INFORMATION TRANSMISSION METHOD, TERMINAL DEVICE, AND NETWORK DEVICE

TECHNICAL FIELD

Embodiments of the application relate to the field of communication, and more particularly to an information transmission method, a terminal device and a network device.

BACKGROUND

In a 5th-Generation (5G) system, or called New Radio (NR), two types of Physical Uplink Control Channels (PUCCHs) with different lengths are supported, i.e., short-PUCCHs and long-PUCCHs. A short-PUCCH occupies one or two time-domain symbols, and a long-PUCCH occupies at least four time-domain symbols. When a short-PUCCH is adopted to transmit 1-bit or 2-bit uplink control information, different uplink control information may be transmitted by use of different sequences. A terminal device is required to select a sequence according to uplink control information that is practically fed back and transmit the sequence, and thus the terminal device is required to efficiently acquire the sequence configured to carry the uplink control information.

SUMMARY

The embodiments of the application provide an information transmission method, a terminal device and a network device. The terminal device may efficiently acquire a sequence configured to carry uplink control information.

A first aspect provides an information transmission method, which may include that: a terminal device acquires a first sequence, the first sequence being used for determining a sequence carrying feedback information for downlink data; the terminal device determines target feedback information for target downlink data sent

transmission parameter may be n, and the number of the multiple offset values may be 2^n, n being a positive integer.

Optionally, in an implementation of the first aspect, before the terminal device determines the multiple offset values, the method may further include that: the terminal device receives the transmission parameter sent by the network device.

Optionally, in an implementation of the first aspect, a sequence number of the second sequence may be equal to a sum of a sequence number of the first sequence and the target offset value.

Optionally, in an implementation of the first aspect, before the operation that the terminal device determines the target offset value corresponding to the target feedback information in the multiple offset values according to the target feedback information and the second mapping relationship, the method may further include that: the terminal device receives third configuration information sent by the network device, the third configuration information including the second mapping relationship.

Optionally, in an implementation of the first aspect, the second mapping relationship may be predefined by the terminal device and the network device.

Optionally, in an implementation of the first aspect, the operation that the terminal device acquires the first sequence may include that: the terminal device receives sequence indication information sent by the network device, the sequence indication information being used for explicitly or implicitly indicating the first sequence.

Optionally, in an implementation of the first aspect, the operation that the terminal device acquires the first sequence may include that: the terminal device receives the sequence indication information sent by the network device; and the terminal device determines the first sequence corresponding to a physical resource according to the physical resource configured to receive the sequence indication information.

A second aspect provides an information transmission method, which may include that: a network device sends sequence indication information to a terminal device, the sequence indication information being used for indicating a first sequence and the first sequence being used for determining a sequence carrying feedback information for downlink data; the network device sends target downlink data to the terminal device; and the network device receives a second sequence sent by the

wearable device, a terminal device in a future 5G network, a terminal device in a future evolved Public Land Mobile Network (PLMN) or the like.

Each embodiment of the application is described in combination with a network device. The network device may be a device configured to communicate with the terminal device. The network device for example, may be a Base Transceiver Station (BTS) in GSM or CDMA, may also be a NodeB (NB) in a WCDMA system, or may also be an Evolutional Node B (eNB or eNodeB) in an LTE system. Or the network device may be a relay station, an access point, a vehicle-mounted device, a wearable device, a network-side device in a future 5G network, a network-side device in a future evolved PLMN or the like.

FIG. 1 is a schematic diagram of an application scenario according to an embodiment of the application. A communication system in FIG. 1 may include a network device 10 and a terminal device 20. The network device 10 is configured to provide communication service for the terminal device 20 for access to a core network. The terminal device 20 may access network by searching for a synchronization signal, broadcast signal and the like sent by the network device 10, thereby communicating with the network. Arrows shown in FIG. 1 may represent uplink/downlink transmission implemented through a cellular link between the terminal device 20 and the network device 10.

A network in the embodiments of the application may refer to a Public Land Mobile Network (PLMN) or a Device to Device (D2D) network or a Machine to Machine/Man (M2M) network or other networks. FIG. 1 is only an exemplary simplified schematic diagram. The network may further include other terminal devices which are not presented in FIG. 1.

FIG. 2 is a schematic flowchart of an information transmission method 200 according to an embodiment of the application. The information transmission method in FIG. 2 may be executed by a terminal device, for example, the terminal device 20 shown in FIG. 1. As shown in FIG. 2, a specific flow for information transmission includes the following operations.

In the operation 210, the terminal device acquires a first sequence.

The first sequence is configured to determine a sequence carrying feedback information for downlink data.

Specifically, the terminal device may generate different feedback information

offset value. For example, the sequence number of the second sequence is equal to a sum of the sequence number of the first sequence and the target offset value.

In the embodiment, the terminal device determines the offset value corresponding to the target feedback information so as to directly calculate the sequence configured to carry the target feedback information according to the first sequence and the offset value, and is not required to determine the multiple sequences in advance in the first manner.

Optionally, the number of the multiple offset values is determined according to a transmission parameter, and the transmission parameter includes any one of: the number of the TB in the target downlink data; the number of the code block group in the target downlink data; the product of the number of the TB and the number of the code block group in the target downlink data; and the maximum bit number of the target feedback information.

Optionally, if a value of the transmission parameter is n, the number of multiple offset values may be 2^n, n being a positive integer.

Optionally, before the terminal device determines the multiple offset values, the method further includes that: the terminal device receives the transmission parameter sent by the network device.

Optionally, before the operation that the terminal device determines the target offset value corresponding to the target feedback information in the multiple offset values according to the target feedback information and the second mapping relationship, the method further includes that: the terminal device receives third configuration information sent by the network device, the third configuration information including the second mapping relationship.

Optionally, the second mapping relationship is predefined by the terminal device and the network device, for example, specified in a protocol.

For example, according to the second mapping relationship shown in Table 3, if the number of the TB in the target downlink data is n=1, the number of the offset values is 2. Table 3 shows the second mapping relationship in case of n=1. When the feedback information includes an ACK, the offset value is $\Delta_{offset,0}$; and when the feedback information includes a NACK, the offset value is $\Delta_{offset,1}$.

Table 3

Feedback information	Offset value
ACK	$\Delta_{offset,0}$
NACK	$\Delta_{offset,1}$

The terminal device, after receiving the sequence indication information sent by the network device, acquires the sequence number S_i of the first sequence and the number n=1 of the TBs carried in the target downlink data. The terminal device decodes the TBs, determines the target feedback result for the target downlink data and determines the target offset value corresponding to the target feedback result according to the second mapping relationship shown in Table 3. If the target feedback result includes an ACK, the corresponding target offset value is $\Delta_{offset,0}$; and if the target feedback result includes a NACK, the corresponding target offset value is $\Delta_{offset,1}$. For example, the offset value $\Delta_{offset,0}$ may be 0 and $\Delta_{offset,1}$ may be 1. Then, the terminal device adds the sequence number of the first sequence to the target offset value to obtain the sequence number of the second sequence carrying the target feedback result, and sends the second sequence to the network device.

For another example, according to the second mapping relationship shown in Table 4, if the maximum bit number of the target feedback information is n=2, the number of the offset values is 4. Table 4 shows the second mapping relationship in case of n=2. When the feedback information includes an ACK and an ACK, the offset value is $\Delta_{offset,0}$; when the feedback information includes an ACK and a NACK, the offset value is $\Delta_{offset,1}$; when the feedback information includes a NACK and an ACK, the offset value is $\Delta_{offset,2}$; and when the feedback information includes a NACK and a NACK, the offset value is $\Delta_{offset,3}$.

Table 4

Feedback information	Offset value
ACK, ACK	$\Delta_{offset,0}$
ACK, NACK	$\Delta_{offset,1}$
NACK, ACK	$\Delta_{offset,2}$
NACK, NACK	$\Delta_{offset,3}$

The terminal device, after receiving the sequence indication information sent by the network device, acquires the sequence number S_i of the first sequence. The terminal device determines the target feedback result for the target downlink data and determines the target offset value corresponding to the target feedback result

according to the second mapping relationship shown in Table 4. If the target feedback result includes an ACK and an ACK, the corresponding target offset value is $\Delta_{offset,0}$; if the target feedback result includes an ACK and a NACK, the corresponding target offset value is $\Delta_{offset,1}$; if the feedback result includes a NACK and an ACK, the corresponding target offset value is $\Delta_{offset,2}$; and if the feedback result includes a NACK and a NACK, the corresponding target offset value is $\Delta_{offset,3}$. The offset values may be $\Delta_{offset,0}=0$, $\Delta_{offset,1}=1$, $\Delta_{offset,2}=2$ and $\Delta_{offset,3}=3$. Then, the terminal device adds the sequence number of the first sequence to the target offset value to obtain the sequence number of the second sequence carrying the target feedback result, and sends the second sequence to the network device.

In 240, the terminal device sends the second sequence to the network device.

FIG. 5 is a schematic flowchart of an information transmission method 500 according to an embodiment of the application. The information transmission method in FIG. 5 may be executed by a network device, for example, the network device 10 shown in FIG. 1. As shown in FIG. 5, a specific flow for information transmission includes the following operations.

In 510, the network device sends sequence indication information to a terminal device, the sequence indication information being used for indicating a first sequence.

The first sequence is configured to acquire a sequence carrying feedback information for downlink data.

In 520, the network device sends target downlink data to the terminal device.

In 530, the network device receives a second sequence sent by the terminal device according to the first sequence, the second sequence carrying target feedback information for the target downlink data.

Specifically, the first sequence sent to the terminal device by the network device is configured for the terminal device to determine the sequence configured to carry the feedback information for the downlink data. A specific process that the terminal device, after the network device sends the target downlink data to the terminal device, determines the second sequence carrying the target feedback information for the target downlink data according to the first sequence may refer to descriptions about 210- to 240 in FIG. 2 to FIG. 4 and will not be elaborated herein for simplicity.

In such a manner, the network device indicates the first sequence to the

execution sequence of each process should be determined by its function and an internal logic and should not form any limit to an implementation process of the embodiments of the application.

FIG. 6 is a schematic block diagram of a terminal device 600 according to an embodiment of the application. As shown in FIG. 6, the terminal device 600 includes an acquisition unit 610, a determination unit 620 and a sending unit 630.

The acquisition unit 610 is configured to acquire a first sequence, the first sequence being used for determining a sequence carrying feedback information for downlink data.

The determination unit 620 is configured to determine target feedback information for target downlink data according to the target downlink data sent by the network device.

The determination unit 620 is further configured to determine a second sequence carrying the target feedback information according to the first sequence acquired by the acquisition unit 610.

The sending unit 630 is configured to send the second sequence determined by the determination unit 620 to the network device.

In such a manner, the terminal device acquires the second sequence carrying feedback information for present downlink data through the first sequence, so that a sequence configured to carry uplink control information may be efficiently determined.

Optionally, the determination unit 620 is specifically configured to: determine other sequences than the first sequence from multiple sequences according to the first sequence, the multiple sequences and multiple types of feedback information meeting a first mapping relationship; and determine, by the terminal device, the second sequence corresponding to the target feedback information in the multiple sequences according to the target feedback information and the first mapping relationship.

Optionally, the number of the multiple sequences is determined according to a transmission parameter, and the transmission parameter includes any one of: the number of TBs in the target downlink data; the number of a code block group in the target downlink data; a product of the number of the TB and the number of the code block group in the target downlink data; and a maximum bit number of the target feedback information.

Optionally, a value of the transmission parameter is n, and the number of multiple sequences is 2^n, n being a positive integer.

Optionally, the terminal device further includes a receiving unit, and the receiving unit is configured to, before the determination unit 620 determines the other sequences than the first sequence in the multiple sequences according to the first sequence, receive the transmission parameter sent by the network device.

Optionally, a sequence number of each sequence in the other sequences than the first sequence in the multiple sequences is equal to a sum of a sequence number of the first sequence and an offset value corresponding to the sequence.

Optionally, the terminal device further includes a receiving unit, and the receiving unit is configured to, before the determination unit 620 determines the other sequences than the first sequence in the multiple sequences according to the first sequence, receive first configuration information sent by the network device, the first configuration information including the offset value corresponding to each sequence.

Optionally, the receiving unit is further configured to, before the determination unit 620 determines the other sequences than the first sequence in the multiple sequences according to the first sequence, receive second configuration information sent by the network device, the second configuration information including the first mapping relationship.

Optionally, the first mapping relationship is predefined by the terminal device and the network device.

Optionally, the determination unit 620 is specifically configured to: determine a target offset value corresponding to the target feedback information from multiple offset values according to the target feedback information and a second mapping relationship, the second mapping relationship representing a corresponding relationship between the multiple offset values and the multiple types of feedback information; and determine the second sequence according to the first sequence and the target offset value.

Optionally, the number of the multiple offset values is determined according to a transmission parameter, and the transmission parameter includes any one of: the number of the TB in the target downlink data; the number of the code block group in the target downlink data; the product of the number of the TB and the number of the code block group in the target downlink data; and the maximum bit number of the

target feedback information.

Optionally, a value of the transmission parameter is n, and the number of the multiple offset values is 2^n, n being a positive integer.

Optionally, the terminal device further includes a receiving unit, and the receiving unit is configured to, before the determination unit 620 determines the multiple offset values, receive the transmission parameter sent by the network device.

Optionally, the sequence number of the second sequence is equal to a sum of the sequence number of the first sequence and the target offset value.

Optionally, the receiving unit is further configured to, before the determination unit 620 determines the target offset value corresponding to the target feedback information in the multiple offset values according to the target feedback information and the second mapping relationship, receive third configuration information sent by the network device, the third configuration information including the second mapping relationship.

Optionally, the second mapping relationship is predefined by the terminal device and the network device.

Optionally, the acquisition unit 610 is specifically configured to receive sequence indication information sent by the network device, the sequence indication information being used for explicitly or implicitly indicating the first sequence.

Optionally, the acquisition unit 610 is specifically configured to: receive the sequence indication information sent by the network device; and determine the first sequence corresponding to a physical resource according to the physical resource configured to receive the sequence indication information.

FIG. 7 is a schematic block diagram of a network device 700 according to an embodiment of the application. As shown in FIG. 7, the network device 700 includes a sending unit 710 and a receiving unit 720.

The sending unit 710 is configured to send sequence indication information to a terminal device, the sequence indication information being used for indicating a first sequence and the first sequence being used for determining a sequence carrying feedback information for downlink data.

The sending unit 710 is further configured to send target downlink data to the terminal device.

The receiving unit 720 is configured to receive a second sequence sent by the

first sequence, send third configuration information to the terminal device, the third configuration information including a second mapping relationship and the second mapping relationship being configured to represent a corresponding relationship between multiple offset values and the multiple types of feedback information.

FIG. 8 is a schematic structure diagram of a terminal device 800 according to an embodiment of the application. As shown in FIG. 8, the terminal device includes a processor 810, a transceiver 820 and a memory 830. The processor 810, the transceiver 820 and the memory 830 may communicate with one another through an internal connecting path. The memory 830 is configured to store an instruction, and the processor 810 is configured to execute the instruction stored in the memory 830 to control the transceiver 820 to receive a signal or send a signal.

The processor 810 is configured to: acquire a first sequence, the first sequence being used for determining a sequence carrying feedback information for downlink data; determine target feedback information for target downlink data sent by a network device according to the target downlink data; and determine a second sequence carrying the target feedback information according to the first sequence acquired by an acquisition unit.

The transceiver 820 is configured to send the second sequence determined by a determination unit to the network device.

Optionally, the processor 810 may call the program code stored in the memory 830 to execute corresponding operations of the terminal device in the method 200 shown in FIG. 2. For similarity, no more elaborations will be made herein.

It is to be understood that, in the embodiment of the application, the processor 810 may be a Central Processing Unit (CPU), or the processor 810 may also be a universal processor, a Digital Signal Processor (DSP), an Application Specific Integrated Circuit (ASIC), a Field-Programmable Gate Array (FPGA) or other programmable logic device, discrete gate or transistor logic device and discrete hardware component and the like. The universal processor may be a microprocessor or any conventional processor and the like.

The memory 830 may include a Read-Only Memory (ROM) and a Random Access Memory (RAM) and provide an instruction and data for the processor 810. A part of the memory 830 may further include a nonvolatile RAM. For example, the memory 830 may further store information of a device type.

In an implementation process, each step of the method may be completed by an integrated logic circuit of hardware in the processor 810 or an instruction in a software form. The steps of a positioning method disclosed in combination with the embodiments of the application may be directly embodied to be executed and completed by a hardware processor or executed and completed by a combination of hardware and software modules in the processor 810. The software module may be located in a mature storage medium in this field such as a RAM, a flash memory, a ROM, a programmable ROM or electrically erasable programmable ROM and a register. The storage medium is located in the memory 830. The processor 810 reads information in the memory 830 and completes the steps of the method in combination with hardware. No more detailed descriptions will be made herein to avoid repetitions.

The terminal device 800 according to the embodiment of the application may correspond to the terminal device configured to execute the method 200 in the method 200 and the terminal device 500 according to the embodiment of the application, and each unit or module in the terminal device 800 is configured to execute each operation or processing process executed by the terminal device in the method 200. Herein, for avoiding elaborations, detailed descriptions thereof are omitted.

FIG. 9 is a schematic structure diagram of a network device 900 according to an embodiment of the application. As shown in FIG. 9, the network device includes a processor 910, a transceiver 920 and a memory 930. The processor 910, the transceiver 920 and the memory 930 may communicate with one another through an internal connecting path. The memory 930 is configured to store an instruction, and the processor 910 is configured to execute the instruction stored in the memory 930 to control the transceiver 920 to receive a signal or send a signal.

The transceiver 920 is configured to: send sequence indication information to a terminal device, the sequence indication information being used for indicating a first sequence and the first sequence being used for determining a sequence carrying feedback information for downlink data; send target downlink data to the terminal device; and receive a second sequence sent by the terminal device according to the first sequence, the second sequence carrying target feedback information for the target downlink data.

Optionally, the processor 910 may call the program code stored in the memory

CLAIMS

1. An information transmission method, comprising:

acquiring, by a terminal device, a first sequence;

determining, by the terminal device, target feedback information for target downlink data sent by a network device according to the target downlink data;

determining, by the terminal device, a second sequence carrying the target feedback information according to the first sequence; and

sending, by the terminal device, the second sequence to the network device.

2. The method of claim 1, wherein determining, by the terminal device, the second sequence carrying the target feedback information according to the first sequence comprises:

determining, by the terminal device, a target offset value corresponding to the target feedback information from multiple offset values according to the target feedback information and a second mapping relationship, the second mapping relationship representing a corresponding relationship between the multiple offset values and multiple types of feedback information; and

determining, by the terminal device, the second sequence according to the first sequence and the target offset value.

3. The method of claim 2, wherein the number of the multiple offset values is determined according to a transmission parameter, and the transmission parameter comprises any one of:

the number of a Transmission Block (TB) in the target downlink data;

the number of a code block group in the target downlink data;

a product of the number of the TB and the number of the code block group in the target downlink data; and

a maximum bit number of the target feedback information.

4. The method of claim 3, before the terminal device determines the multiple offset values, the method further comprising:

receiving, by the terminal device, the transmission parameter sent by the network device.

5. The method of any one of claims 2-4, wherein a sequence number of the second sequence is equal to a sum of a sequence number of the first sequence and the target offset value.

6. The method of any one of claims 2-5, wherein the second mapping relationship is predefined by a protocol.

7. The method of any one of claims 1-6, wherein acquiring, by the terminal device, the first sequence comprises:

receiving, by the terminal device, sequence indication information sent by the network device, wherein the sequence indication information is used for explicitly or implicitly indicating the first sequence.

8. A terminal device, comprising:

an acquisition unit, configured to acquire a first sequence;

a determination unit, configured to determine target feedback information for target downlink data sent by a network device according to the target downlink data,

the determination unit, further configured to determine a second sequence carrying the target feedback information according to the first sequence acquired by the acquisition unit; and

a sending unit, configured to send the second sequence determined by the determination unit to the network device.

9. The terminal device of claim 8, wherein the determination unit is specifically configured to:

determine a target offset value corresponding to the target feedback information from multiple offset values according to the target feedback information and a second mapping relationship, the second mapping relationship representing a corresponding relationship between the multiple offset values and multiple types of feedback information; and

determine the second sequence according to the first sequence and the target offset value.

10. The terminal device of claim 9, wherein the number of the multiple offset values is determined according to a transmission parameter, and the transmission parameter comprises any one of:

the number of a Transmission Block (TB) in the target downlink data;

the number of a code block group in the target downlink data;

a product of the number of the TB and the number of the code block group in the target downlink data; and

a maximum bit number of the target feedback information.

11. The terminal device of claim 10, further comprising a receiving unit, wherein the receiving unit is configured to:

before the determination unit determines the multiple offset values, receive the transmission parameter sent by the network device.

12. The terminal device of any one of claims 9-11, wherein a sequence number of the second sequence is equal to a sum of a sequence number of the first sequence and the target offset value.

13. The terminal device of any one of claims 9-12, wherein the second mapping relationship is predefined by a protocol.

14. The terminal device of any one of claims 9-13, wherein the acquisition unit is specifically configured to:

receive sequence indication information sent by the network device, wherein the sequence indication information is used for explicitly or implicitly indicating the first sequence.

15. The terminal device of any one of claims 9-14, wherein

in a case that the maximum bit number of the target feedback information is 2, the number of the multiple offset values is 4; or

in a case that the number of the TB in the target downlink data is 1, the number of the multiple offset values is 2.