The network device includes but is not limited to: a base station (base station), an evolved NodeB (evolved NodeB, eNodeB), a transmission reception point (transmission reception point, TRP), a next generation NodeB (next generation NodeB, gNB) in a 5th generation (5th generation, 5G) mobile communication system, an access network device in an open radio access network (open radio access network, O-RAN), a next-generation base station in a 6th generation (6th generation, 6G) mobile communication system, a base station in a future mobile communication system, an access node in a wireless fidelity (wireless fidelity, Wi-Fi) system, or the like; or may be a module or a unit that completes a part of functions of the base station, for example, may be a central unit (central unit, CU), a distributed unit (distributed unit, DU), a central unit control plane (CU control plane, CU-CP) module, or a central unit user plane (CU user plane, CU-UP) module. The access network device may be a macro base station, may be a micro base station or an indoor base station, or may be a relay node, a donor node, or the like. A specific technology and a specific device form used by the network device are not limited in this application.

**[0073]** As shown in FIG. 2, in some implementations, the network device may include a central unit (central unit, CU) and a distributed unit (distributed unit, DU). The RAN device including a CU node and a DU node separates protocol layers of a gNB in an NR system. Functions of some protocol layers are controlled by the CU in a centralized manner. Functions of some or all remaining protocol layers are distributed in the DU, and the CU controls the DU in a centralized manner. Further, the CU may be further divided into a control plane (CU-CP) and a user plane (CU-UP). The CU-CP is responsible for a control plane function, mainly including radio resource control (radio resource control, RRC) and packet data convergence protocol (packet data convergence protocol, PDCP) (namely, PDCP-C) corresponding to the control plane. The PDCP-

C is mainly responsible for data encryption/decryption, integrity protection, data transmission, and the like on a control plane. The CU-UP is responsible for a user plane function, mainly including a service data adaptation protocol (service data adaptation protocol, SDAP) and a PDCP (namely, PDCP-U) corresponding to the user plane. The SDAP is mainly responsible for processing data of a core network and mapping a flow (flow) to a bearer. The PDCP-U is mainly responsible for data plane encryption/decryption, integrity protection, header compression, sequence number maintenance, data transmission, and the like. The CU-CP and the CU-UP are connected through an E1 interface. The CU-CP, on behalf of the gNB, is connected to the core network through an NG interface and connected to the DU through an F1 interface-control plane (namely, F1-C). The CU-UP is connected to the DU through an F1 interface-user plane (namely, F1-U). Certainly, in another possible implementation, the PDCP-C is alternatively in the CU-UP.

**[0074]** It may be understood that, in different systems, the CU (including the CU-CP or the CU-UP) or the DU may alternatively have different names, but a person skilled in the art can understand meanings of the names. For example, in an open radio access network (open radio access network, O-RAN or ORAN) system, a CU may also be referred to as an open CU (open CU, O-CU), a DU may also be referred to as an open DU (open DU, O-DU), a CU-CP may also be referred to as an O-CU-CP, and a CU-UP may also be referred to as an O-CU-UP. For ease of description, the CU, the CU-CP, the CU-UP, and the DU are used as examples for description in this application. The network device may further include an active antenna unit (active antenna unit, AAU). The CU implements some functions of the gNB, and the DU implements some functions of the gNB. For example, the CU is responsible for processing a non-real-time protocol and service, to implement functions of an RRC layer. The DU is responsible for processing a physical layer protocol and a real-time service, and implements functions of a radio link control (radio link control, RLC) layer, a media access control (media access control, MAC) layer, and a physical (physical, PHY) layer. In some deployments, the CU may be further divided into a central unit control plane (CU-CP) node and a central unit user plane (CU-UP) node. The CU-CP is responsible for the control plane function, and the CU-UP is responsible for the user plane function.

**[0075]** The terminal device in embodiments of this application may be a wireless terminal apparatus that can receive scheduling and indication information from the network apparatus. The terminal device may be referred to as a terminal apparatus, and may be further referred to as user equipment (user equipment, UE), a terminal, a mobile station (mobile station, MS), a mobile terminal (mobile terminal, MT), or the like. The terminal apparatus may be a device with a wireless communication function (for providing voice/data connectivity to a user). For example, a handheld device, a vehicle-mounted device, or a vehicle-mounted module having a wireless connection function. Currently, some examples of terminal apparatuses are: a mobile phone (mobile phone),

a tablet computer, a notebook computer, a palmtop computer, a mobile internet device (mobile internet device, MID), a wearable device, a virtual reality (virtual reality, VR) device, an augmented reality (augmented reality, AR) device, a wireless terminal in industrial control (industrial control), a wireless terminal in an internet of vehicles, a wireless terminal in self-driving (self-driving), a wireless terminal in remote medical surgery (remote medical surgery), a wireless terminal in a smart grid (smart grid), a wireless terminal in transportation safety (transportation safety), a wireless terminal in a smart city (smart city), a wireless terminal in a smart home (smart home), a device-to-device (device-to-device, D2D) terminal apparatus, a vehicle to everything (vehicle to everything, V2X) communication terminal apparatus, a smart vehicle, an in-vehicle infotainment (also referred to as a vehicle-mounted sending unit) (telematics box, T-box), a machine-to-machine/machine-type communication (machine-to-machine/machine-type communication, M2M/MTC) terminal apparatus, an internet of things (internet of things, IoT) terminal apparatus, and the like. For example, the terminal apparatus may be a vehicle-mounted device, an entire vehicle device, a vehicle-mounted module, a vehicle, an on board unit (on board unit, OBU), a roadside unit (roadside unit, RSU), a T-box, a chip, a system on chip (system on chip, SoC), or the like. The chip or the SoC may be mounted in a vehicle, an OBU, an RSU, or a T-box. The wireless terminal in industrial control may be a camera, a robot, or the like. The wireless terminal in the smart home may be a television, an air conditioner, a sweeper, a speaker, a set-top box, or the like. The terminal device may alternatively be a V2X device, for example, a smart car (smart car or intelligent car), a digital car (digital car), an unmanned car (unmanned car, driverless car, pilotless car, or automobile), a self-driving car (self-driving car or autonomous car), a pure electric vehicle (pure EV or Battery EV), a hybrid electric vehicle (hybrid electric vehicle, HEV), a range extended electric vehicle (range extended EV, REEV), a plug-in hybrid electric vehicle (plug-in HEV, PHEV), a new energy vehicle (new energy vehicle), or a roadside device (roadside unit, RSU). The terminal device may alternatively be a device in device-to-device (device-to-device, D2D) communication, for example, an electricity meter or a water meter. In addition, in embodiments of this application, the terminal device may alternatively be a terminal device in an IoT system. An IoT is an important part of future development of information technology, and is mainly technically characterized in that things are connected to networks by using communication technologies, to implement intelligent networks of human-machine interconnection and thing-thing interconnection.

**[0076]** In this application, preset or predefined content is usually defined in a standard, does not need to be configured by another device, and is information recorded/written in advance in hardware and/or software of the terminal apparatus, or may be understood as information that cannot be changed by a network apparatus or another terminal apparatus. Preconfigured content is

usually information recorded/written in advance in hardware and/or software of the terminal apparatus, is determined by a factory device vendor, and may be changed by using software or hardware.

**[0077]** In mobile communication technologies, for example, an NR system, an LTE system, or a future communication system, a network device may send DCI including an uplink grant to a terminal device when the network device does not receive a resource application message (for example, a BSR) of the terminal device, to pre-schedule a resource for the terminal device by using the uplink grant. In this way, when the terminal device needs to transmit uplink data, the terminal device may directly use the pre-scheduled resource to send the uplink data, thereby reducing a data transmission delay.

**[0078]** From a perspective of the network device, there may be two cases in which the network device fails to detect the uplink data in the pre-scheduled resource.

**[0079]** Case 1: The terminal device does not transmit the uplink data on the pre-scheduled resource.

**[0080]** Case 2: The terminal device transmits the uplink data on the pre-scheduled resource, but the network device cannot detect the uplink data due to poor channel quality.

**[0081]** The network device cannot distinguish a specific case that causes the failure to detect the uplink data on the pre-scheduled resource. Therefore, to avoid data loss, if the terminal device has no to-be-transmitted uplink data, the terminal device needs to transmit padding (padding) data on the pre-scheduled resource. In this way, when receiving the padding data, the network device may determine that the terminal device has no uplink data to be transmitted. When the network device does not receive the data, the network device may reschedule a resource used for retransmission, so that the terminal device retransmits the uplink data, thereby avoiding data loss.

**[0082]** However, if the terminal device does not need to send data, and still transmits the padding data on the pre-scheduled resource, power consumption of the terminal device is wasted. Especially for a terminal device with low power consumption, an operating time of the terminal device is reduced. Therefore, this application provides a method, to reduce power consumption of the terminal device.

**[0083]** In this application, a method performed on a terminal device side may alternatively be performed by a module (for example, a chip) in a terminal device. A method performed on a network device side may alternatively be performed by a module (for example, a chip or a modem) in a network device.

**[0084]** It may be understood that a specific structure of an execution entity of the method provided in embodiments of this application is not particularly limited in this application, and may be applied to a module in the terminal device or a module in the network device, provided that a

program that records code of the method provided in embodiments of this application can be run to perform communication according to the method provided in embodiments of this application. In the following procedures, interaction between the terminal device and the network device is used as an example for description.

**[0085]** FIG. 3 is a schematic flowchart of a communication method according to an embodiment of this application. The method includes the following steps.

**[0086]** Step 301: A network device sends first scheduling information, where the first scheduling information indicates a first resource.

**[0087]** Correspondingly, the terminal device receives the first scheduling information from the network device.

**[0088]** In an implementation, the first resource indicated by the first scheduling information may be a pre-scheduled resource. For example, the network device sends the first scheduling information when the network device does not receive a resource request message from the terminal device. For example, the resource request message may be a BSR or a scheduling request (scheduling request, SR).

**[0089]** The first scheduling information may be an uplink grant in DCI, or may be scheduling information of another type. This is not limited in this application.

**[0090]** In this application, the first scheduling information may indicate one or more of the following items of the first resource:

frequency allocation information of the first resource, where for example, the frequency allocation information of the first resource may indicate at least one of a quantity of resource blocks (resource blocks, RBs) included in the first resource and an RB location (index) included in the first resource;

time domain allocation information of the first resource, where for example, the time domain allocation information of the first resource may indicate at least one of a quantity of symbols of the first resource and a symbol location (or index) of the first resource, where the symbol may be an orthogonal frequency division multiplexing (orthogonal frequency division multiplexing, OFDM) symbol;

modulation scheme information of the first resource, where for example, the modulation scheme information may indicate a modulation and coding scheme (modulation and coding scheme, MCS) of data transmitted in the first resource; and

multiple input multiple output (multiple input multiple output, MIMO) stream quantity information of the first resource, which may indicate a quantity of MIMO streams of data transmitted in the first resource.

**[0091]** If the first scheduling information indicates only a part of the information about the

first resource, other information about the first resource may be preset or predefined. For example, if the first scheduling information indicates the frequency allocation information and the time domain allocation information of the first resource, the modulation scheme information and the MIMO stream quantity information may be preset or predefined.

**[0092]** In this application, a second resource may be further included. An amount of data capable of being transmitted on the second resource is less than an amount of data capable of being transmitted on the first resource. The terminal device may determine the second resource based on related parameters of the second resource.

**[0093]** It may be understood that the amount of data capable of being transmitted on the second resource is less than the amount of data capable of being transmitted on the first resource, and therefore scheduling information corresponding to the second resource may also be referred to as reduced scheduling (grant).

**[0094]** The related parameters of the second resource include at least one of the following:

frequency allocation information of the second resource, where for example, the frequency allocation information of the second resource may indicate at least one of a quantity of RBs of the second resource and an RB location (or index) of the second resource;

time domain allocation information of the second resource, where for example, the time domain allocation information of the second resource may indicate at least one of a quantity of symbols of the second resource and a symbol location (or an index) of the second resource;

modulation scheme information of the second resource, where for example, the modulation scheme information may indicate an MCS of data transmitted in the second resource; and

MIMO stream quantity information of the second resource, which may indicate a quantity of MIMO streams of data transmitted in the second resource.

**[0095]** One or more of the related parameters of the second resource may be preset or predefined, or may be determined based on the first resource, or may be configured by the network device.

**[0096]** Optionally, information about different items in the related information of the second resource may be determined in different manners. For example, the information about the second resource includes three pieces of specific information: the quantity of RBs of the second resource, the quantity of symbols of the second resource, and the MCS. The quantity of RBs is determined based on the first resource, the quantity of symbols is preset, and the MCS is configured based on configuration information.

**[0097]** For example, in Implementation 1, each of the related parameters of the second resource is preset. For example, the quantity of RBs of the second resource may be preset to 1, the

quantity of symbols of the second resource may be preset to 1, the MCS of the data transmitted in the second resource may be preset to 0 or 1, and the quantity of MIMO streams of the second resource may be preset to 1.

**[0098]** Implementation 2: At least one of the related parameters of the second resource is determined based on the first resource. For example, the second resource is a part of the first resource. For example, the RB of the second resource is determined based on the RB of the first resource. For example, RB allocation of the second resource is a subset of RB allocation of the first resource. For example, the symbol of the second resource is determined based on the symbol of the first resource. For example, symbol allocation of the second resource is a subset of symbol allocation of the first resource. Another parameter in the related parameters of the second resource may be preset, or may be determined in another manner. For example, the quantity of symbols of the second resource is less than the quantity of symbols of the first resource. The MCS of the data transmitted on the second resource may be preset to 0 or 1, and the quantity of MIMO streams of the second resource may be preset to 1.

**[0099]** Implementation 3: The network device may send second scheduling information, where the second scheduling information indicates at least one of the frequency allocation information, the time domain allocation information, the modulation scheme information, and the MIMO stream quantity information of the second resource. In the related parameters of the second resource, a parameter that is not indicated by the second scheduling information may be preset, or may be indicated by RRC signaling or layer 2 (layer 2, L2) signaling, or may be indicated by the first scheduling information. This is not limited in this application.

**[00100]** For example, the second scheduling information indicates the frequency allocation information and the time domain allocation information of the second resource, the MCS of the data transmitted in the second resource may be preset to 0 or 1, and the quantity of MIMO streams of the second resource may be preset to 1.

**[00101]** The second scheduling information and the first scheduling information are different scheduling information, and the second scheduling information and the first scheduling information are scrambled by using different radio network temporary identifiers (radio network temporary identifiers, RNTIs). The RNTIs respectively used by the second scheduling information and the first scheduling information may be configured by the network for the terminal device by RRC signaling, or may be predefined or preset.

**[00102]** Implementation 4: In addition to the frequency allocation information, the time domain allocation information, the modulation scheme information, and the MIMO stream quantity information of the first resource, the first scheduling information may further indicate at least one of the frequency allocation information, the time domain allocation information, the modulation

scheme information, and the MIMO stream quantity information of the second resource. In the related parameters of the second resource, a parameter that is not indicated by the first scheduling information may be preset, or may be indicated by RRC signaling or layer 2 signaling. This is not limited in this application.

**[00103]** For example, the first scheduling information further indicates the frequency allocation information of the second resource and the time domain allocation information of the second resource. The MCS of the data transmitted on the second resource may be preset to 0 or 1, and the quantity of MIMO streams of the second resource may be preset to 1.

**[00104]** Implementation 5: The network device may send RRC signaling or L2 signaling, where the RRC signaling or the L2 signaling indicates at least one of the frequency allocation information, the time domain allocation information, the modulation scheme information, and the MIMO stream quantity information of the second resource. In the related parameters of the second resource, a parameter that is not indicated by the RRC signaling or the L2 signaling may be preset, or may be indicated by the second scheduling information, or may be indicated by the first scheduling information. This is not limited in this application.

**[00105]** The foregoing is merely an example. How to specifically determine the related parameters of the second resource is not limited in this application, and examples are not described herein one by one.

**[00106]** Optionally, the network device may further send first information, where the first information indicates that a resource is allowed to be selected from the first resource and the second resource, or the first information indicates that the first resource is allowed to be ignored or skipped. The terminal device receives the first information, and may determine that a resource can be selected from the first resource and the second resource, or determine that the first resource can be ignored or skipped. The first information may be carried in RRC signaling or L2 signaling, or may be carried in the first scheduling information. This is not limited in this application.

**[00107]** When obtaining the first resource, the terminal device may determine, based on an amount of the to-be-transmitted data, whether to transmit the data using the first resource. For details, refer to the following procedure.

**[00108]** Step 302: The terminal device determines the resource from the first resource and the second resource based on the amount of the to-be-transmitted data, and sends the first data using the resource.

**[00109]** The first data includes at least one of the to-be-transmitted data and the padding data. For example, if the terminal device has no to-be-transmitted data, the first data may include the padding data, the padding data may be a bit that does not carry information, and the network device does not need to parse the padding data. For another example, if the amount of the to-be-

transmitted data of the terminal device is less than an amount of data capable of being transmitted on the resource, the first data may include the to-be-transmitted data and the padding data. After receiving the first data, the network device does not need to parse the padding data in the first data. The to-be-transmitted data may be user service data, or may be control information. For example, the control information includes a MAC control element (control element, CE) or other transport layer control information. For another example, the control information includes power headroom information of the terminal device.

**[00110]** How the terminal device determines the resource from the first resource and the second resource is not limited in this application. In an implementation, if the amount of the to-be-transmitted data of the terminal device is less than or equal to a first data amount, the resource determined from the first resource and the second resource is the second resource.

**[00111]** The first data amount may be preset or predefined, or may be determined based on the amount of data capable of being transmitted on the second resource, or may be indicated by the network device. This is not limited in this application. For example, the first data amount may be less than or equal to the amount of data capable of being transmitted on the second resource.

**[00112]** In this implementation, if the amount of the to-be-transmitted data is equal to the amount of data capable of being transmitted on the second resource, the first data sent by the terminal device using the second resource includes the to-be-transmitted data; and if the amount of the to-be-transmitted data is less than the amount of data capable of being transmitted on the second resource, the first data sent by the terminal device using the second resource includes the to-be-transmitted data and the padding data.

**[00113]** According to the foregoing method, when the amount of the to-be-transmitted data of the terminal device is small, the second resource is selected to transmit the to-be-transmitted data, thereby avoiding transmitting a large amount of padding data by the terminal device, reducing power consumption of the terminal device, and increasing an operating time of the terminal device. Particularly, when the terminal device has no data to transmit, the terminal device does not need to send the padding data using the first resource, thereby reducing power consumption of the terminal device for data transmission.

**[00114]** In an implementation, if the amount of the to-be-transmitted data of the terminal device is greater than the first data amount, the resource determined from the first resource and the second resource is the first resource.

**[00115]** In this implementation, if the amount of the to-be-transmitted data is equal to the amount of data capable of being transmitted on the first resource, the first data sent by the terminal device by using the first resource includes the to-be-transmitted data. If the amount of the to-be-transmitted data is less than the amount of data capable of being transmitted on the first resource,

the first data sent by the terminal device by using the first resource includes the to-be-transmitted data and the padding data. If the amount of the to-be-transmitted data is greater than the amount of data capable of being transmitted on the first resource, the first data sent by the terminal device by using the first resource includes a part of the to-be-transmitted data, and the terminal device may send another part of the to-be-transmitted data on another resource (for example, the second resource). The another resource may be the second resource, or may be another resource pre-scheduled by the network device. This is not limited in this application.

**[00116]** With reference to the foregoing descriptions, as shown in FIG. 4, the first resource includes four RBs and one symbol, the MCS corresponding to the first resource is 13, and the stream quantity corresponding to the first resource is 1. The second resource includes one RB and one symbol, the MCS corresponding to the second resource is 0, and the stream quantity corresponding to the second resource is 1. Because the quantity of RBs included in the first resource is greater than the RB data included in the second resource, and the MCS corresponding to the first resource is greater than the MCS corresponding to the second resource, an amount of data transmitted by the terminal device in the first resource is greater than an amount of data transmitted in the second resource. Therefore, first power used by the terminal device to transmit data in the first resource is greater than second power used by the terminal device to transmit data in the second resource. As a result, power consumption of the terminal device for transmitting the data in the first resource is greater than power consumption for transmitting the data in the second resource. According to the method provided in this application, if the amount of the to-be-transmitted data of the terminal device is less than or equal to the first data amount, the to-be-transmitted data is transmitted using the second resource, so that power consumption of the terminal device may be reduced, and an operating time of the device may be increased.

**[00117]** In this application, if the terminal device selects the first resource and the amount of the to-be-transmitted data is less than the amount of data capable of being transmitted on the first resource, or the terminal device selects the second resource and the amount of the to-be-transmitted data is less than the amount of data capable of being transmitted on the second resource, the first data may further include control information, and the control information includes but is not limited to the power headroom information of the terminal device.

**[00118]** Step 303: The network device receives the first data from the terminal device using the first resource or the second resource.

**[00119]** In an implementation, the network device performs signal detection on the first resource, and if the first data is detected and correctly decoded, determines that the first resource is used by the terminal device. In this implementation, if the second resource is located after the first resource in time domain, the network device may not perform signal detection on the second

resource.

**[00120]** In an implementation, the network device performs signal detection on the second resource, and if the first data is detected and correctly decoded, determines that the first resource is not used by the terminal device. In this implementation, if the first resource is located after the second resource in time domain, the network device may not perform signal detection on the first resource.

**[00121]** In an implementation, the network device separately performs signal detection on the first resource and the second resource. If the network device detects no data from the terminal device on both the first resource and the second resource, the network device may determine that uplink transmission of the terminal device fails. The network device may reschedule a resource for the terminal device to retransmit the uplink data. For example, if the first resource is associated with a first hybrid automatic repeat request (hybrid automatic repeat request, HARQ) process identifier, the network device may further send third scheduling information by using the first HARQ process identifier. The third scheduling information is used to schedule a third resource. The third scheduling information may further indicate the terminal device to retransmit, by using the third resource, data that is in the first resource and that is associated with the first HARQ process identifier. Correspondingly, the terminal device receives the third scheduling information, and may retransmit, by using the third resource, the data that is in the first resource and that is associated with the first HARQ process identifier, for example, retransmit the first data.

**[00122]** In this application, if the terminal device transmits the first data using the second resource, the terminal device may further send second information to the network device, where the second information indicates to ignore or skip the first resource scheduled by using the first scheduling information. The second information may be carried in RRC signaling or L2 signaling, or may be carried in the first data. This is not limited in this application. The network device may determine, based on the second information, that the first resource is not used by the terminal device, and therefore does not need to schedule a retransmission resource. In addition, because the second information indicates to ignore or skip the first resource, the network device can determine that the terminal device does not transmit the uplink data using the first resource, and the network device does not detect, on the first resource, whether the uplink data exists, thereby reducing power consumption of the network device.

**[00123]** For example, the network device configures P pre-scheduled resources for the terminal device, where P is an integer greater than 1. For the first y pre-scheduled resources in the P pre-scheduled resources, the terminal device sends uplink data on the y pre-scheduled resources. For x pre-scheduled resources in the P pre-scheduled resources other than the y pre-scheduled resources, the terminal device skips the x pre-scheduled resources, and sends padding data or

uplink data including padding data by using another resource, where x+y=P, x and y are integers greater than 0. In this case, the terminal device may send the second information, and the second information indicates to ignore or skip the x pre-scheduled resources in the P pre-scheduled resources.

**[00124]** According to the foregoing method, before sending the data, the terminal device selects the resource from the first resource and the second resource based on the amount of the to-be-transmitted data. When the amount of the to-be-transmitted data is small, the resource that can be used to transmit a smaller amount of data can be selected to transmit the to-be-transmitted data. This avoids transmitting a large amount of padding data by the terminal device, reduces power consumption of the terminal device, increases an operating time of the terminal device, and improves resource utilization.

**[00125]** This application further provides a method, so that an uplink sequence can be transmitted when no data needs to be transmitted. For details, refer to descriptions in the following procedure.

**[00126]** FIG. 5 is a schematic flowchart of a communication method according to an embodiment of this application. The method includes the following steps.

**[00127]** Step 501: A network device sends first scheduling information, where the first scheduling information indicates a first resource.

**[00128]** Correspondingly, the terminal device receives the first scheduling information from the network device.

**[00129]** For related descriptions of the first scheduling information and the first resource, refer to the descriptions in step 301. Details are not described herein again.

**[00130]** In this application, a second resource may be further included. Optionally, a quantity of RBs included in the second resource is less than a quantity of RBs included in the first resource, and/or a quantity of symbols included in the second resource is less than a quantity of symbols included in the first resource.

**[00131]** In an implementation, the related parameters of the second resource include at least one of the following:

frequency allocation information of the second resource, where for example, the frequency allocation information of the second resource may indicate at least one of a quantity of RBs of the second resource and an RB location (or index) of the second resource;

time domain allocation information of the second resource, for example, the time domain allocation information of the second resource, may indicate at least one of a quantity of symbols of the second resource and a symbol location (or an index) of the second resource; and

a first sequence, where the first sequence is transmitted using the second resource, the

first sequence may be a demodulation reference signal (demodulation reference signal, DMRS) sequence, a sounding reference signal (sounding reference signal, SRS) sequence, a specific signal sequence, or the like, and a type of the first sequence is not limited in this application. The first sequence may be used by the network device to perform channel estimation. The first sequence may alternatively indicate an amount of the to-be-transmitted data. For example, the terminal device sends the first sequence when the amount of the to-be-transmitted data is less than or equal to the second data amount. The network device may determine, based on the first sequence, that the amount of the to-be-transmitted data of the terminal device is less than or equal to the second data amount. Optionally, the first sequence may also be any sequence. The network device does not parse the first sequence, and the terminal device sends the first sequence to indicate that the terminal device has no data to transmit in the first resource. Correspondingly, the network device determines, based on the first sequence, that detection does not need to perform on the first resource, or the network device determines, based on the first sequence, that the terminal device does not transmit data using the first resource.

**[00132]** One or more of the related parameters of the second resource may be preset or predefined, or may be determined based on the first resource, or may be configured by the network device.

**[00133]** For example, in Implementation 1, each of the related parameters of the second resource is preset. For example, the quantity of RBs of the second resource may be preset to 1, the quantity of symbols of the second resource may be preset to 1, and the first sequence is a DMRS sequence.

**[00134]** Implementation 2: The first sequence in the related parameters of the second resource is configured by the network device by RRC signaling or layer 2 signaling, and frequency allocation information and time domain allocation information of the second resource are predetermined or fixed values, or the second resource is a part of the first resource.

**[00135]** Implementation 3: The network device may send second scheduling information, where the second scheduling information indicates at least one of frequency allocation information and time domain allocation information of the second resource, and the first sequence. In the related parameters of the second resource, a parameter that is not indicated by the second scheduling information may be preset, or may be indicated by RRC signaling or layer 2 (layer 2, L2) signaling, or may be indicated by the first scheduling information. This is not limited in this application.

**[00136]** For example, the second scheduling information indicates the frequency allocation information and the time domain allocation information of the second resource. The first sequence may be preset as a DMRS sequence.

**[00137]** The second scheduling information and the first scheduling information are different types of scheduling information, and the second scheduling information and the first scheduling information are scrambled by using different RNTIs.

**[00138]** Implementation 4: The first scheduling information may further indicate at least one of frequency allocation information and time domain allocation information of the second resource, and the first sequence. In the related parameters of the second resource, a parameter that is not indicated by the first scheduling information may be preset, or may be indicated by RRC signaling or layer 2 signaling. This is not limited in this application.

**[00139]** The foregoing is merely an example. How to specifically determine the related parameters of the second resource is not limited in this application, and examples are not described herein one by one.

**[00140]** Optionally, the network device may further send first information, where the first information indicates that a resource is allowed to be selected from the first resource and the second resource, or the first information indicates that the first resource is allowed to be ignored or skipped. The terminal device receives the first information, and may determine that a resource can be selected from the first resource and the second resource, or determine that the first resource can be ignored or skipped. The first information may be carried in RRC signaling or L2 signaling, or may be carried in the first scheduling information. This is not limited in this application.

**[00141]** When obtaining the first resource, the terminal device may determine, based on an amount of the to-be-transmitted data, whether to transmit the data using the first resource. For details, refer to the following procedure.

**[00142]** Step 502: The terminal device sends the first data using the first resource or sends the first sequence using the second resource based on the amount of the to-be-transmitted data.

**[00143]** The first data includes a part or all of the to-be-transmitted data. For example, if the amount of the to-be-transmitted data is greater than the amount of data that is transmittable by the first resource, the first data may include a part of the to-be-transmitted data. If the amount of the to-be-transmitted data is less than or equal to the amount of data that is transmittable by the first resource, the first data may include all of the to-be-transmitted data. In addition, if the amount of the to-be-transmitted data is less than the amount of data that is transmittable by the first resource, the first data may further include padding data.

**[00144]** There may be a plurality of implementations for how the terminal device specifically sends the first data or the first sequence. For example, in an implementation, the amount of the to-be-transmitted data of the terminal device is less than or equal to the second data amount, and the terminal device sends the first sequence using the second resource. The second data amount may be preset or predefined, or may be indicated by the network device. This is not limited in this

application. For example, the second data amount is equal to 0.

**[00145]** If the terminal device sends the first sequence, the first sequence may also indicate the amount of the to-be-transmitted data. For example, the first sequence indicates that the amount of the to-be-transmitted data of the terminal device is less than or equal to the second data amount. After receiving the first sequence, the network device may determine that the amount of the to-be-transmitted data of the terminal device is less than or equal to the second data amount.

**[00146]** In an implementation, the amount of the to-be-transmitted data of the terminal device is greater than the second data amount, and the terminal device sends the first data using the first resource.

**[00147]** In this implementation, if the amount of the to-be-transmitted data is greater than the amount of data capable of being transmitted on the first resource, the first data sent by the terminal device by using the first resource includes a part of the to-be-transmitted data, and the terminal device may send another part of the to-be-transmitted data on another resource (for example, the second resource). The another resource may be the second resource, or may be another resource pre-scheduled by the network device. This is not limited in this application.

**[00148]** In an implementation, the amount of the to-be-transmitted data of the terminal device is greater than 0 and is less than or equal to the first data amount, and the terminal device sends the first data on fourth resource. The amount of to-be-transmitted data of the terminal device is greater than the first data amount, and the terminal device sends the first data using the first resource. Herein, "less than or equal to" may be replaced with "less than", and "greater than" may be replaced with "greater than or equal to". The amount of data capable of being transmitted on the fourth resource is less than the amount of data capable of being transmitted on the first resource. The fourth resource may be a part of the first resource, or the fourth resource may be preset or predefined, or the fourth resource is configured by the network device. This is not limited in this application.

**[00149]** Step 503: The network device receives the first data from the terminal device using the first resource, or receives the first sequence from the terminal device using the second resource.

**[00150]** In an implementation, the network device performs signal detection on the first resource, and if the first data is detected and correctly decoded, determines that the first resource is used by the terminal device. In this implementation, if the second resource is located after the first resource in time domain, the network device may not perform signal detection on the second resource.

**[00151]** In an implementation, the network device performs signal detection on the second resource, and if the first sequence is detected, determines that the first resource is not used by the terminal device. In this implementation, if the first resource is located after the second resource in

time domain, the network device may not perform signal detection on the first resource.

**[00152]** In an implementation, the network device separately performs signal detection on the first resource and the second resource. If the network device detects no data or sequence from the terminal device on both the first resource and the second resource, the network device may determine that uplink transmission of the terminal device fails. The network device may reschedule a resource for the terminal device to retransmit the uplink data. For example, if the first resource is associated with the first HARQ process identifier, the network device may send the third scheduling information by using the first HARQ process identifier, where the third scheduling information is used to schedule the third resource, and the third scheduling information may further indicate the terminal device to retransmit, by using the third resource, data that is in the first resource and that is associated with the first HARQ process identifier. Correspondingly, the terminal device receives the third scheduling information, and may retransmit, by using the third resource, the data that is in the first resource and that is associated with the first HARQ process identifier, for example, retransmit the first data.

**[00153]** In this application, if the terminal device transmits the first sequence using the second resource, the terminal device may further send second information to the network device, where the second information indicates to ignore or skip the first resource scheduled by using the first scheduling information. The second information may be carried in RRC signaling or L2 signaling, or may be carried in the first data. This is not limited in this application. The network device may determine, based on the second information, that the first resource is not used by the terminal device, and therefore does not need to schedule a retransmission resource.

**[00154]** According to the foregoing method, before sending the data, the terminal device selects the resource from the first resource and the second resource based on the amount of the to-be-transmitted data, so that the first sequence can be transmitted using the second resource when the amount of the to-be-transmitted data is relatively small, thereby avoiding transmission of a relatively large amount of padding data, reducing power consumption of the terminal device, increasing an operating time of the terminal device, and improving resource utilization.

**[00155]** In this application, for a resource pre-scheduled by the network device, the terminal device may also feed back, to the network device, whether to use the pre-scheduled resource, so that the network device can determine whether the terminal device sends data on the pre-scheduled resource, thereby avoiding that the network device mistakenly considers that data transmission on the pre-scheduled resource fails, and improving communication efficiency. Details are described below.

**[00156]** FIG. 6 is a schematic flowchart of a communication method according to an embodiment of this application. The method includes the following steps.

**[00157]** Step 601: The terminal device generates first indication information.

**[00158]** Optionally, before step 601, the terminal device may receive at least one piece of resource indication information, where the resource indication information indicates an uplink transmission resource. The resource indication information may also be referred to as scheduling information, an uplink grant, or the like. This is not limited in this application. The uplink transmission resource indicated by using the resource indication information may be a pre-scheduled resource. That is, the network device may send the resource indication information without receiving a resource request message from the terminal device.

**[00159]** Optionally, before step 601, the network device sends the second indication information. The second indication information indicates that the terminal device is allowed to ignore or skip the uplink transmission resource indicated by using the resource indication information when there is no uplink data transmission. The second indication information may further indicate the ignored or skipped resource indication information to the network device when the terminal device ignores or skips the uplink transmission resource indicated by using the resource indication information.

**[00160]** In this application, the first indication information includes X pieces of transmission information, and X is an integer greater than 0. There may be a plurality of implementations for the transmitting information. The following provides several examples.

**[00161]** Implementation 1: The X pieces of transmission information are in a one-to-one correspondence with X time units, and one or more of the X time units include resource indication information. Correspondingly, one piece of transmission information may indicate whether resource indication information is included in one time unit, and/or whether the resource indication information in the time unit is ignored or is used to transmit uplink data. The time unit may be a frame (frame), a subframe, a slot, a radio frame, a mini-slot (mini-slot), an OFDM symbol group, an OFDM symbol, or the like.

**[00162]** Specifically, in this implementation, one piece of transmission information indicates any one of the following:

resource indication information is received in a time unit corresponding to the transmission information, and an uplink transmission resource indicated by using the resource indication information is ignored or skipped;

the resource indication information is received in the time unit corresponding to the transmission information, and the uplink transmission resource indicated by using the resource indication information is used to transmit uplink data; and

the resource indication information is not received in the time unit corresponding to the transmission information.

**[00163]** That the uplink transmission resource is ignored or skipped may also be understood as that the resource indication information is ignored or skipped.

**[00164]** For example, it is assumed that X=4, and content indicated by the four pieces of transmission information included in the first indication information may be shown in Table 1.

Table 1

| | Corresponding time unit | Content indicated by the transmission information |
|---|---|---|
| Transmission information 1 | Time unit 1 | Resource indication information is received in the time unit 1, and the resource indication information is ignored. |
| Transmission information 2 | Time unit 2 | Resource indication information is received in the time unit 2, and uplink data is transmitted on an uplink transmission resource indicated by using the resource indication information. |
| Transmission information 3 | Time unit 3 | Resource indication information is not received in the time unit 3. |
| Transmission information 4 | Time unit 4 | Resource indication information is received in the time unit 4, and the resource indication information is ignored. |

**[00165]** It can be learned from the four pieces of transmission information shown in Table 1 that, in the time unit 1, the terminal device receives resource indication information from the network device, but the resource indication information is ignored or skipped. This may be understood as that an uplink transmission resource indicated by using the resource indication information is ignored or skipped. In other words, the terminal device does not transmit uplink data on the uplink transmission resource indicated by using the resource indication information. For another example, in the time unit 3, the terminal device does not receive the resource indication information from the network device. Details in another case are not described.

**[00166]** Implementation 2: The X pieces of transmission information are in a one-to-one correspondence with X time units, and one or more of the X time units include an uplink transmission resource scheduled by using the resource indication information. Correspondingly, one piece of transmission information may indicate whether an uplink transmission resource is included in a time unit, and/or whether the uplink transmission resource in the time unit is ignored or is used to transmit uplink data.

**[00167]** Specifically, in this implementation, one piece of transmission information indicates any one of the following:

a time unit corresponding to the transmission information includes an uplink transmission resource scheduled by using the resource indication information, and the uplink transmission resource included in the time unit is ignored or skipped;

the time unit corresponding to the transmission information includes the uplink transmission resource scheduled by using the resource indication information, and the uplink transmission resource included in the time unit is used to transmit the uplink data; and

the time unit corresponding to the transmission information does not include the uplink transmission resource scheduled by using the resource indication information.

**[00168]** For example, it is assumed that X=4, and content indicated by the four pieces of transmission information included in the first indication information may be shown in Table 2.

Table 2

| | Corresponding time unit | Content indicated by the transmission information |
|---|---|---|
| Transmission information 1 | Time unit 1 | The time unit 1 includes an uplink transmission resource scheduled by using the resource indication information, and the uplink transmission resource included in the time unit 1 is ignored or skipped. |
| Transmission information 2 | Time unit 2 | The time unit 2 includes an uplink transmission resource scheduled by using the resource indication information, and the uplink transmission resource included in the time unit 2 is used to transmit uplink data. |
| Transmission information 3 | Time unit 3 | The time unit 3 does not include an uplink transmission resource scheduled by using the resource indication information. |
| Transmission information 4 | Time unit 4 | The time unit 4 includes an uplink transmission resource scheduled by using the resource indication information, and the uplink transmission resource included in the time unit 4 is ignored or skipped. |

**[00169]** Implementation 3: The X pieces of transmission information are in a one-to-one correspondence with X time units, and one or more of the X time units include the resource indication information, and/or one or more of the X time units include the uplink transmission resource scheduled by using the resource indication information.

**[00170]** Correspondingly, one piece of transmission information may indicate at least one of the following:

resource indication information is received in a time unit corresponding to the transmission information, and an uplink transmission resource indicated by using the resource

indication information is ignored or skipped;

the resource indication information is received in the time unit corresponding to the transmission information, and the uplink transmission resource indicated by using the resource indication information is used to transmit uplink data;

the resource indication information is not received in the time unit corresponding to the transmission information;

the time unit corresponding to the transmission information includes the uplink transmission resource scheduled by using the resource indication information, and the uplink transmission resource included in the time unit is ignored or skipped;

the time unit corresponding to the transmission information includes the uplink transmission resource scheduled by using the resource indication information, and the uplink transmission resource included in the time unit is used to transmit the uplink data; and

the time unit corresponding to the transmission information does not include the uplink transmission resource scheduled by using the resource indication information.

**[00171]** For example, it is assumed that X=4, and content indicated by the four pieces of transmission information included in the first indication information may be shown in Table 3.

Table 3

| | Corresponding time unit | Content indicated by the transmission information |
|---|---|---|
| Transmission information 1 | Time unit 1 | Resource indication information is received in the time unit 1, and the resource indication information is ignored; and<br>the time unit 1 includes an uplink transmission resource scheduled by using the resource indication information, and the uplink transmission resource included in the time unit 1 is ignored or skipped. |
| Transmission information 2 | Time unit 2 | Resource indication information is received in the time unit 2, and the resource indication information is ignored; and<br>the time unit 2 includes an uplink transmission resource scheduled by using the resource indication information, and the uplink transmission resource included in the time unit 2 is used to transmit uplink data. |
| Transmission information 3 | Time unit 3 | Resource indication information is received in the time unit 3, and uplink data is transmitted on an uplink transmission resource indicated by using the resource indication information; and |

| | Corresponding time unit | Content indicated by the transmission information |
|---|---|---|
| | | the time unit 3 does not include the uplink transmission resource scheduled by using the resource indication information. |
| Transmission information 4 | Time unit 4 | The time unit 4 includes an uplink transmission resource scheduled by using the resource indication information, and the uplink transmission resource included in the time unit 4 is ignored or skipped. |

**[00172]** The foregoing is merely an example. Specific content of the transmission information is not limited in this application.

**[00173]** Step 602: The terminal device sends first indication information to the network device.

**[00174]** Correspondingly, the network device receives the first indication information.

**[00175]** In this application, the first indication information may be carried in layer 2 signaling or RRC signaling. The layer 2 signaling herein includes a MAC control element (control element, CE) and RLC signaling. The RRC signaling includes UE assistance information (UE assistance information, UAI).

**[00176]** Optionally, the terminal device may send the first indication information when a trigger condition of the first indication information is satisfied.

**[00177]** For example, in a first implementation, the terminal device may periodically send the first indication information, and the terminal device sends the first indication information once at an interval of Y time units. In other words, a transmission period of the first indication information is Y time units, and Y is an integer greater than 0.

**[00178]** In a second implementation, the terminal device is triggered, based on an instruction from the network device side, to report the first indication information. For example, the network device sends trigger information, where the trigger information indicates to report the first indication information. After receiving the trigger information, the terminal device may report the first indication information. The network device may send the trigger information by RRC signaling, L2 signaling, or DCI. This is not limited in this application.

**[00179]** In a third implementation, the terminal device may send the first indication information based on a quantity of pieces of received resource indication information or a quantity of pieces of ignored resource indication information. For example, if the terminal device determines that the quantity of pieces of received resource indication information is N, or determines that the quantity of pieces of ignored resource indication information is M, the terminal device sends the first indication information, where M and N are integers greater than 0.

**[00180]** The foregoing is merely an example. The terminal device may alternatively send one

piece of first indication information each time one piece of resource indication information is received. This is not limited in this application.

**[00181]** In this application, after receiving the first indication information, the network device determines, based on the first indication information, whether uplink data of the terminal device is received on an uplink resource indicated by the sent resource indication information. If the network device detects no uplink data on an uplink resource, but the first indication information indicates that the terminal device transmits uplink data on the uplink resource, the network device may determine that the uplink data is not correctly received, and may perform retransmission scheduling.

**[00182]** First transmission information in the X pieces of transmission information is used as an example. The first transmission information indicates that a first uplink transmission resource indicated by first resource indication information transmitted in a first time unit is used to transmit the uplink data, but the network device does not receive the uplink data on the first uplink transmission resource; or the first transmission information indicates that the first uplink transmission resource included in the first time unit is used to transmit the uplink data, but the network device does not receive the uplink data on the first uplink transmission resource included in the first time unit. In this case, the network device may perform the following step.

**[00183]** Step 603: The network device sends second resource indication information, where the second resource indication information is used to schedule a second uplink transmission resource, and the second uplink transmission resource is used to retransmit the uplink data in the first uplink transmission resource.

**[00184]** Correspondingly, the terminal device receives the second resource indication information, and retransmits the uplink data in the first uplink transmission resource by using the second uplink transmission resource indicated by the second resource indication information.

**[00185]** Because one uplink resource is associated with one HARQ process identifier, if the first uplink resource is associated with a first HARQ process identifier, the network device may send the second resource indication information by using the first HARQ process identifier. The second resource indication information is used to schedule the second uplink transmission resource. Correspondingly, the terminal device may retransmit, by using the second uplink transmission resource, uplink data that is in the first uplink transmission resource and that is associated with the first HARQ process identifier.

**[00186]** In another implementation, if the first transmission information indicates to ignore or skip the first resource indication information transmitted in the first time unit, or the first transmission information indicates that no resource indication information is received in the first time unit, the network device may ignore the first transmission information.

**[00187]** According to the method provided in this application, the terminal device indicates, by using the first indication information, whether the resource indication information transmitted in each of X time units is ignored. When the network device does not receive uplink data on an uplink transmission resource, the network device may determine, based on the first indication information, whether the uplink data is not received on the uplink transmission resource or the terminal device does not send the uplink data. In addition, the network device can determine, based on the first indication information, whether there is uplink data that fails to be transmitted, to determine whether to schedule a retransmission resource for the terminal device, thereby improving communication efficiency. Further, when the network device determines, based on the first indication information, that a resource in a time unit is ignored or skipped, the network device may not detect whether uplink data exists in the resource, thereby reducing power consumption of the network device.

**[00188]** It may be understood that, to implement functions in the foregoing embodiments, the terminal device or the network device includes corresponding hardware structures and/or software modules for performing the functions. A person skilled in the art should be easily aware that, in this application, the units and method steps in the examples described with reference to embodiments disclosed in this application can be implemented by hardware or a combination of hardware and computer software. Whether a function is performed by hardware or hardware driven by computer software depends on particular application scenarios and design constraint conditions of the technical solutions.

**[00189]** The following are diagrams of possible structures of communication apparatuses according to embodiments of this application. These communication apparatuses may be configured to implement functions of the terminal device or the network device in the foregoing method embodiments, and therefore can also achieve beneficial effects of the foregoing method embodiments.

**[00190]** As shown in FIG. 7, a communication apparatus 700 includes a processing unit 710 and a communication unit 720. The communication apparatus 700 is configured to implement functions of the terminal device or the network device in the foregoing method embodiments.

**[00191]** In an implementation, the communication apparatus is configured to implement the following functions.

**[00192]** The communication unit is configured to receive first scheduling information from a network device, where the first scheduling information indicates a first resource.

**[00193]** The processing unit is configured to determine the resource from the first resource and the second resource based on an amount of to-be-transmitted data.

**[00194]** The communication unit is configured to send first data using the resource, where the

first data includes at least one of the to-be-transmitted data and padding data, an amount of data capable of being transmitted on the second resource is less than an amount of data capable of being transmitted on the first resource.

**[00195]** In an implementation, the communication apparatus is configured to implement the following functions.

**[00196]** The processing unit is configured to send first scheduling information using the communication unit, where the first scheduling information indicates a first resource.

**[00197]** The communication unit is configured to receive first data from a terminal device by using the first resource or the second resource, where an amount of data capable of being transmitted on the second resource is less than an amount of data capable of being transmitted on the first resource.

**[00198]** In an implementation, the communication apparatus is configured to implement the following functions.

**[00199]** The communication unit is configured to receive first scheduling information from a network device, where the first scheduling information indicates a first resource.

**[00200]** The communication unit is configured to: based on an amount of to-be-transmitted data, send first data using the first resource or send a first sequence, where the first data includes a part or all of the to-be-transmitted data, and the first sequence indicates the amount of the to-be-transmitted data.

**[00201]** In an implementation, the communication apparatus is configured to implement the following functions.

**[00202]** The communication unit is configured to send first scheduling information, where the first scheduling information indicates a first resource.

**[00203]** The communication unit is configured to receive first data from a terminal device by using the first resource, or receive a first sequence from the terminal device using a second resource, where the first sequence indicates an amount of the to-be-transmitted data.

**[00204]** In an implementation, the communication apparatus is configured to implement the following functions.

**[00205]** The processing unit is configured to generate first indication information, where the first indication information includes X pieces of transmission information, the X pieces of transmission information are in a one-to-one correspondence with X time units, X is an integer greater than 0, and one piece of transmission information indicates any one of the following:

resource indication information is received in a time unit corresponding to the transmission information, and an uplink transmission resource indicated by using the resource indication information is ignored; and the resource indication information is received in the time

unit corresponding to the transmission information, and the uplink transmission resource indicated by using the resource indication information is used to transmit uplink data; and the resource indication information is not received in the time unit corresponding to the transmission information.

**[00206]** The communication unit is configured to send the first indication information to a network device.

**[00207]** In an implementation, the communication apparatus is configured to implement the following functions.

**[00208]** The communication unit is configured to receive first indication information from a terminal device, where the first indication information includes X pieces of transmission information, the X pieces of transmission information are in a one-to-one correspondence with X time units, X is an integer greater than 0, and one piece of transmission information indicates any one of the following: Resource indication information is received in a time unit corresponding to the transmission information, and an uplink transmission resource indicated by using the resource indication information is ignored; the resource indication information is received in the time unit corresponding to the transmission information, and the uplink transmission resource indicated by using the resource indication information is used to transmit uplink data; and the resource indication information is not received in the time unit corresponding to the transmission information.

**[00209]** The processing unit is configured to: send second resource indication information using the communication unit if first transmission information in the X pieces of transmission information indicates that a first uplink transmission resource indicated by first resource indication information transmitted in a first time unit is used to transmit uplink data but the uplink data is not received on the first uplink transmission resource, where the second resource indication information is used to schedule a second uplink transmission resource, and the second uplink transmission resource is used to retransmit the uplink data in the first uplink transmission resource.

**[00210]** For other functions or steps that can be implemented by the foregoing communication apparatus, directly refer to related descriptions in the foregoing method embodiments. Details are not described herein again.

**[00211]** It should be understood that division of the units in the foregoing apparatus is merely logical function division. During actual implementation, all or some of the units may be integrated into one physical entity, or may be physically separated. In addition, all the units in the apparatus may be implemented in a form of software invoked by a processing element, or may be implemented in a form of hardware; or some units may be implemented in a form of software invoked by a processing element, and some units may be implemented in a form of hardware. For

example, each unit may be a separately disposed processing element, or may be integrated into a chip of the apparatus for implementation. In addition, each unit may alternatively be stored in a memory in a form of a program to be invoked by a processing element of the apparatus to perform a function of the unit. In addition, all or some of the units may be integrated, or may be implemented independently. The processing element herein may also be referred to as a processor, and may be an integrated circuit having a signal processing capability. In an implementation process, operations in the foregoing methods or the foregoing units may be implemented by using a hardware integrated logic circuit in the processor element or may be implemented in a form in which the processing element invokes software.

**[00212]** In an example, a unit in any one of the foregoing apparatuses may be one or more integrated circuits configured to implement the foregoing methods, for example, one or more application-specific integrated circuits (application-specific integrated circuit, ASIC), one or more microprocessors (digital signal processor, DSP), one or more field programmable gate arrays (field programmable gate array, FPGA), or a combination of at least two of these integrated circuit forms. For another example, when the units in the apparatus may be implemented in a form in which a processing element schedules a program, the processing element may be a processor, for example, a general-purpose central processing unit (central processing unit, CPU) or another processor that can invoke the program. For still another example, the units may be integrated and implemented in a form of a system-on-a-chip (system-on-a-chip, SOC).

**[00213]** The foregoing unit configured for receiving is an interface circuit of the apparatus, and is configured to receive a signal from another apparatus. For example, when the apparatus is implemented in a manner of a chip, the receiving unit is an interface circuit that is of the chip and that is configured to receive a signal from another chip or apparatus. The foregoing unit configured for sending is an interface circuit of the apparatus, and is configured to send a signal to another apparatus. For example, when the apparatus is implemented in the manner of the chip, the sending unit is an interface circuit that is of the chip and that is configured to send a signal to another chip or apparatus.

**[00214]** In another possible product form, the terminal device or the network device in embodiments of this application may be implemented by a general bus architecture. For ease of description, refer to FIG. 8. FIG. 8 is a diagram of a structure of a communication apparatus 800 according to an embodiment of this application. The communication apparatus 800 includes a processor 801 and a transceiver 802. The communication apparatus 800 may be a terminal device, or a chip or a chip system in the terminal device. Alternatively, the communication apparatus 800 may be a network device, or a chip or a module in the network device. FIG. 8 shows only main components of the communication apparatus 800. In addition to the processor 801 and the

transceiver 802, the communication apparatus 800 may further include a memory 803 and an input/output apparatus (not shown in the figure).

**[00215]** Optionally, the processor 801 is mainly configured to process a communication protocol and communication data, control the entire communication apparatus, execute a software program, and process data of the software program. The memory 803 is mainly configured to store the software program and the data. The transceiver 802 may include a radio frequency circuit and an antenna. The radio frequency circuit is mainly configured to: perform conversion between a baseband signal and a radio frequency signal, and process the radio frequency signal. The antenna is mainly configured to receive and send a radio frequency signal in a form of an electromagnetic wave. The input/output apparatus, for example, a touchscreen, a display, a keyboard, is mainly configured to receive data input by a user and output data to the user.

**[00216]** Optionally, the processor 801, the transceiver 802, and the memory 803 may be connected through a communication bus.

**[00217]** After the communication apparatus is powered on, the processor 801 may read the software program in the memory 803, interpret and execute instructions of the software program, and process the data of the software program. When data needs to be sent in a wireless manner, the processor 801 performs baseband processing on to-be-sent data, and then outputs a baseband signal to the radio frequency circuit. The radio frequency circuit performs radio frequency processing on the baseband signal, and then sends a radio frequency signal in an electromagnetic wave form through the antenna. When data is sent to the communication apparatus, the radio frequency circuit receives the radio frequency signal through the antenna, converts the radio frequency signal into a baseband signal, and outputs the baseband signal to the processor 801. The processor 801 converts the baseband signal into data and processes the data.

**[00218]** In another implementation, the radio frequency circuit and the antenna may be disposed independently of the processor for baseband processing. For example, in a distributed scenario, the radio frequency circuit and the antenna may be remotely disposed independently of the communication apparatus.

**[00219]** In some embodiments, in terms of hardware implementation, a person skilled in the art may figure out that the communication apparatus 700 may be in a form of the communication apparatus 800 shown in FIG. 8.

**[00220]** In an example, functions/implementation processes of the processing unit 710 in FIG. 7 may be implemented by the processor 801 in the communication apparatus 800 shown in FIG. 8 by invoking computer-executable instructions stored in the memory 803. Functions/implementation processes of the communication unit 720 in FIG. 7 may be implemented by the transceiver 802 in the communication apparatus 800 shown in FIG. 8.

**[00221]** In still another possible product form, the terminal device or the network device in this application may use a composition structure shown in FIG. 9, or include components shown in FIG. 9. FIG. 9 is a diagram of composition of a communication apparatus 900 according to this application.

**[00222]** As shown in FIG. 9, the communication apparatus 900 includes at least one processor 901. Optionally, the communication apparatus further includes a communication interface 902.

**[00223]** When related program instructions are executed in the at least one processor 901, the communication apparatus 900 may be caused to implement the method provided in any one of the foregoing embodiments and any possible design of the method. Alternatively, the processor 901 is configured to implement, by using a logic circuit or executing code instructions, the method provided in any one of the foregoing embodiments and any possible design of the foregoing embodiments.

**[00224]** The communication interface 902 may be configured to receive program instructions and transmit the program instructions to the processor. Alternatively, the communication interface 902 may be configured to perform communication interaction between the communication apparatus 900 and another communication device, for example, exchange control signaling and/or service data. For example, the communication interface 902 may be configured to receive a signal from an apparatus other than the communication apparatus 900, and transmit the signal to the processor 901, or send a signal from the processor 901 to a communication apparatus other than the communication apparatus 900.

**[00225]** Optionally, the communication interface 902 may be a code and/or data read/write interface circuit, or the communication interface 902 may be a signal transmission interface circuit between a communication processor and a transceiver machine, or may be a pin of a chip.

**[00226]** Optionally, the communication apparatus 900 may further include at least one memory 903, and the memory 903 may be configured to store the related required program instructions and/or data. It should be noted that the memory 903 may exist independently of the processor 901, or may be integrated with the processor 901. The memory 903 may be located inside the communication apparatus 900, or may be located outside the communication apparatus 900. This is not limited.

**[00227]** Optionally, the communication apparatus 900 may further include a power supply circuit 904, and the power supply circuit 904 may be configured to supply power to the processor 901. The power supply circuit 904 may be located in a same chip as the processor 901, or may be located in a chip other than a chip in which the processor 901 is located.

**[00228]** Optionally, the communication apparatus 900 may further include a bus, and parts of the communication apparatus 900 may be interconnected through the bus.

**[00229]** In some embodiments, in hardware implementation, a person skilled in the art may figure out that the foregoing communication apparatus 700 shown in FIG. 7 may be in a form of the communication apparatus 900 shown in FIG. 9.

**[00230]** In an example, functions/implementation processes of the processing unit 710 in FIG. 7 may be implemented by the processor 901 in the communication apparatus 900 shown in FIG. 9 by invoking computer-executable instructions stored in the memory 903. Functions/implementation processes of the communication unit 720 in FIG. 7 may be implemented by the communication interface 902 in the communication apparatus 900 shown in FIG. 9.

**[00231]** It should be noted that the structure shown in FIG. 9 does not constitute a specific limitation on the terminal device or the network device. For example, in some other embodiments of this application, the terminal device or the network device may include more or fewer components than those shown in the figure, or a combination of a part of the components, or splits from a part of the components, or an arrangement of different components. The components shown in the figure may be implemented by hardware, software, or a combination of software and hardware.

**[00232]** When the communication apparatus is a chip used in a terminal, the chip in the terminal implements a function of the terminal in the foregoing method embodiments. The chip in the terminal receives information from another module (for example, a radio frequency module or an antenna) in the terminal, where the information is sent by a base station to the terminal. Alternatively, the chip in the terminal sends information to another module (for example, a radio frequency module or an antenna) in the terminal, where the information is sent by the terminal to a base station.

**[00233]** When the communication apparatus is a module used in a base station, the base station module implements a function of the base station in the foregoing method embodiment. The module in the base station receives information from another module (for example, a radio frequency module or an antenna) in the base station, where the information is sent by a terminal to the base station; or the module in the base station sends information to another module (for example, a radio frequency module or an antenna) in the base station, where the information is sent by the base station to a terminal. The module in the base station herein may be a baseband chip in the base station, or may be a DU or another module. The DU herein may be a DU in an open radio access network (open radio access network, O-RAN) architecture.

**[00234]** It can be understood that the processor in embodiments of this application may be a central processing unit (Central Processing Unit, CPU), or may be another general-purpose processor, a digital signal processor (Digital Signal Processor, DSP), an application specific integrated circuit (Application Specific Integrated Circuit, ASIC), a field programmable gate array

(Field Programmable Gate Array, FPGA) or another programmable logic device, a transistor logic device, a hardware component, or any combination thereof. The general purpose processor may be a microprocessor or any regular processor.

**[00235]** The method steps in embodiments of this application may be implemented in a hardware manner, or may be implemented in a manner of executing software instructions by the processor. The software instructions may include a corresponding software module. The software module may be stored in a random access memory, a flash memory, a read-only memory, a programmable read-only memory, an erasable programmable read-only memory, an electrically erasable programmable read-only memory, a register, a hard disk, a removable hard disk, a CD-ROM, or any other form of storage medium well-known in the art. For example, a storage medium is coupled to a processor, so that the processor can read information from the storage medium and write information into the storage medium. Certainly, the storage medium may be a component of the processor. The processor and the storage medium may be disposed in an ASIC. In addition, the ASIC may be located in a base station or a terminal. Certainly, the processor and the storage medium may exist in a base station or terminal as discrete components.

**[00236]** All or some of the foregoing embodiments may be implemented by using software, hardware, firmware, or any combination thereof. When software is used to implement the embodiments, all or a part of the embodiments may be implemented in a form of a computer program product. The computer program product includes one or more computer programs or instructions. When the computer programs or the instructions are loaded and executed on a computer, the procedures or functions in embodiments of this application are all or partially executed. The computer may be a general-purpose computer, a dedicated computer, a computer network, a network device, user equipment, or another programmable apparatus. The computer program or instructions may be stored in a computer-readable storage medium, or may be transmitted from a computer-readable storage medium to another computer-readable storage medium. For example, the computer program or instructions may be transmitted from a website, computer, server, or data center to another website, computer, server, or data center in a wired or wireless manner. The computer-readable storage medium may be any usable medium that can be accessed by the computer, or a data storage device, for example, a server or a data center, integrating one or more usable media. The usable medium may be a magnetic medium, for example, a floppy disk, a hard disk, or a magnetic tape; or may be an optical medium, for example, a digital video disc; or may be a semiconductor medium, for example, a solid-state drive. The computer-readable storage medium may be a volatile or non-volatile storage medium, or may include two types of storage media: a volatile storage medium and a non-volatile storage medium.

**[00237]** In various embodiments of this application, unless otherwise stated or there is a logic

conflict, terms and/or descriptions in different embodiments are consistent and may be mutually referenced, and technical features in different embodiments may be combined based on an internal logical relationship thereof, to form a new embodiment.

**[00238]** A person skilled in the art should understand that the embodiments of this application may be provided as a method, a system, or a computer program product. Therefore, this application may use a form of hardware only embodiments, software only embodiments, or embodiments with a combination of software and hardware. In addition, this application may use a form of a computer program product that is implemented on one or more computer-usable storage media (including but not limited to a disk memory, an optical memory, and the like) that include computer-usable program code.

**[00239]** This application is described with reference to the flowcharts and/or block diagrams of the method, the device (system), and the computer program product according to this application. It should be understood that computer program instructions may be used to implement each process and/or each block in the flowcharts and/or the block diagrams and a combination of a process and/or a block in the flowcharts and/or the block diagrams. These computer program instructions may be provided for a general-purpose computer, a dedicated computer, an embedded processor, or a processor of any other programmable data processing device to generate a machine, so that the instructions executed by a computer or a processor of any other programmable data processing device generate an apparatus for implementing a specific function in one or more processes in the flowcharts and/or in one or more blocks in the block diagrams.

**[00240]** These computer program instructions may be stored in a computer-readable memory that can instruct the computer or any other programmable data processing device to work in a specific manner, so that the instructions stored in the computer-readable memory generate an artifact that includes an instruction apparatus. The instruction apparatus implements a specific function in one or more processes in the flowcharts and/or in one or more blocks in the block diagrams.

**[00241]** It is clear that a person skilled in the art can make various modifications and variations to this application without departing from the scope of this application. This application is intended to cover these modifications and variations of this application provided that they fall within the scope of protection defined by the following claims and their equivalent technologies.

# CLAIMS

1. A communication method, comprising:

receiving first scheduling information from a network device, wherein the first scheduling information indicates a first resource, and

determining a resource from the first resource and a second resource based on an amount of to-be-transmitted data, and sending first data using the resource, wherein the first data comprises at least one of the to-be-transmitted data and padding data, wherein

an amount of data capable of being transmitted on the second resource is less than an amount of data capable of being transmitted on the first resource.

2. The method according to claim 1, wherein the determining the resource from the first resource and the second resource based on the amount of the to-be-transmitted data comprises:

if the amount of the to-be-transmitted data is less than or equal to a first data amount, the resource determined from the first resource and the second resource is the second resource; or

if the amount of the to-be-transmitted data is greater than the first data amount, the resource determined from the first resource and the second resource is the first resource.

3. The method according to claim 1 or 2, wherein related parameters of the second resource comprise at least one of the following: frequency allocation information, time domain allocation information, modulation scheme information, and multiple input multiple output MIMO stream quantity information.

4. The method according to claim 3, wherein one or more of the related parameters of the second resource are determined in any one of the following manners:

preset;

determined based on the first resource;

indicated by second scheduling information from the network device;

indicated by the first scheduling information; and

indicated by radio resource control RRC signaling or layer 2 L2 signaling from the network device.

5. The method according to any one of claims 1 to 4, wherein the method further comprises:

receiving first information from the network device, wherein the first information indicates that selection of the resource from the first resource and the second resource is allowed.

6. The method according to any one of claims 1 to 5, wherein the method further comprises:

sending second information, wherein the second information indicates to ignore the first resource scheduled by using the first scheduling information.

7. A communication method, comprising:

sending first scheduling information, wherein the first scheduling information indicates a first resource; and

receiving first data from a terminal device by using the first resource or a second resource, wherein an amount of data capable of being transmitted on the second resource is less than an amount of data capable of being transmitted on the first resource.

8. The method according to claim 7, wherein related parameters of the second resource comprise at least one of the following: frequency allocation information, time domain allocation information, modulation scheme information, and multiple input multiple output MIMO stream quantity information.

9. The method according to claim 8, wherein one or more of the related parameters of the second resource are determined in any one of the following manners:

preset;

determined based on the first resource;

indicated by second scheduling information from the network device;

indicated by the first scheduling information; and

indicated by radio resource control RRC signaling or layer 2 L2 signaling from the network device.

10. The method according to any one of claims 7 to 9, wherein the method further comprises:

sending first information, wherein the first information indicates that selection of the resource from the first resource and the second resource is allowed.

11. The method according to any one of claims 7 to 10, wherein the method further comprises:

receiving second information, wherein the second information indicates to ignore the first resource scheduled by using the first scheduling information.

12. A communication method, comprising:

receiving first scheduling information from a network device, wherein the first scheduling information indicates a first resource, and

based on an amount of to-be-transmitted data, sending first data using the first resource or sending a first sequence, wherein the first data comprises a part or all of the to-be-transmitted data, and the first sequence indicates the amount of the to-be-transmitted data.

13. The method according to claim 12, wherein based on the amount of the to-be-transmitted data, sending the first data using the first resource or sending the first sequence comprises:

when the amount of the to-be-transmitted data is equal to 0, sending the first sequence using a second resource; or

when the amount of the to-be-transmitted data is greater than 0, sending the first data using the first resource.

14. The method according to claim 13, wherein related parameters of the second resource comprise at least one of the following: the first sequence, frequency allocation information, and time domain allocation information.

15. The method according to claim 14, wherein at least one of the related parameters of the second resource is determined in any one of the following manners:

preset;

determined based on the first resource;

indicated by second scheduling information from the network device;

indicated by the first scheduling information; and

indicated by radio resource control RRC signaling or layer 2 L2 signaling from the network device.

16. A communication method, comprising:

sending first scheduling information, wherein the first scheduling information indicates a first resource; and

receiving first data from a terminal device by using the first resource, or receiving a first sequence from the terminal device using a second resource, wherein the first sequence indicates an amount of the to-be-transmitted data.

17. A communication method, comprising:

generating first indication information, wherein the first indication information comprises X pieces of transmission information, the X pieces of transmission information are in a one-to-one correspondence with X time units, X is an integer greater than 0, and one piece of transmission information indicates any one of the following:

resource indication information is received in a time unit corresponding to the transmission information, and an uplink transmission resource indicated by using the resource indication information is ignored;

the resource indication information is received in the time unit corresponding to the transmission information, and the uplink transmission resource indicated by using the resource indication information is used to transmit uplink data; and

the resource indication information is not received in the time unit corresponding to the transmission information; and

sending the first indication information to a network device.

18. The method according to claim 17, wherein a transmission period of the first indication information is Y time units, and Y is an integer greater than 0.

19. The method according to claim 17, wherein the method further comprises:

receiving trigger information from the network device, wherein the trigger information

indicates to report the first indication information.

20. The method according to claim 17, wherein the method further comprises:

determining that a quantity of pieces of received resource indication information is N, or determining that a quantity of pieces of ignored resource indication information is M, wherein M and N are integers greater than 0.

21. A communication method, comprising:

receiving first indication information from a terminal device, wherein the first indication information comprises X pieces of transmission information, the X pieces of transmission information are in a one-to-one correspondence with X time units, X is an integer greater than 0, and one piece of transmission information indicates any one of the following: Resource indication information is received in a time unit corresponding to the transmission information, and an uplink transmission resource indicated by using the resource indication information is ignored; the resource indication information is received in the time unit corresponding to the transmission information, and the uplink transmission resource indicated by using the resource indication information is used to transmit uplink data; and the resource indication information is not received in the time unit corresponding to the transmission information; and

sending second resource indication information if first transmission information in the X pieces of transmission information indicates that a first uplink transmission resource indicated by first resource indication information transmitted in a first time unit is used to transmit uplink data but the uplink data is not received on the first uplink transmission resource, wherein the second resource indication information is used to schedule a second uplink transmission resource, and the second uplink transmission resource is used to retransmit the uplink data in the first uplink transmission resource.

22. A communication apparatus, comprising:

a communication unit, configured to receive first scheduling information from a network device, wherein the first scheduling information indicates a first resource; and

a processing unit, configured to determine the resource from the first resource and the second resource based on an amount of to-be-transmitted data, wherein

the communication unit is configured to send first data using the resource, wherein the first data comprises at least one of the to-be-transmitted data and padding data, an amount of data capable of being transmitted on the second resource is less than an amount of data capable of being transmitted on the first resource.

23. A communication apparatus, comprising:

a processing unit, configured to send first scheduling information through a communication unit, wherein the first scheduling information indicates a first resource; and

the communication unit, configured to receive first data from a terminal device by using the first resource or a second resource, wherein an amount of data capable of being transmitted on the second resource is less than an amount of data capable of being transmitted on the first resource.

24. A communication apparatus, comprising:

a communication unit, configured to receive first scheduling information from a network device, wherein the first scheduling information indicates a first resource, wherein

the communication unit is configured to: based on an amount of to-be-transmitted data, send first data using the first resource or send a first sequence, wherein the first data comprises a part or all of the to-be-transmitted data, and the first sequence indicates the amount of the to-be-transmitted data.

25. A communication apparatus, comprising:

a communication unit, configured to send first scheduling information, wherein the first scheduling information indicates a first resource, wherein

the communication unit is configured to receive first data from a terminal device by using the first resource, or receive a first sequence from the terminal device using a second resource, wherein the first sequence indicates an amount of the to-be-transmitted data.

26. A communication apparatus, comprising:

a processing unit, configured to generate first indication information, wherein the first indication information comprises X pieces of transmission information, the X pieces of transmission information are in a one-to-one correspondence with X time units, X is an integer greater than 0, and one piece of transmission information indicates any one of the following:

resource indication information is received in a time unit corresponding to the transmission information, and an uplink transmission resource indicated by using the resource indication information is ignored; the resource indication information is received in the time unit corresponding to the transmission information, and the uplink transmission resource indicated by using the resource indication information is used to transmit uplink data; and the resource indication information is not received in the time unit corresponding to the transmission information; and

a communication unit, configured to send the first indication information to a network device.

27. A communication apparatus, comprising:

a communication unit, configured to receive first indication information from a terminal device, wherein the first indication information comprises X pieces of transmission information, the X pieces of transmission information are in a one-to-one correspondence with X time units, X is an integer greater than 0, and one piece of transmission information indicates any one of the following: Resource indication information is received in a time unit corresponding to the

transmission information, and an uplink transmission resource indicated by using the resource indication information is ignored; the resource indication information is received in the time unit corresponding to the transmission information, and the uplink transmission resource indicated by using the resource indication information is used to transmit uplink data; and the resource indication information is not received in the time unit corresponding to the transmission information; and

a processing unit, configured to: send second resource indication information using the communication unit if first transmission information in the X pieces of transmission information indicates that a first uplink transmission resource indicated by first resource indication information transmitted in a first time unit is used to transmit uplink data but the uplink data is not received on the first uplink transmission resource, wherein the second resource indication information is used to schedule a second uplink transmission resource, and the second uplink transmission resource is used to retransmit the uplink data in the first uplink transmission resource.

28. A communication apparatus, comprising a processor, wherein

the processor is configured to execute a computer program or instructions stored in a memory, to cause the communication apparatus to perform the method according to any one of claims 1 to 21.

29. A computer-readable storage medium, wherein the computer-readable storage medium stores a computer program or instructions, and when the computer program or the instructions are run on a computer, the computer is caused to perform the method according to any one of claims 1 to 21.

30. A computer program product, wherein when a computer reads and executes the computer program product, the method according to any one of claims 1 to 21 is performed.