

DOWNLINK CONTROL INFORMATION SENDING METHOD AND APPARATUS, AND READABLE STORAGE MEDIUM

TECHNICAL FIELD

The disclosure relates to a field of wireless communication technologies, in particular to a method for sending downlink control information (DCI), an apparatus for sending DCI and a readable storage medium.

BACKGROUND

With the development of wireless communication technologies, the Internet of Things (IoT) brings great convenience to life and work. Machine Type Communication (MTC) is one of typical representatives of applications of the cellular IoT technology.

SUMMARY

The disclosure provides a method for sending downlink control information (DCI), an apparatus for sending DCI and a readable storage medium. The technical solution of the disclosure will be described as follows.

According to a first aspect of embodiments of the disclosure, a method for sending DCI is provided. The method includes: obtaining a number of transmission blocks scheduled by the DCI; determining whether to compress an information field in the DCI

disclosure.

FIG. 6 is a block diagram of an apparatus for sending DCI according to an example embodiment.

FIG. 7 is a schematic diagram of a base station according to an example embodiment.

DETAILED DESCRIPTION

Reference will now be made in detail to exemplary embodiments, examples of which are illustrated in the accompanying drawings. The following description refers to the accompanying drawings in which the same numbers in different drawings represent the same or similar elements unless otherwise represented. The implementations set forth in the following description of exemplary embodiments do not represent all implementations consistent with the disclosure. Instead, they are merely examples of apparatuses and methods consistent with aspects related to the disclosure as recited in the appended claims.

It should be understood that “several” mentioned in the disclosure refers to one or more, and “a plurality of” refers to two or more. The term “and/or” describes an association relationship among the associated objects, indicating that there are three types of relationships, for example, A and/or B, i.e., A alone exists, A and B exist at the same time, and B exists alone. The character “/” generally indicates that the associated objects before and after are in an “or” relationship. To facilitate understanding, some application scenarios involved in the disclosure will be briefly introduced below.

In the related art, for MTC communication services, when a terminal transmits MTC data, it needs to know information such as a resource location when sending the MTC data and corresponding modulation/demodulation scheme in advance. The information can be notified to the terminal by a base station in advance through DCI. For example, the base station may send a generated physical resource block (PRB) to the terminal through the DCI. Generally, the base station needs to allocate several bits in the DCI to represent a resource allocation indication field for the PRB. In order to save the number of bits allocated by the base station to the DCI, the base station generally compress the resource allocation indication field of for the PRB in the DCI issued to the terminal each time, thereby reducing the number of bits allocated by the base station to the DCI.

FIG. 1 is a schematic diagram of a wireless communication system according to an

embodiment of the disclosure. As illustrated in FIG. 1, the wireless communication system is a communication system based on the cellular mobile communication technology. The wireless communication system may include several terminals 110 and several base stations 120.

The terminal 110 may be a device that provides voice and/or data connectivity to a user. The terminal 110 can communicate with one or more core networks via a radio access network (RAN). The terminal 110 can be an IoT terminal, such as a sensor device, a mobile phone (or a cellular phone), and a computer having an IoT terminal, for example, a fixed, portable, pocket-sized, handheld, built-in computer or vehicle-mounted device, such as, a

each TB are both 1, the number of bits of the non-shared information field before compression acquired by the base station is 2.

Alternatively, the base station may obtain a product of the number of bits of the non-shared information field before compression and the number of TBs based on the number of TBs. That is, the number of bits actually required for the non-shared information field in the DCI is calculated. For example, when the base station acquires the number of TBs scheduled by the DCI, which is N , the number of bits actually required for the non-shared information field in the DCI is $2N$.

Alternatively, the base station may obtain a sum of the number of bits of the shared information field before the compression and the product as the amount of information of the DCI before the compression. That is, the sum of the number of bits of the shared information field before the compression obtained by the base station and the obtained product is the amount of information of the DCI before compression. Assuming that the obtained number of bits of the shared information field before compression is 9, and the number of bits actually required for the non-shared information field is $2N$, the amount of information before compression obtained by the base station the DCI is $(9+2N)$ bits.

In 503, the base station determines whether the information field in the DCI needs to be compressed and the compressing mode when the information field needs to be compressed, based on a size relationship between the amount of information and a threshold value.

Alternatively, the threshold value may be a fixed amount of information allocated to the DCI when the base station generates the DCI. That is, no matter how many TBs are scheduled by the DCI, the amount of information allocated by the base station to the DCI is equal to the threshold value. For example, in a possible implementation, the amount of information allocated by the base station to DCI used for the PRB field, the MCS field, the NDI field, and the RV field is M bits (M is an integer greater than or equal to 16). Regardless of how many TBs are scheduled by the DCI, the DCI carries the amount of information of M bits to indicate the PRB field, the MCS field, the NDI field, and the RV field respectively.

resources in a narrowband, so that no additional bit is required to indicate the PRB field. In the MTC CE mode A, the amount of information of 5 bits can be directly saved by compression, that is, DCI can carry 5 bits less.

In a possible implementation, when the base station compresses the PRB field, it restricts the amount of allocated resources indicated by the PRB field to 6 PRBs or 4 PRBs. In this case, the base station can use 2 bits for indication of the PRB field, in the MTC CE mode A, the base station can directly save the amount of information of 3 bits by compression, that is, the DCI can carry 3 bits less. Table 5 shows a mapping relationship between 3-bit information carried in the DCI indication information and the specific PRB resource allocation according to an embodiment of the disclosure.

Table 5

DCI indication information (2 bit)	Resource start position (PRB number)	Amount of allocated resources (number of PRBs)	Positions of allocated resource (PRB number set)
00	1	4	1,2,3, 4
01	2	4	2,3,4,5
10	3	4	3,4,5,6
11	1	6	1,2,3, 4,5,6

As shown in Table 5, the base station can use 2 bits to indicate the PRB field in the DCI.

Alternatively, when the base station compresses the PRB indication field in the DCI, it may also restrict the positions of allocated resources indicated by the PRB field. In a possible implementation, when the base station compresses the PRB field, it can restrict the amount of allocated resources indicated by the PRB field to correspond to a set of positions of the allocated resource. For example, the amount of allocated resources of 4 PRBs corresponds to the set of positions (3, 4, 5, 6), that is, when the amount of allocated resources of the PRB field in the DCI is 4, it indicates that the terminal can transmit data at resource positions (3, 4, 5, 6) in a narrowband. In this case, the base station can use 3 bits to indicate the PRB field. In the MTC CE mode A, the amount of information of 2 bits can be directly saved by compression, that is, DCI can carry 2 bits less. Table 6 shows a

WHAT IS CLAIMED IS:

1. A method for sending downlink control information (DCI), comprising:
obtaining a number of transmission blocks scheduled by the DCI;
determining whether to compress an information field in the DCI based on the number of the transmission blocks; and
sending the DCI based on a compressing mode in response to determining to compress.
2. The method according to claim 1, wherein determining whether to compress the information field in the DCI based on the number of the transmission blocks, comprises:
obtaining an amount of information of the DCI before compression based on the number of the transmission blocks;
determining whether the information field in the DCI needs to be compressed based on a size relationship between the amount of information and a threshold value; and
determining the compressing mode in response to determining that the information field needs to be compressed.
3. The method according to claim 2, wherein obtaining the amount of information of the DCI before compression based on the number of the transmission blocks comprises:
obtaining a number of bits of a shared information field before compression for the transmission blocks and a number of bits of a non-shared information field before compression for the transmission blocks;
obtaining a product of the number of bits of the non-shared information field before compression and the number of the transmission blocks; and
obtaining a sum of the number of bits of the shared information field before compression and the product as the amount of information.
4. The method according to claim 3, wherein the shared information field comprises a physical resource block (PRB) field and/or a modulation and coding scheme (MCS) field.
5. The method according to any one of claims 1 to 4, wherein the compressing mode is configured to indicate a compressing strategy of the information field in the DCI.

6. The method according to claim 5, wherein the compressing strategy comprises at least one of:

- compressing a PRB field in the DCI; and,
- compressing a MCS field in the DCI.

7. The method according to claim 6, wherein compressing the PRB field in the DCI comprises:

- restricting an amount of allocated resources indicated by the PRB field; or
- restricting positions of the allocated resources indicated by the PRB field; or
- restricting the amount of the allocated resources indicated by the PRB field and the positions of the allocated resources indicated by the PRB field.

8. The method according to claim 6, wherein compressing the MCS field in the DCI comprises:

- restricting the MCS indicated by the MCS field as a fixed MCS; or
- restricting the MCS indicated by the MCS field as at least two designated MCSs, where the at least two designated MCSs are a part of MCSs supported by a system; or
- restricting the MCS indicated by the MCS field as at least two MCSs extracted from the MCSs supported by the system based on a designated extracting mode.

9. The method according to claim 8, wherein the designated extracting mode comprises a uniform extracting mode or a non-uniform extracting mode.

10. An apparatus for sending downlink control information (DCI), comprising:
a number obtaining module, configured to obtain a number of transmission blocks scheduled by the DCI;

- an information sending module, configured to determine whether to compress an information field in the DCI based on the number of the transmission blocks and to send the DCI based on a compressing mode in response to determining to compress.

11. The apparatus according to claim 10, wherein the information sending module comprises:

- an information amount obtaining sub-module, configured to obtain an amount of information of the DCI before compression based on the number of the transmission

blocks; and

a compressing mode determining sub-module, configured to determine the compressing mode in response to determining that the information field needs to be compressed based on a size relationship between the amount of information and a threshold value.

12. The apparatus according to claim 11, wherein the information amount obtaining sub-module comprises:

a first obtaining unit, configured to obtain a number of bits of a shared information field before compression for the transmission blocks and a number of bits of a non-shared information field before compression for the transmission blocks;

a second obtaining unit, configured to obtain a product of the number of bits of the non-shared information field before compression and the number of the transmission blocks; wherein

a sum of the number of bits of the shared information field before compression and the product is configured as the amount of information.

13. The apparatus according to claim 12, wherein the shared information field comprises a physical resource block (PRB) field and/or a modulation and coding scheme (MCS) field.

14. The apparatus according to any one of claims 10 to 13, wherein the compressing mode is configured to indicate a compressing strategy of the information field in the DCI.

15. The apparatus according to claim 14, wherein the compressing strategy comprises at least one of:

compressing a PRB field in the DCI; and,

compressing a MCS field in the DCI.

16. The apparatus according to claim 15, wherein compressing the PRB field in the DCI comprises:

restricting an amount of allocated resources indicated by the PRB field; or

restricting positions of the allocated resources indicated by the PRB field; or

restricting the amount of the allocated resources indicated by the PRB field and the

positions of the allocated resources indicated by the PRB field.

17. The apparatus according to claim 15, wherein compressing the MCS field in the DCI comprises:

restricting the MCS indicated by the MCS field as a fixed MCS; or

restricting the MCS indicated by the MCS field as at least two designated MCSs, where the at least two designated MCSs are a part of MCSs supported by a system; or

restricting the MCS indicated by the MCS field as at least two MCSs extracted from the MCSs supported by the system based on a designated extracting mode.

18. The apparatus according to claim 17, wherein the designated extracting mode comprises a uniform extracting mode or a non-uniform extracting mode.

19. An apparatus for downlink control information (DCI), comprising:

a processor;

a memory for storing executable instructions of the processor; wherein,

the processor is configured to:

obtain a number of transmission blocks scheduled by the DCI;

determine whether to compress an information field in the DCI based on the number of the transmission blocks; and

send the DCI based on a compressing mode in response to determining to compress.

20. A computer-readable storage medium comprising executable instructions, wherein when the executable instructions are called by a processor of a base station, the method for sending downlink control information (DCI) according to any one of claims 1 to 9 is implemented.