HARQ FEEDBACK METHOD AND APPARATUS

TECHNICAL FIELD

[0001] The present disclosure generally relates to the technical field of communication, and particularly, to a Hybrid Automatic Repeat reQuest (HARQ) feedback method and apparatus.

BACKGROUND

[0002] Narrow Band Internet of Things (NB-IoT) and Machine Type Communication (MTC) are promising cellular IoT technologies and have been widely used. Moreover, a mechanism for transmitting uplink (UL) data in a random access process has been introduced into NB-IoT and MTC so as to further reduce a transmission delay and saving power. The mechanism is called Early Data Transmission (EDT) during RACH for short. The RACH may refer to random access channel. However, in an existing EDT, A base station and a terminal usually have different HARQ feedback contents and time point, resulting in reduction of the transmission quality.

SUMMARY

[0003] For solving the problem in the related art, embodiments of the present disclosure provide a HARQ feedback method and apparatus.

[0004] According to a first aspect of the embodiments of the present disclosure, a HARQ feedback method may be applicable to a base station that allocates, to a terminal, multiple available scheduling resources configured to provide EDT service. The method including:

[0005] performing blind detection on EDT data transmitted to the base station by the terminal on respective available scheduling resources;

[0006] determining a HARQ feedback time point for the blind detection according to a preset rule; and

[0007] sending HARQ information about the blind detection to the terminal at the HARQ feedback time point.

[0008] In an embodiment, the EDT data may be UL data transmitted by the terminal in a random access process and may be in a message 3 in the random access process.

[0009] In an embodiment, the available scheduling resource may include a Transmission Block Size (TBS) and UL transmission repetition count.

[0010] The operation of performing blind detection on the EDT data transmitted to the base station by the terminal on respective available scheduling resources may include:

[0011] determining UL transmission ending time points for respective available scheduling resources based on the TBS and the UL transmission repetition count in respective available scheduling resources, and

[0012] performing blind detection on the EDT data at respective UL transmission ending time points.

[0013] In an embodiment, the preset rule may be that a HARQ feedback is made based on a maximum UL transmission repetition count.

[0014] The operation of determining the HARQ feedback time point for the blind detection according to the preset rule may include:

[0015] determining the maximum UL transmission repetition count according to the UL transmission repetition count in a respective available scheduling resource;

[0016] determining a UL transmission ending time point corresponding to the maximum UL transmission repetition count based on a respective UL transmission ending time point; and

[0017] determining the HARQ feedback time point based on the UL transmission ending time point corresponding to the maximum UL transmission repetition count, where the determined HARQ feedback time point is at a specified position after the UL transmission ending time point corresponding to the maximum UL transmission repetition count.

[0018] In an embodiment, the HARQ information about the blind detection may include first information indicating successful demodulation or second information indicating unsuccessful demodulation.

[0019] The operation of sending the HARQ information about the blind detection to the terminal at the HARQ feedback time point may include:

[0020] sending the first information to the terminal at the HARQ feedback time point

in response to determining that each blind detection result at each UL transmission ending time point comprises successful demodulation; and

[0021] sending the second information to the terminal at the HARQ feedback time point in response to determining that each blind detection result does not comprise successful demodulation.

[0022] In an embodiment, the preset rule may be that a HARQ feedback is made for the UL transmission ending time point respectively for each available scheduling resource.

[0023] The operation of determining the HARQ feedback time point for the blind detection according to the preset rule may include:

[0024] determining a HARQ feedback time point corresponding to any UL transmission ending time point, where the determined HARQ feedback time point is at a specified position after the UL transmission ending time point.

[0025] In an embodiment, the HARQ information about the blind detection may include first information indicating successful demodulation or second information indicating unsuccessful demodulation.

[0026] The operation of sending the HARQ information about the blind detection to the terminal at the HARQ feedback time point may include:

[0027] in response to determining that a blind detection result at any UL transmission ending time point is successful demodulation, sending the first information to the terminal at the HARQ feedback time point corresponding to the UL transmission ending time point; and

[0028] in response to that the blind detection result is unsuccessful demodulation, sending the second information to the terminal at the HARQ feedback time point corresponding to the UL transmission ending time point.

[0029] In an embodiment, the preset rule may be that a HARQ feedback is made only when the blind detection result is successful demodulation.

[0030] The operation of determining the HARQ feedback time point for the blind detection according to the preset rule may include:

[0031] determining a HARQ feedback time point corresponding to any UL transmission ending time point, where the determined HARQ feedback time point is at a specified position after the UL transmission ending time point.

[0032] In an embodiment, the HARQ information about the blind detection may include the first information indicating successful demodulation.

[0033] The operation of sending the HARQ information about the blind detection to the terminal at the HARQ feedback time point may include:

[0034] in response to determining that a blind detection result at any UL transmission ending time point is successful demodulation, sending the first information to the terminal at the HARQ feedback time point corresponding to the UL transmission ending time point; and

[0035] in response to determining that the blind detection result is unsuccessful demodulation, not performing HARQ feedback at the HARQ feedback time point corresponding to the UL transmission ending time point.

[0036] In an embodiment, the specified position may be configured by the base station and may be in a UL grant in a Random Access Response (RAR) sent to the terminal by the base station; or

[0037] the preset rule may include third information indicating the specified position, and the third information may be configured to indicate a relative relationship between a HARQ feedback time point and a determined UL transmission ending time point.

[0038] According to a second aspect of the embodiments of the present disclosure, a HARQ feedback method may be applicable to a terminal. A base station may allocate, to the terminal, multiple available scheduling resources configured to provide EDT service. The method may include:

[0039] selecting an available scheduling resource from the multiple available scheduling resources;

[0040] sending EDT data to the base station on the selected available scheduling resource;

[0041] determining a HARQ feedback time point for the EDT data according to a preset rule; and

[0042] when HARQ information sent by the base station is received at the HARQ feedback time point, determining a transmission result of the EDT data based on the HARQ information.

[0043] In an embodiment, the EDT data may be UL data required to be transmitted by

the terminal in a random access process and may be in a message 3 in the random access process.

[0044] In an embodiment, the available scheduling resource may include a TBS and a UL transmission repetition count.

[0045] The operation of selecting the available scheduling resource from the multiple available scheduling resources and sending the EDT data to the base station on the selected available scheduling resource may include:

[0046] selecting the available scheduling resource from the multiple available scheduling resources based on the TBS and the UL transmission repetition count of the multiple available scheduling resources; and

[0047] sending the EDT data to the base station on the selected available scheduling resource.

[0048] In an embodiment, the preset rule may be that a HARQ information is made based on a maximum UL transmission repetition count.

[0049] The operation of determining the HARQ feedback time point for the EDT data according to the preset rule may include:

[0050] determining a UL transmission ending time point for the selected available scheduling resource based on the TBS and the UL transmission repetition count of the selected available scheduling resource;

[0051] determining the maximum UL transmission repetition count according to the UL transmission repetition count in the selected available scheduling resource;

[0052] determining a UL transmission ending time point corresponding to the maximum UL transmission repetition count based on the UL transmission ending time point; and

[0053] determining the HARQ feedback time point based on the UL transmission ending time point corresponding to the maximum UL transmission repetition count, where the determined HARQ feedback time point is at a specified position after the UL transmission ending time point corresponding to the maximum UL transmission repetition count.

[0054] In an embodiment, the HARQ information may include first information indicating successful demodulation or second information indicating unsuccessful

demodulation.

[0055] The operation of determining the transmission result of the EDT data based on the HARQ information when the HARQ information sent by the base station is received at the HARQ feedback time point may include:

[0056] receiving the HARQ information from the base station at the HARQ feedback time point;

[0057] determining that the transmission result of the EDT data is successful transmission in response to that the HARQ information is the first information; or

[0058] determining that the transmission result of the EDT data is unsuccessful transmission in response to that the HARQ information is the second information.

[0059] In an embodiment, the preset rule may be that a HARQ feedback is made for each UL transmission ending time point respectively for each available scheduling resource.

[0060] The operation of determining the HARQ feedback time point for the EDT data according to the preset rule may include:

[0061] determining a UL transmission ending time point corresponding to the selected available scheduling resource based on the TBS and the UL transmission repetition count in the selected available scheduling resource; and

[0062] determining a HARQ feedback time point corresponding to the UL transmission ending time point corresponding to the selected available scheduling resource, where the determined HARQ feedback time point is at a specified position after the UL transmission ending time point.

[0063] In an embodiment, the HARQ information may include first information indicating successful demodulation or second information indicating unsuccessful demodulation.

[0064] The operation of determining the transmission result of the EDT data based on the HARQ information when the HARQ information sent by the base station is received at the HARQ feedback time point may include:

[0065] receiving the HARQ information from the base station at the HARQ feedback time point corresponding to the UL transmission ending time point;

[0066] determining that the transmission result of the EDT data is successful

transmission in response to that the HARQ information is the first information; or

[0067] determining that the transmission result of the EDT data is unsuccessful transmission in response to that the HARQ information is the second information.

[0068] In an embodiment, the preset rule may be that a HARQ feedback is made only when a blind detection result is successful demodulation.

[0069] The operation of determining the HARQ feedback time point for the EDT data according to the preset rule may include:

[0070] determining a UL transmission ending time point corresponding to the selected available scheduling resource based on the TBS and the UL transmission repetition count in the selected available scheduling resource; and

[0071] determining the HARQ feedback time point corresponding to the UL transmission ending time point corresponding to the selected available scheduling resource, where the determined HARQ feedback time point is at a specified position after the UL transmission ending time point.

[0072] In an embodiment, the HARQ information may include the first information indicating successful demodulation.

[0073] The operation of determining the transmission result of the EDT data based on the HARQ information when the HARQ information sent by the base station is received at the HARQ feedback time point may include:

[0074] in response to receiving the HARQ information from the base station at the HARQ feedback time point corresponding to the UL transmission ending time point and the HARQ information being the first information, determining that the transmission result of the EDT data is successful transmission, and

[0075] in response to not receiving the HARQ information from the base station at the HARQ feedback time point corresponding to the UL transmission ending time point, determining that the transmission result of the EDT data is unsuccessful transmission.

[0076] In an embodiment, the specified position may be configured by the base station and may be in a UL grant in an RAR sent to the terminal by the base station; or

[0077] the preset rule may include third information indicating the specified position, and the third information may indicate a relative relationship between a HARQ feedback time

point and a determined UL transmission ending time point.

[0078] According to a third aspect of the embodiments of the present disclosure, a HARQ feedback apparatus may be applicable to a base station that allocates, to a terminal, multiple available scheduling resources configured to provide EDT service. The apparatus may include:

[0079] a detection module, configured to perform blind detection on EDT data transmitted to the base station by the terminal on respective available scheduling resources;

[0080] a first determination module, configured to determine a HARQ feedback time point for the blind detection according to a preset rule; and

[0081] a sending module, configured to send HARQ information about the blind detection to the terminal at the HARQ feedback time point.

[0082] In an embodiment, the EDT data may be UL data transmitted by the terminal in a random access process and may be in a message 3 in the random access process.

[0083] In an embodiment, the available scheduling resource may include a TBS and a UL transmission repetition count.

[0084] The detection module may include:

[0085] a first determination submodule, configured to determine UL transmission ending time points for respective available scheduling resources based on the TBS and the UL transmission repetition count in respective available scheduling resources, and

[0086] a detection submodule, configured to perform blind detection on the EDT data at respective UL transmission ending time points.

[0087] In an embodiment, the preset rule may be that a HARQ feedback is made based on a maximum UL transmission repetition count;.

[0088] The first determination module may include:

[0089] a second determination submodule, configured to determine the maximum UL transmission repetition count according to the UL transmission repetition count in a respective available scheduling resource;

[0090] a third determination submodule, configured to determine a UL transmission ending time point corresponding to the maximum UL transmission repetition count based on a respective UL transmission ending time point; and

[0091] a fourth determination submodule, configured to determine the HARQ feedback time point based on the UL transmission ending time point corresponding to the maximum UL transmission repetition count, where the determined HARQ feedback time point is at a specified position after the UL transmission ending time point corresponding to the maximum UL transmission repetition count.

[0092] In an embodiment, the HARQ information about the blind detection may include first information indicating successful demodulation or second information indicating unsuccessful demodulation.

[0093] The sending module may include:

[0094] a first sending submodule, configured to send the first information to the terminal at the HARQ feedback time point in response to determining that each blind detection result at each UL transmission ending time point comprises successful demodulation, and

[0095] a second sending submodule, configured to send the second information to the terminal at the HARQ feedback time point in response to determining that each blind detection result does not comprise successful demodulation.

[0096] In an embodiment, the preset rule may be that a HARQ feedback is made for the UL transmission ending time point respectively for each available scheduling resource.

[0097] The first determination module may include:

[0098] a fifth determination submodule, configured to determine a HARQ feedback time point corresponding to any UL transmission ending time point, where the determined HARQ feedback time point is at a specified position after the UL transmission ending time point.

[0099] In an embodiment, the HARQ information about the blind detection may include first information indicating successful demodulation or second information indicating unsuccessful demodulation.

[00100] The sending module may include:

[00101] a third sending submodule, configured to, in response to determining that a blind detection result at any UL transmission ending time point is successful demodulation, send the first information to the terminal at the HARQ feedback time point corresponding to

the UL transmission ending time point, and

[00102] a fourth sending submodule, configured to, in response to determining that the blind detection result is unsuccessful demodulation, send the second information to the terminal at the HARQ feedback time point corresponding to the UL transmission ending time point.

[00103] In an embodiment, the preset rule may be that a HARQ feedback is made only when a blind detection result is successful demodulation.

[00104] The first determination module may include:

[00105] a sixth determination submodule, configured to determine a HARQ feedback time point corresponding to any UL transmission ending time point, where the determined HARQ feedback time point is at a specified position after the UL transmission ending time point.

[00106] In an embodiment, the HARQ information about the blind detection may include the first information indicating successful demodulation.

[00107] The sending module may include:

[00108] a fifth sending submodule, configured to, in response to determining that a blind detection result at any UL transmission ending time point is successful demodulation, send the first information to the terminal at the HARQ feedback time point corresponding to the UL transmission ending time point, and

[00109] a sixth sending submodule, configured to, in response to determining that the blind detection result is unsuccessful demodulation, not perform HARQ feedback at the HARQ feedback time point corresponding to the UL transmission ending time point.

[00110] In an embodiment, the specified position may be configured by the base station and may be in a UL grant in an RAR sent to the terminal by the base station; or

[00111] the preset rule may include third information indicating the specified position, and the third information may indicate a relative relationship between a HARQ feedback time point and a determined UL transmission ending time point.

[00112] According to a fourth aspect of the embodiments of the present disclosure, a HARQ feedback apparatus may be applicable to a terminal. A base station may allocate to the terminal multiple available scheduling resources configured to provide EDT service. The

apparatus may include:

[00113] a selection module, configured to select an available scheduling resource from the multiple available scheduling resources and send EDT data to the base station on the selected available scheduling resource;

[00114] a second determination module, configured to determine a HARQ feedback time point for EDT data according to a preset rule; and

[00115] a third determination module, configured to, in response to that HARQ information sent by the base station is received at the HARQ feedback time point, determine a transmission result of the EDT data based on the HARQ information.

[00116] In an embodiment, the EDT data may be UL data required to be transmitted by the terminal in a random access process and may be in a message 3 in the random access process.

[00117] In an embodiment, the available scheduling resource may include a TBS and a UL transmission repetition count.

[00118] The selection module may include:

[00119] a selection submodule, configured to select the available scheduling resource from the multiple available scheduling resources based on the TBS and the UL transmission repetition count of the multiple available scheduling resources; and

[00120] a sending submodule, configured to send the EDT data to the base station on the selected available scheduling resource.

[00121] In an embodiment, the preset rule may be that a HARQ feedback is made based on a maximum UL transmission repetition count.

[00122] The second determination module may include:

[00123] a first time point determination submodule, configured to determine a UL transmission ending time point for the selected available scheduling resource based on the TBS and the UL transmission repetition count of the selected available scheduling resource;

[00124] a repetition count determination submodule, configured to determine the maximum UL transmission repetition count according to the UL transmission repetition count in the selected available scheduling resource;

[00125] a second time point determination submodule, configured to determine a UL

transmission ending time point corresponding to the maximum UL transmission repetition count based on the UL transmission ending time point, and

[00126] a third time point determination submodule, configured to determine the HARQ feedback time point based on the UL transmission ending time point corresponding to the maximum UL transmission repetition count, where the determined HARQ feedback time point is at a specified position after the UL transmission ending time point corresponding to the maximum UL transmission repetition count.

[00127] In an embodiment, the HARQ information may include first information indicating successful demodulation or second information indicating unsuccessful demodulation.

[00128] The third determination module may include:

[00129] a first receiving submodule, configured to receive the HARQ information from the base station at the HARQ feedback time point,

[00130] a first processing submodule, configured to determine that the transmission result of the EDT data is successful transmission in response to that the HARQ information is the first information, and

[00131] a second processing submodule, configured to determine that the transmission result of the EDT data is unsuccessful transmission in response to that the HARQ information is the second information.

[00132] In an embodiment, the preset rule may be that a HARQ feedback is made for each UL transmission ending time point respectively for each available scheduling resource.

[00133] The second determination module may include:

[00134] a fourth time point determination submodule, configured to determine a UL transmission ending time point corresponding to the selected available scheduling resource based on the TBS and UL transmission repetition count in the selected available scheduling resource, and

[00135] a fifth time point determination submodule, configured to determine a HARQ feedback time point corresponding to the UL transmission ending time point corresponding to the selected available scheduling resource, where the determined HARQ feedback time point is at a specified position after the UL transmission ending time point.

[00136] In an embodiment, the HARQ information may include first information indicating successful demodulation or second information indicating unsuccessful demodulation.

[00137] The third determination module may include:

[00138] a second receiving submodule, configured to receive the HARQ information from the base station at the HARQ feedback time point corresponding to the UL transmission ending time point,

[00139] a third processing submodule, configured to determine that the transmission result of the EDT data is successful transmission when the HARQ information is the first information, and

[00140] a fourth processing submodule, configured to determine that the transmission result of the EDT data is unsuccessful transmission when the HARQ information is the second information.

[00141] In an embodiment, the preset rule may be that a HARQ feedback is made only when a blind detection result is successful demodulation.

[00142] The second determination module may include:

[00143] a sixth time point determination submodule, configured to determine a UL transmission ending time point corresponding to the selected available scheduling resource based on the TBS and UL transmission repetition count in the selected available scheduling resource, and

[00144] a seventh time point determination submodule, configured to determine the HARQ feedback time point corresponding to the UL transmission ending time point corresponding to the selected available scheduling resource, where the determined HARQ feedback time point is at a specified position after the UL transmission ending time point.

[00145] In an embodiment, the HARQ information may include the first information indicating successful demodulation.

[00146] The third determination module may include:

[00147] a fifth processing submodule, configured to, in response to receiving the HARQ information from the base station at the HARQ feedback time point corresponding to the UL transmission ending time point and the HARQ information being the first information,

determine that the transmission result of the EDT data is successful transmission, and

[00148] a sixth processing submodule, configured to, in response to not receiving the HARQ information from the base station at the HARQ feedback time point corresponding to the UL transmission ending time point, determine that the transmission result of the EDT data is unsuccessful transmission.

[00149] In an embodiment, the specified position may be configured by the base station and may be in a UL grant in an RAR sent to the terminal by the base station; or

[00150] the preset rule may include third information indicating the specified position, and the third information may indicate a relative relationship between a HARQ feedback time point and a determined UL transmission ending time point.

[00151] According to a fifth aspect of the embodiments of the present disclosure, a non-transitory computer-readable storage medium has stored computer instructions configured to execute the HARQ feedback method provided in the first aspect.

[00152] According to a sixth aspect of the embodiments of the present disclosure, a non-transitory computer-readable storage medium has stored computer instructions configured to execute the HARQ feedback method provided in the second aspect.

[00153] According to a seventh aspect of the embodiments of the present disclosure, a HARQ feedback apparatus is provided, which may be applicable to a base station that allocates multiple available scheduling resources configured to provide EDT service to a terminal. The apparatus may include:

[00154] memory configured to store instructions executable by a processor,

[00155] wherein the processor may be configured to:

[00156] perform blind detection on EDT data transmitted to the base station by the terminal on respective available scheduling resources;

[00157] determine a HARQ feedback time point for the blind detection according to a preset rule; and

[00158] send HARQ information about the blind detection to the terminal at the HARQ feedback time point.

[00159] According to an eighth aspect of the embodiments of the present disclosure, a HARQ feedback apparatus may be applicable to a terminal. A base station may allocate

multiple available scheduling resources configured to provide EDT service to the terminal. The apparatus may include:

[00160] memory configured to store instructions executable by a processor,

[00161] wherein the processor may be configured to:

[00162] select an available scheduling resource from the multiple available scheduling resources;

[00163] send EDT data to the base station on the selected available scheduling resource;

[00164] determine a HARQ feedback time point for the EDT data according to a preset rule; and

[00165] when HARQ information sent by the base station is received at the HARQ feedback time point, determine a transmission result of the EDT data based on the HARQ information.

[00166] The technical solutions provided in the embodiments of the present disclosure may have the following beneficial effects.

[00167] In the present disclosure, a base station may perform blind detection on EDT data transmitted to the base station by a terminal on each available scheduling resource, determine a HARQ feedback time point for the blind detection according to a preset rule and send HARQ information about the blind detection to the terminal at the HARQ feedback time point. Then, the terminal may receive the HARQ information from the base station at the HARQ feedback time point determined according to the preset rule and determine a correct transmission result of the EDT data based on the HARQ information. Accordingly, the HARQ feedback reliability is improved, and the EDT efficiency is also improved.

[00168] In the present disclosure, the terminal may select an available scheduling resource from multiple available scheduling resources, send the EDT data to the base station on the selected available scheduling resource, determine the HARQ feedback time point for the EDT data according to the preset rule and, when receiving the HARQ information from the base station at the HARQ feedback time point, determine the transmission result of the EDT data based on the HARQ information. Accordingly, the HARQ feedback reliability is improved, and the EDT efficiency is also improved.

[00169] It is to be understood that the above general descriptions and detailed descriptions below are only exemplary and explanatory and not intended to limit the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[00170] The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate embodiments consistent with the present disclosure and, together with the description, serve to explain the principles of the present disclosure.

[00171] FIG. 1 is a flowchart showing a HARQ feedback method according to an exemplary embodiment.

[00172] FIG. 2 is a diagram of an application scenario of a HARQ feedback method according to an exemplary embodiment.

[00173] FIG. 3A is a flowchart showing another HARQ feedback method according to an exemplary embodiment.

[00174] FIG. 3B is an information interaction diagram of a HARQ feedback method according to an exemplary embodiment.

[00175] FIG. 4A is a flowchart showing another HARQ feedback method according to an exemplary embodiment.

[00176] FIG. 4B is an information interaction diagram of another HARQ feedback method according to an exemplary embodiment.

[00177] FIG. 5A is a flowchart showing a HARQ feedback method according to an exemplary embodiment.

[00178] FIG. 5B is an information interaction diagram of a HARQ feedback method according to an exemplary embodiment.

[00179] FIG. 5C is an information interaction diagram of another HARQ feedback method according to an exemplary embodiment.

[00180] FIG. 6A is a flowchart showing a HARQ feedback method according to an exemplary embodiment.

[00181] FIG. 6B is an information interaction diagram of a HARQ feedback method according to an exemplary embodiment.

[00182] FIG. 6C is an information interaction diagram of another HARQ feedback method according to an exemplary embodiment.

[00183] FIG. 7 is a flowchart showing a HARQ feedback method according to an exemplary embodiment.

[00184] FIG. 8 is a flowchart showing another HARQ feedback method according to an exemplary embodiment.

[00185] FIG. 9 is a flowchart showing another HARQ feedback method according to an exemplary embodiment.

[00186] FIG. 10 is a flowchart showing another HARQ feedback method according to an exemplary embodiment.

[00187] FIG. 11 is a flowchart showing another HARQ feedback method according to an exemplary embodiment.

[00188] FIG. 12 is a block diagram of a HARQ feedback apparatus according to an exemplary embodiment.

[00189] FIG. 13 is a block diagram of another HARQ feedback apparatus according to an exemplary embodiment.

[00190] FIG. 14 is a block diagram of another HARQ feedback apparatus according to an exemplary embodiment.

[00191] FIG. 15 is a block diagram of another HARQ feedback apparatus according to an exemplary embodiment.

[00192] FIG. 16 is a block diagram of another HARQ feedback apparatus according to an exemplary embodiment.

[00193] FIG. 17 is a block diagram of another HARQ feedback apparatus according to an exemplary embodiment.

[00194] FIG. 18 is a block diagram of another HARQ feedback apparatus according to an exemplary embodiment.

[00195] FIG. 19 is a block diagram of another HARQ feedback apparatus according to an exemplary embodiment.

[00196] FIG. 20 is a block diagram of a HARQ feedback apparatus according to an exemplary embodiment.

[00197] FIG. 21 is a block diagram of another HARQ feedback apparatus according to an exemplary embodiment.

[00198] FIG. 22 is a block diagram of another HARQ feedback apparatus according to an exemplary embodiment.

[00199] FIG. 23 is a block diagram of another HARQ feedback apparatus according to an exemplary embodiment.

[00200] FIG. 24 is a block diagram of another HARQ feedback apparatus according to an exemplary embodiment.

[00201] FIG. 25 is a block diagram of another HARQ feedback apparatus according to an exemplary embodiment.

[00202] FIG. 26 is a block diagram of another HARQ feedback apparatus according to an exemplary embodiment.

[00203] FIG. 27 is a block diagram of another HARQ feedback apparatus according to an exemplary embodiment.

[00204] FIG. 28 is a structure diagram of a HARQ feedback apparatus according to an exemplary embodiment.

[00205] FIG. 29 is a structure diagram of a HARQ feedback apparatus according to an exemplary embodiment.

DETAILED DESCRIPTION

[00206] 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 present disclosure. Instead, they are merely examples of apparatuses and methods consistent with aspects related to the present disclosure as recited in the appended claims.

[00207] Terms used in the present disclosure are only adopted for describing specific embodiments and not intended to limit the present disclosure. "A/an", "said" and "the" in a

singular form in the present disclosure and the appended claims are also intended to include a plural form, unless other meanings are clearly denoted throughout the present disclosure. It is also to be understood that term "and/or" used in the present disclosure refers to and includes one or any or all possible combinations of multiple associated items that are listed.

[00208] It is to be understood that, although terms first, second, third and the like may be adopted to describe various information in the present disclosure, the information should not be limited to these terms. These terms are only adopted to distinguish the information of the same type. For example, without departing from the scope of the present disclosure, first information may also be called second information and, similarly, second information may also be called first information. For example, term "if" used here may be explained as "while" or "when" or "responsive to determining", which depends on the context.

[00209] FIG. 1 is a flowchart showing a HARQ feedback method according to an exemplary embodiment. FIG. 2 is a diagram of an application scenario of a HARQ feedback method according to an exemplary embodiment. The HARQ feedback method may be applicable to a base station that allocates, to a terminal, multiple available scheduling resources configured to provide EDT service. As shown in FIG. 1, the HARQ feedback method may include the following Operations 110-130.

[00210] In Operation 110, blind detection is performed on EDT data transmitted to the base station by the terminal on respective available scheduling resources.

[00211] In the embodiment of the present disclosure, the base station may provide an EDT service and may allocate multiple available scheduling resources configured to provide the EDT service to a terminal applying for the EDT service.

[00212] For example, the base station may allocate a available scheduling resource 1, a available scheduling resource 2, an available scheduling resource 3 and an available scheduling resource 4 to the terminal. The Number of Resource Units (N_RU) of each of all the available scheduling resource 1, the available scheduling resource 2, the available scheduling resource 3 and the available scheduling resource 4 is 3. However, a TBS and a UL transmission repetition count of the available scheduling resource 1 are 328 bits and 32 respectively. A TBS and a UL transmission repetition count of the available scheduling resource 2 are 536 bits and 48 respectively. A TBS and a UL transmission repetition count of

the available scheduling resource 3 are 776 bits and 64 respectively. A TBS and a UL transmission repetition count of the available scheduling resource 4 are 1,000 bits and 96 respectively.

[00213] In addition, the base station allocates multiple available scheduling resources to the terminal for enabling the terminal to select an available scheduling resource from these available scheduling resources according to its own actual condition and send EDT data to the base station on the selected available scheduling resource. The selected available scheduling resource may be a available scheduling resource actually used by the terminal. However, the base station does not know the specific available scheduling resource to be adopted by the terminal for transmission. Accordingly, the base station may perform blind detection on each available scheduling resource. That is, the base station may perform blind detection on the available scheduling resource actually used by the terminal and may also perform blind detection on the other available scheduling resources.

[00214] In an embodiment, the EDT data may refer to UL data transmitted by the terminal in a random access process and is in a message 3 (scheduled transmission, msg3) in the random access process. That is, the terminal may add the EDT data to the message 3 and send the message 3 to the base station such that the base station can acquire the EDT data transmitted by the terminal from the message 3.

[00215] In an embodiment, the available scheduling resource may include a TBS and a UL transmission repetition count. Operation 110 may be executed in, but not limited to, the following implementation manners:

[00216] (1-1) a UL transmission ending time point is determined respectively for each available scheduling resource based on the TBS and UL transmission repetition count in each available scheduling resource; and

[00217] (1-2) blind detection is performed on the EDT data at each UL transmission ending time point.

[00218] In Operation 120, a HARQ feedback time point for the blind detection is determined according to a preset rule.

[00219] In the embodiment of the present disclosure, since the base station may perform blind detection on the available scheduling resource actually used by the terminal

and may also perform blind detection on the other available scheduling resources, it is needed to determine a specific time point for HARQ feedback.

[00220] In addition, the HARQ feedback time point for the blind detection may be determined according to a preset rule. The preset rule may be written in an EDT protocol such that both the base station and the terminal can acquire the preset rule according to the EDT protocol.

[00221] Moreover, for meeting different requirements of the base station and the terminal, the predefined preset rule may include, but not limited to, the following three conditions, but the base station and the terminal may negotiate about the specific preset rule to be adopted by the base station and the terminal in advance.

[00222] (2-1) The preset rule is that a HARQ feedback is made based on a maximum UL transmission repetition count. Details about a specific implementation process may refer to the embodiment shown in FIG. 4A.

[00223] (2-2) The preset rule is that a HARQ feedback is made for a UL transmission ending time point respectively for each available scheduling resource. Details about a specific implementation process may refer to the embodiment shown in FIG. 5A.

[00224] (2-3) The preset rule is that a HARQ feedback is made only when a blind detection result is successful demodulation. Details about a specific implementation process may refer to the embodiment shown in FIG. 6A.

[00225] In Operation 130, HARQ information about the blind detection is sent to the terminal at the HARQ feedback time point.

[00226] In the embodiment of the present disclosure, after the base station sends the HARQ information to the terminal at the HARQ feedback time point, the terminal, after receiving the HARQ information from the base station at the HARQ feedback time point determined according to the preset rule, may determine a transmission result of the EDT data based on the HARQ information.

[00227] In the application scenario shown in FIG. 2, a terminal and a base station are included. The base station may allocate multiple available scheduling resources to the terminal, for example, an available scheduling resource 1, a available scheduling resource 2, an available scheduling resource 3 and an available scheduling resource 4. The terminal may

select an available scheduling resource from these available scheduling resources. For example, the selected available scheduling resource may be the available scheduling resource 2. In such case, the terminal may send EDT data to the base station on the available scheduling resource 2. The base station, although allocating the multiple available scheduling resources to the terminal, does not know that the terminal transmits the data on the available scheduling resource 2. Accordingly, the base station is required to perform blind detection on the EDT data on each available scheduling resource, determine a HARQ feedback time point for the blind detection according to a preset rule and send HARQ information about the blind detection to the terminal at the HARQ feedback time point. Then, the terminal, after receiving the HARQ information from the base station at the HARQ feedback time point determined according to the preset rule, may determine a transmission result of the EDT data based on the HARQ information. Therefore, the EDT reliability is improved.

[00228] It can be seen from the embodiment that, blind detection may be performed on the EDT data transmitted to the base station by the terminal on each available scheduling resource. The HARQ feedback time point for the blind detection may be determined according to the preset rule. The HARQ information about the blind detection may be sent to the terminal at the HARQ feedback time point. Then, the terminal may receive the HARQ information from the base station at the HARQ feedback time point determined according to the preset rule and determine a correct transmission result of the EDT data based on the HARQ information. Accordingly, the HARQ feedback reliability is improved, and the EDT efficiency is also improved.

[00229] FIG. 3A is a flowchart showing another HARQ feedback method according to an exemplary embodiment. The HARQ feedback method may be applicable to a base station that allocates, to a terminal, multiple available scheduling resources configured to provide EDT service. Based on the method shown in FIG. 1, the available scheduling resource includes the TBS and the UL transmission repetition count. When Operation 110 is executed, as shown in FIG. 3A, the following Operations 310-320 may be included.

[00230] In Operation 310, UL transmission ending time points are determined for respective available scheduling resources based on the TBS and UL transmission repetition count in respective available scheduling resources.

[00231] In the embodiment of the present disclosure, the amount of the UL transmission ending time points may be determined according to the amount of the TBSs. For example, the number of the TBSs is 4, and the number of the UL transmission ending time points is also 4. Since the terminal have four possible TBS choices corresponding to four different UL transmission repetition counts, there may be four possible UL transmission ending time points during EDT. As shown in FIG. 3B, the four possible UL transmission ending time points may be a possible UL transmission ending time point #1, a possible UL transmission ending time point #2, a possible UL transmission ending time point #3 and a possible UL transmission ending time point #4 respectively.

[00232] In Operation 320, blind detection is performed on the EDT data at respective UL transmission ending time points.

[00233] It can be seen from the embodiment that the UL transmission ending time point may be determined respectively for each available scheduling resource based on the TBS and UL transmission repetition count in each available scheduling resource, and blind detection may be performed on the EDT data at each UL transmission ending time point. Accordingly, the blind detection accuracy is improved.

[00234] FIG. 4A is a flowchart showing another HARQ feedback method according to an exemplary embodiment. The HARQ feedback method may be applicable to a base station that allocates, to a terminal, multiple available scheduling resources configured to provide EDT service. Based on the method shown in FIG. 1, the preset rule is that a HARQ feedback is made based on the maximum UL transmission repetition count. When Operation 120 is executed, as shown in FIG. 4A, the following Operations 410-430 may be included.

[00235] In Operation 410, the maximum UL transmission repetition count is determined according to the UL transmission repetition count in a respective available scheduling resource.

[00236] In the embodiment of the present disclosure, the UL transmission repetition count in each available scheduling resource may be different from each other. The maximum UL transmission repetition count may be determined from these different UL transmission repetition counts.

[00237] For example, the base station may allocate the available scheduling resource 1,

the available scheduling resource 2, the available scheduling resource 3 and the available scheduling resource 4 to the terminal. UL transmission repetition counts of the available scheduling resource 1, the available scheduling resource 2, the available scheduling resource 3 and the available scheduling resource 4 are 32, 48, 64 and 96 respectively. In such case, the maximum UL transmission repetition count is 96.

[00238] In Operation 420, a UL transmission ending time point corresponding to the maximum UL transmission repetition count is determined based on a respective UL transmission ending time point.

[00239] In the embodiment of the present disclosure, the maximum UL transmission repetition count corresponds to maximum possible transmission time point. That is, the maximum possible transmission time point may be determined by the maximum UL transmission repetition count. Moreover, the UL transmission ending time point corresponding to the maximum UL transmission repetition count may be the last UL transmission ending time point among the UL transmission ending time points. As shown in FIG. 3B, the last UL transmission ending time point may be the possible UL transmission ending time point #4.

[00240] In Operation 430, the HARQ feedback time point is determined based on the UL transmission ending time point corresponding to the maximum UL transmission repetition count, where the determined HARQ feedback time point is at a specified position after the UL transmission ending time point corresponding to the maximum UL transmission repetition count.

[00241] In the embodiment of the present disclosure, the specified position may be a preset fixed value or a numerical value determined by the base station according to an actual condition. For example, the specified position may be a specified number of subframes. Moreover, a value of the specified number is usually larger than or equal to 4. If one subframe is 1ms, then four subframes is 4ms.

[00242] For example, the specified position may be a position after a specified number of subframes. That is, the HARQ feedback time is a sum of the maximum possible transmission time (the maximum possible transmission time is determined by the maximum UL transmission repetition count) and the specified number of subframes. As shown in FIG.

3B, the UL transmission ending time point corresponding to the maximum UL transmission repetition count is the possible UL transmission ending time point #4. The possible UL transmission ending time point #4 is set as a HARQ feedback reference point. A position after the specified number of subframes relative to the HARQ feedback reference point is determined as the HARQ feedback time point.

[00243] For another example, the specified position may be a first downlink control channel transmission position after the specified number of subframes. A possible downlink control channel transmission position shown in FIG. 4B may be determined as the HARQ feedback time point.

[00244] In an embodiment, the specified position is configured by the base station and is in a UL grant in a random access preamble (RAR). That is, the base station may add the specified position to the UL grant in the RAR and send the RAR to the terminal. The terminal may determine the specified position configured by the base station according to the RAR. Or, the preset rule includes third information indicating the specified position, and the third information indicates a relative relationship between a HARQ feedback time point and a determined UL transmission ending time point. That is, a specific content of the specified position is fixedly written in the preset rule. Accordingly, both the base station and the terminal can determine the specified position based on the third information in the preset rule.

[00245] In an embodiment, the HARQ information about the blind detection may include first information indicating successful demodulation or second information indicating unsuccessful demodulation. When Operation 130 is executed, as shown in FIG. 4A, the following Operations 440-450 may be included.

[00246] In Operation 440, for a blind detection result at each UL transmission ending time point, when each blind detection result includes successful demodulation, the first information indicating successful demodulation is sent to the terminal at the HARQ feedback time point.

[00247] In the embodiment of the present disclosure, the blind detection result at each UL transmission ending time point may be successful demodulation or unsuccessful demodulation. As shown in FIG. 3B, when a blind detection result of the possible UL transmission ending time point #1 is unsuccessful demodulation, a blind detection result of

the possible UL transmission ending time point #2 is successful demodulation, a blind detection result of the possible UL transmission ending time point #3 is unsuccessful demodulation and a blind detection result of the possible UL transmission ending time point #4 is unsuccessful demodulation, the first information indicating successful demodulation may be sent to the terminal at the determined HARQ feedback time point.

[00248] In Operation 450, when each blind detection result does not include successful demodulation, the second information indicating unsuccessful demodulation is sent to the terminal at the HARQ feedback time point.

[00249] In the embodiment of the present disclosure, the blind detection result may be successful demodulation or unsuccessful demodulation. As shown in FIG. 3B, when the blind detection result of the possible UL transmission ending time point #1 is unsuccessful demodulation, the blind detection result of the possible UL transmission ending time point #2 is unsuccessful demodulation, the blind detection result of the possible UL transmission ending time point #3 is unsuccessful demodulation and the blind detection result of the possible UL transmission ending time point #4 is unsuccessful demodulation, the second information indicating unsuccessful demodulation may be sent to the terminal at the determined HARQ feedback time point.

[00250] It can be seen from the embodiment that, when the preset rule is that a HARQ feedback is made based on the maximum UL transmission repetition count, the maximum UL transmission repetition count may be determined based on the UL transmission repetition count in each available scheduling resource. The UL transmission ending time point corresponding to the maximum UL transmission repetition count may be determined. The HARQ feedback time point may be determined based on the UL transmission ending time point corresponding to the maximum UL transmission repetition count. The determined HARQ feedback time point may be at a specified position after the UL transmission ending time point corresponding to the maximum UL transmission repetition count. Accordingly, a function of performing HARQ feedback based on the maximum UL transmission repetition count is realized, the terminal can receive correct HARQ information, and the quality of service of HARQ feedback is also improved.

[00251] FIG. 5A is a flowchart showing another HARQ feedback method according to

an exemplary embodiment. The HARQ feedback method may be applicable to a base station that allocates multiple available scheduling resources configured to provide EDT service to a terminal. Based on the method shown in FIG. 1, the preset rule is that a HARQ feedback is made for the UL transmission ending time point respectively for each available scheduling resource. When Operation 120 is executed, as shown in FIG. 5A, the following Operation 510 may be included.

[00252] In Operation 510, for any UL transmission ending time point, a HARQ feedback time point corresponding to the UL transmission ending time point is determined, the determined HARQ feedback time point being at a specified position after the UL transmission ending time point.

[00253] In the embodiment of the present disclosure, for each UL transmission ending time point, the base station is required to determine a HARQ feedback time point corresponding to the UL transmission ending time point. For example, as shown in FIG. 3B, the four possible UL transmission ending time points may be the possible UL transmission ending time point #1, the possible UL transmission ending time point #2, the possible UL transmission ending time point #3 and the possible UL transmission ending time point #4 respectively. The base station is required to determine respective HARQ feedback time points corresponding to the four possible UL transmission ending time points.

[00254] In addition, a specified position after each UL transmission ending time point may be a preset fixed value or a numerical value determined by the base station according to the actual condition. For example, the specified position is a specified number of subframes.

[00255] For example, the specified position may be a position after the specified number of subframes. In such case, the determined HARQ feedback time points are positions after the specified number of subframes after the UL transmission ending time points, i.e., a HARQ feedback time point of #1, HARQ feedback time point of #2, HARQ feedback time point of #3 and HARQ feedback time point of #4 in FIG. 5B. Acknowledgement (ACK) is the first information indicating successful demodulation, and Negative Acknowledgement (NACK) is the second information indicating unsuccessful demodulation.

[00256] For another example, the specified position may be a first downlink control channel transmission position after the specified number of subframes. In such case, the

determined HARQ feedback time points are first downlink control channel transmission positions after the specified number of subframes after respective UL transmission ending time points, i.e., a possible downlink control channel transmission position of #1, a possible downlink control channel transmission position of #2, a possible downlink control channel transmission position of #3 and a possible downlink control channel transmission position of #4 in FIG. 5C. ACK is the first information indicating successful demodulation, and NACK is the second information indicating unsuccessful demodulation.

[00257] In an embodiment, the specified position may be configured by the base station and may be in a UL grant in an RAR sent to the terminal by the base station. That is, the base station may add the specified position to the UL grant in the RAR and send the RAR to the terminal. Then, the terminal may determine the specified position configured by the base station according to the RAR. Or, the preset rule includes third information indicating the specified position, and the third information indicates a relative relationship between a HARQ feedback time point and a determined UL transmission ending time point. That is, a specific content of the specified position is fixedly written in the preset rule. Accordingly, both the base station and the terminal can determine the specified position based on the third information in the preset rule.

[00258] In an embodiment, the HARQ information about the blind detection may include first information indicating successful demodulation or second information indicating unsuccessful demodulation. When Operation 130 is executed, as shown in FIG. 5A, the following Operations 520-530 may be included.

[00259] In Operation 520, for a blind detection result of any UL transmission ending time point, when the blind detection result is successful demodulation, the first information indicating successful demodulation is sent to the terminal at the HARQ feedback time point corresponding to the UL transmission ending time point.

[00260] In Operation 530, when the blind detection result is unsuccessful demodulation, the second information indicating unsuccessful demodulation is sent to the terminal at the HARQ feedback time point corresponding to the UL transmission ending time point.

[00261] It can be seen from the embodiment that, when the preset rule is that a HARQ

feedback is made for the UL transmission ending time point respectively for each available scheduling resource, the HARQ feedback time point corresponding to each UL transmission ending time point may be determined at first. For a blind detection result at any UL transmission ending time point, when the blind detection result is successful demodulation, the first information indicating successful demodulation may be sent to the terminal at the HARQ feedback time point corresponding to the UL transmission ending time point. When the blind detection result is unsuccessful demodulation, the second information indicating unsuccessful demodulation may be sent to the terminal at the HARQ feedback time point corresponding to the UL transmission ending time point. Accordingly, a function of performing HARQ feedback for each UL transmission ending time point respectively for each available scheduling resource is realized, the terminal can receive the correct HARQ information, and a service style of HARQ feedback is further enriched.

[00262] FIG. 6A is a flowchart showing another HARQ feedback method according to an exemplary embodiment. The HARQ feedback method may be applicable to a base station that allocates multiple available scheduling resources configured to provide EDT service to a terminal. Based on the method shown in FIG. 3A, the preset rule is that a HARQ feedback is made only when the blind detection result is successful demodulation. When Operation 120 is executed, as shown in FIG. 6A, the following Operation 610 may be included.

[00263] In Operation 610, for any UL transmission ending time point, a HARQ feedback time point corresponding to the UL transmission ending time point is determined, the determined HARQ feedback time point being at a specified position after the UL transmission ending time point.

[00264] In the embodiment of the present disclosure, for each UL transmission ending time point, the base station is required to determine each HARQ feedback time point corresponding to each UL transmission ending time point. For example, as shown in FIG. 3B, the four possible UL transmission ending time points may be the possible UL transmission ending time point #1, the possible UL transmission ending time point #2, the possible UL transmission ending time point #3 and the possible UL transmission ending time point #4 respectively. The base station is required to determine respective HARQ feedback time points corresponding to the four possible UL transmission ending time points.

[00265] In addition, a specified position after each UL transmission ending time point may be a preset fixed value or a numerical value determined by the base station according to the actual condition. For example, the specified position may be a specified number of subframes.

[00266] For example, the specified position may be a position after the specified number of subframes. In such case, the determined HARQ feedback time points are positions after the specified number of subframes after respective UL transmission ending time points. The possible UL transmission ending time point #2 shown in FIG. 6B is an actual transmission ending time point. ACK is the first information indicating successful demodulation. That is, only when the blind detection result at the possible UL transmission ending time point #2 is successful demodulation, the first information indicating successful demodulation, i.e., the ACK, is sent to the terminal at a position after the specified number of subframes.

[00267] For another example, the specified position may be a first downlink control channel transmission position after the specified number of subframes. In such case, the determined HARQ feedback time points are first downlink control channel transmission positions after the specified number of subframes after respective UL transmission ending time points. The possible UL transmission ending time point #2 shown in FIG. 6C is an actual transmission ending time point. ACK is the first information indicating successful demodulation. That is, only when the blind detection result at the possible UL transmission ending time point #2 is successful demodulation, the first information indicating successful demodulation, i.e., the ACK, is sent to the terminal at a possible downlink control channel transmission position.

[00268] In an embodiment, the specified position may be configured by the base station and may be in a UL grant in an RAR sent to the terminal by the base station. That is, the base station may add the specified position to the UL grant in the RAR and send the RAR to the terminal. Then, the terminal may determine the specified position configured by the base station according to the RAR. Or, the preset rule includes third information indicating the specified position, and the third information indicates a relative relationship between a HARQ feedback time point and a determined UL transmission ending time point. That is, a

specific content of the specified position is fixedly written in the preset rule. Accordingly, both the base station and the terminal can determine the specified position based on the third information in the preset rule.

[00269] In an embodiment, the HARQ information about the blind detection may include the first information indicating successful demodulation. When Operation 130 is executed, as shown in FIG. 6A, the following Operations 620-630 may be included.

[00270] In Operation 620, for a blind detection result at any UL transmission ending time point, when the blind detection result is successful demodulation, the first information representing successful demodulation is sent to the terminal at the HARQ feedback time point corresponding to the UL transmission ending time point.

[00271] In Operation 630, when the blind detection result is unsuccessful demodulation, HARQ feedback is not made at the HARQ feedback time point corresponding to the UL transmission ending time point.

[00272] It can be seen from the embodiment that, when the preset rule is that a HARQ feedback is made only when the blind detection result is successful demodulation, each HARQ feedback time point corresponding to each UL transmission ending time point may be determined at first. For a blind detection result at any UL transmission ending time point, when the blind detection result is successful demodulation, the first information representing successful demodulation is sent to the terminal at the HARQ feedback time point corresponding to the UL transmission ending time point. When the blind detection result is unsuccessful demodulation, HARQ feedback is not made at the HARQ feedback time point corresponding to the UL transmission ending time point. Accordingly, a function of performing HARQ feedback only when the blind detection result is successful demodulation is realized, and on the premise of ensuring that the terminal can receive the correct HARQ information, a HARQ feedback content and a feedback frequency are reduced and the HARQ feedback efficiency is improved.

[00273] FIG. 7 is a flowchart showing a HARQ feedback method according to an exemplary embodiment. The HARQ feedback method may be applicable to a terminal. A base station may allocate, to the terminal, multiple available scheduling resources configured to provide EDT service. As shown in FIG. 7, the HARQ feedback method may include the

following Operations 710-730.

[00274] In Operation 710, an available scheduling resource is selected from the multiple available scheduling resources, and EDT data is sent to the base station on the selected available scheduling resource.

[00275] In an embodiment, the EDT data may be UL data required to be transmitted by the terminal in a random access process and may be in a message 3 in the random access process. That is, the terminal may add the EDT data to the message 3 and send the message 3 to the base station such that the base station can acquire the EDT data transmitted by the terminal from the message 3.

[00276] In Operation 720, a HARQ feedback time point for the EDT data is determined according to a preset rule.

[00277] In the embodiment of the present disclosure, for meeting different requirements of the base station and the terminal, the predefined preset rule may include, but not limited to, the following three conditions, but the base station and the terminal may negotiate about the specific preset rule to be adopted by the base station and the terminal in advance.

[00278] (3-1) The preset rule is that a HARQ feedback is made based on a maximum UL transmission repetition count. Details about a specific implementation process may refer to the embodiment shown in FIG. 9.

[00279] (3-2) The preset rule is that a HARQ feedback is made for each UL transmission ending time point respectively for each available scheduling resource. Details about a specific implementation process may refer to the embodiment shown in FIG. 10.

[00280] (3-3) The preset rule is that a HARQ feedback is made only when a blind detection result is successful demodulation. Details about a specific implementation process may refer to the embodiment shown in FIG. 11.

[00281] In Operation 730, when HARQ information sent by the base station is received at the HARQ feedback time point, a transmission result of the EDT data is determined based on the HARQ information.

[00282] It can be seen from the embodiment that an available scheduling resource may be selected from the multiple available scheduling resources, the EDT data may be sent to the

base station on the selected available scheduling resource, the HARQ feedback time point for the EDT data may be determined according to the preset rule. In response to that the HARQ information sent by the base station is received at the HARQ feedback time point, the transmission result of the EDT data may be determined based on the HARQ information. Accordingly, the HARQ feedback reliability is improved, and the EDT efficiency is also improved.

[00283] FIG. 8 is a flowchart showing another HARQ feedback method according to an exemplary embodiment. The HARQ feedback method may be applicable to a terminal. A base station may allocate multiple available scheduling resources configured to provide EDT service to the terminal. Based on the method shown in FIG. 7, the available scheduling resource includes a TBS and a UL transmission repetition count. When Operation 710 is executed, as shown in FIG. 8, the following Operations 810-820 may be included.

[00284] In Operation 810, the available scheduling resource is selected from the multiple available scheduling resources based on the TBS and UL transmission repetition count of the multiple available scheduling resources.

[00285] In Operation 820, the EDT data is sent to the base station on the selected available scheduling resource.

[00286] It can be seen from the embodiment that an available scheduling resource may be selected from the multiple available scheduling resources based on the TBS and UL transmission repetition count in each available scheduling resource and the EDT data may be sent to the base station on the selected available scheduling resource. Accordingly, the available scheduling resource may be selected accurately.

[00287] FIG. 9 is a flowchart showing another HARQ feedback method according to an exemplary embodiment. The HARQ feedback method may be applicable to a terminal. A base station may allocate multiple available scheduling resources configured to provide EDT service to the terminal. Based on the method shown in FIG. 8, the preset rule is that a HARQ feedback is made based on the maximum UL transmission repetition count. When Operation 720 is executed, as shown in FIG. 9, the following Operations 910-950 may be included.

[00288] In Operation 910, a UL transmission ending time point is determined for the selected available scheduling resource based on the TBS and the UL transmission repetition

count of the selected available scheduling resource.

[00289] In Operation 920, the maximum UL transmission repetition count is determined according to the UL transmission repetition count in the selected available scheduling resource.

[00290] In Operation 930, the UL transmission ending time point corresponding to the maximum UL transmission repetition count is determined based on the UL transmission ending time point.

[00291] In Operation 940, the HARQ feedback time point is determined based on the UL transmission ending time point corresponding to the maximum UL transmission repetition count, the determined HARQ feedback time point being at a specified position after the UL transmission ending time point corresponding to the maximum UL transmission repetition count.

[00292] In an embodiment, the specified position may be configured by the base station and may be in a UL grant in an RAR sent to the terminal by the base station. That is, the base station may add the specified position to the UL grant in the RAR and send the RAR to the terminal. Thus, the terminal may determine the specified position configured by the base station according to the RAR. Or, the preset rule includes third information indicating the specified position, and the third information indicates a relative relationship between a HARQ feedback time point and a determined UL transmission ending time point. That is, a specific content of the specified position is fixedly written in the preset rule. Accordingly, both the base station and the terminal may determine the specified position based on the third information in the preset rule.

[00293] In an embodiment, the HARQ information may include first information indicating successful demodulation or second information indicating unsuccessful demodulation. When Operation 730 is executed, as shown in FIG. 9, the following Operations 950-970 may be included.

[00294] In Operation 950, the HARQ information sent by the base station is received at the HARQ feedback time point.

[00295] In Operation 960, in response to that the HARQ information is the first information indicating successful demodulation, it is determined that the transmission result

of the EDT data is successful transmission.

[00296] In Operation 970, in response to that the HARQ information is the second information indicating unsuccessful demodulation, it is determined that the transmission result of the EDT data is unsuccessful transmission.

[00297] It can be seen from the embodiment that, when the preset rule is that a HARQ feedback is made based on the maximum UL transmission repetition count, the maximum UL transmission repetition count may be determined based on the TBS and UL transmission repetition count in each available scheduling resource, each UL transmission ending time point may be determined respectively for each available scheduling resource, the UL transmission ending time point corresponding to the maximum UL transmission repetition count may be determined, and the HARQ feedback time point may be determined based on the UL transmission ending time point corresponding to the maximum UL transmission repetition count, the determined HARQ feedback time point being at a specified position after the UL transmission ending time point corresponding to the maximum UL transmission repetition count. Accordingly, a function of performing HARQ feedback based on the maximum UL transmission repetition count is realized, the terminal can receive correct HARQ information, and the quality of service of HARQ feedback is also improved.

[00298] FIG. 10 is a flowchart showing another HARQ feedback method according to an exemplary embodiment. The HARQ feedback method may be applicable to a terminal. A base station may allocate multiple available scheduling resources configured to provide EDT service to the terminal. Based on the method shown in FIG. 8, the preset rule is that a HARQ feedback is made for each UL transmission ending time point respectively for each available scheduling resource. When Operation 720 is executed, as shown in FIG. 10, the following Operations 1010-1020 may be included.

[00299] In Operation 1010, the UL transmission ending time point corresponding to the selected available scheduling resource is determined based on the TBS and UL transmission repetition count in the selected available scheduling resource.

[00300] In Operation 1020, for the UL transmission ending time point corresponding to the selected available scheduling resource, a HARQ feedback time point corresponding to the UL transmission ending time point is determined, the determined HARQ feedback time

point being at a specified position after the UL transmission ending time point.

[00301] In an embodiment, the specified position may be configured by the base station and is in a UL grant in an RAR sent to the terminal by the base station. That is, the base station may add the specified position to the UL grant in the RAR and send the RAR to the terminal. Thus, the terminal may determine the specified position configured by the base station according to the RAR. Or, the preset rule includes third information indicating the specified position, and the third information indicates a relative relationship between a HARQ feedback time point and a determined UL transmission ending time point. That is, a specific content of the specified position is fixedly written in the preset rule. Accordingly, both the base station and the terminal can determine the specified position based on the third information in the preset rule.

[00302] In an embodiment, the HARQ information may include first information indicating successful demodulation or second information indicating unsuccessful demodulation. When Operation 730 is executed, as shown in FIG. 10, the following Operations 1030-1050 may be included.

[00303] In Operation 1030, the HARQ information sent by the base station is received at the HARQ feedback time point corresponding to the UL transmission ending time point.

[00304] In Operation 1040, when the HARQ information is the first information indicating successful demodulation, it is determined that the transmission result of the EDT data is successful transmission.

[00305] In Operation 1050, when the HARQ information is the second information indicating unsuccessful demodulation, it is determined that the transmission result of the EDT data is unsuccessful transmission.

[00306] It can be seen from the embodiment that, when the preset rule is that a HARQ feedback is made for each UL transmission ending time point respectively for each available scheduling resource, a UL transmission ending time point corresponding to the selected available scheduling resource and a HARQ feedback time point corresponding to the UL transmission ending time point may be determined only. HARQ information sent by the base station may be received at the HARQ feedback time point corresponding to the UL transmission ending time point. When the HARQ information is the first information

indicating successful demodulation, it can be determined that the transmission result of the EDT data is successful transmission. When the HARQ information is the second information indicating unsuccessful demodulation, it can be determined that the transmission result of the EDT data is unsuccessful transmission. Accordingly, the accuracy of the transmission result is improved.

[00307] FIG. 11 is a flowchart showing another HARQ feedback method according to an exemplary embodiment. The HARQ feedback method may be applicable to a terminal. A base station may allocate multiple available scheduling resources configured to provide EDT service to the terminal. Based on the method shown in FIG. 8, the preset rule is that a HARQ feedback is made only when a blind detection result is successful demodulation. When Operation 720 is executed, as shown in FIG. 11, the following Operations 1110-1120 may be included.

[00308] In Operation 1110, the UL transmission ending time point corresponding to the selected available scheduling resource is determined based on the TBS and UL transmission repetition count in the selected available scheduling resource.

[00309] In Operation 1120, for the UL transmission ending time point corresponding to the selected available scheduling resource, a HARQ feedback time point corresponding to the UL transmission ending time point is determined, the determined HARQ feedback time point being at the specified position after the UL transmission ending time point.

[00310] In an embodiment, the specified position may be configured by the base station and may be in a UL grant in an RAR sent to the terminal by the base station. That is, the base station may add the specified position to the UL grant in the RAR and send the RAR to the terminal. Thus, the terminal may determine the specified position configured by the base station according to the RAR. Or, the preset rule includes third information indicating the specified position, and the third information indicates a relative relationship between a HARQ feedback time point and a determined UL transmission ending time point. That is, a specific content of the specified position is fixedly written in the preset rule. Accordingly, both the base station and the terminal may determine the specified position based on the third information in the preset rule.

[00311] In an embodiment, the HARQ information may include the first information

indicating successful demodulation. When Operation 730 is executed, as shown in FIG. 11, the following Operations 1130-1140 may be included.

[00312] In Operation 1130, when the HARQ information sent by the base station is received at the HARQ feedback time point corresponding to the UL transmission ending time point and the HARQ information is the first information indicating successful demodulation, it is determined that the transmission result of the EDT data is successful transmission.

[00313] In Operation 1140, when the HARQ information sent by the base station is not received at the HARQ feedback time point corresponding to the UL transmission ending time point, it is determined that the transmission result of the EDT data is unsuccessful transmission.

[00314] It can be seen from the embodiment that, when the preset rule is that a HARQ feedback is made only when the blind detection result is successful demodulation, the UL transmission ending time point corresponding to the selected available scheduling resource and the HARQ feedback time point corresponding to the UL transmission ending time point may be determined only. When the HARQ information sent by the base station is received at the HARQ feedback time point corresponding to the UL transmission ending time point and the HARQ information is the first information indicating successful demodulation, it may be determined that the transmission result of the EDT data is successful transmission. When the HARQ information is not received at the HARQ feedback time point corresponding to the UL transmission ending time point, it may be determined that the transmission result of the EDT data is unsuccessful transmission. Accordingly, the accuracy of the transmission result is ensured, in addition, a HARQ feedback content and a feedback frequency are also reduced, and the HARQ feedback efficiency is improved.

[00315] Corresponding to the embodiments of the HARQ feedback methods, the present disclosure also provides embodiments of HARQ feedback apparatuses.

[00316] FIG. 12 is a block diagram of a HARQ feedback apparatus according to an exemplary embodiment. The apparatus may be applicable to a base station that allocates, to a terminal, multiple available scheduling resources configured to provide EDT service. The base station is configured to execute the HARQ feedback method shown in FIG. 1. As shown in FIG. 12, the HARQ feedback apparatus may include:

[00317] a detection module 121, configured to perform blind detection on EDT data transmitted to the base station by the terminal on respective available scheduling resources;

[00318] a first determination module 122, configured to determine a HARQ feedback time point for the blind detection according to a preset rule; and

[00319] a sending module 123, configured to send HARQ information about the blind detection to the terminal at the HARQ feedback time point.

[00320] It can be seen from the embodiment that, blind detection may be performed on the EDT data transmitted to the base station by the terminal on each available scheduling resource, the HARQ feedback time point for the blind detection may be determined according to the preset rule, the HARQ information about the blind detection may be sent to the terminal at the HARQ feedback time point. Thus, the terminal may receive the HARQ information from the base station at the HARQ feedback time point determined according to the preset rule and determine a correct transmission result of the EDT data based on the HARQ information. Accordingly, the HARQ feedback reliability is improved, and the EDT efficiency is also improved.

[00321] In an embodiment, based on the apparatus shown in FIG. 12, the EDT data may be UL data transmitted by the terminal in a random access process and may be in a message 3 in the random access process.

[00322] In an embodiment, based on the apparatus shown in FIG. 12, the available scheduling resource may include a TBS and a UL transmission repetition count. As shown in FIG. 13, the detection module 121 may include:

[00323] a first determination submodule 131, configured to determine UL transmission ending time points for respective available scheduling resources based on the TBS and the UL transmission repetition count in respective available scheduling resources; and

[00324] a detection submodule 132, configured to perform blind detection on the EDT data at respective UL transmission ending time points.

[00325] It can be seen from the embodiment that the UL transmission ending time point may be determined respectively for each available scheduling resource based on the TBS and UL transmission repetition count in each available scheduling resource and blind detection may be performed on the EDT data at each UL transmission ending time point.

Accordingly, the blind detection accuracy is improved.

[00326] In an embodiment, based on the apparatus shown in FIG. 13, the preset rule is that a HARQ feedback is made based on a maximum UL transmission repetition count. As shown in FIG. 14, the first determination module 122 may include:

[00327] a second determination submodule 141, configured to determine the maximum UL transmission repetition count according to the UL transmission repetition count in a respective available scheduling resource;

[00328] a third determination submodule 142, configured to determine a UL transmission ending time point corresponding to the maximum UL transmission repetition count based on a respective UL transmission ending time point; and

[00329] a fourth determination submodule 143, configured to determine the HARQ feedback time point based on the UL transmission ending time point corresponding to the maximum UL transmission repetition count, the determined HARQ feedback time point being at a specified position after the UL transmission ending time point corresponding to the maximum UL transmission repetition count.

[00330] In an embodiment, based on the apparatus shown in FIG. 14, the HARQ information about the blind detection may include first information indicating successful demodulation or second information indicating unsuccessful demodulation. As shown in FIG. 15, the sending module 123 may include:

[00331] a first sending submodule 151, configured to, for each blind detection result at each UL transmission ending time point, when each blind detection result includes successful demodulation, send the first information to the terminal at the HARQ feedback time point; and

[00332] a second sending submodule 152, configured to, when each blind detection result does not include successful demodulation, send the second information to the terminal at the HARQ feedback time point.

[00333] It can be seen from the embodiment that, when the preset rule is that a HARQ feedback is made based on the maximum UL transmission repetition count, the maximum UL transmission repetition count may be determined according to the UL transmission repetition count in each available scheduling resource. The UL transmission ending time point

corresponding to the maximum UL transmission repetition count may be determined and the HARQ feedback time point may be determined based on the UL transmission ending time point corresponding to the maximum UL transmission repetition count, the determined HARQ feedback time point being at a specified position after the UL transmission ending time point corresponding to the maximum UL transmission repetition count. Accordingly, a function of performing HARQ feedback based on the maximum UL transmission repetition count is realized, the terminal can receive correct HARQ information, and the quality of service of HARQ feedback is also improved.

[00334] In an embodiment, based on the apparatus shown in FIG. 13, the preset rule is that a HARQ feedback is made for each UL transmission ending time point respectively for each available scheduling resource. As shown in FIG. 16, the first determination module 122 may include:

[00335] a fifth determination submodule 161, configured to, for any UL transmission ending time point, determine a HARQ feedback time point corresponding to the UL transmission ending time point, the determined HARQ feedback time point being at a specified position after the UL transmission ending time point.

[00336] In an embodiment, based on the apparatus shown in FIG. 16, as shown in FIG. 17, the sending module 123 may include:

[00337] a third sending submodule 171, configured to, for a blind detection result at any UL transmission ending time point, when the blind detection result is successful demodulation, send the first information to the terminal at the HARQ feedback time point corresponding to the UL transmission ending time point; and

[00338] a fourth sending submodule 172, configured to, when the blind detection result is unsuccessful demodulation, send the second information to the terminal at the HARQ feedback time point corresponding to the UL transmission ending time point.

[00339] It can be seen from the embodiment that, when the preset rule is that a HARQ feedback is made for each UL transmission ending time point respectively for each available scheduling resource, each HARQ feedback time point corresponding to each UL transmission ending time point may be determined at first. For a blind detection result at any UL transmission ending time point, when the blind detection result is successful demodulation,

the first information indicating successful demodulation may be sent to the terminal at the HARQ feedback time point corresponding to the UL transmission ending time point. When the blind detection result is unsuccessful demodulation, the second information indicating unsuccessful demodulation may be sent to the terminal at the HARQ feedback time point corresponding to the UL transmission ending time point. Accordingly, a function of performing HARQ feedback for each UL transmission ending time point respectively for each available scheduling resource is realized, the terminal can receive the correct HARQ information, and a service style of HARQ feedback is further enriched.

[00340] In an embodiment, based on the apparatus shown in FIG. 13, the preset rule is that a HARQ feedback is made only when the blind detection result is successful demodulation. As shown in FIG. 18, the first determination module 122 may include:

[00341] a sixth determination submodule 181, configured to, for any UL transmission ending time point, determine a HARQ feedback time point corresponding to the UL transmission ending time point, the determined HARQ feedback time point being at a specified position after the UL transmission ending time point.

[00342] In an embodiment, based on the apparatus shown in FIG. 18, as shown in FIG. 19, the sending module 123 may include:

[00343] a fifth sending submodule 191, configured to, for a blind detection result at any UL transmission ending time point, when the blind detection result is successful demodulation, send the first information to the terminal at the HARQ feedback time point corresponding to the UL transmission ending time point; and

[00344] a sixth sending submodule 192, configured to, when the blind detection result is unsuccessful demodulation, not perform HARQ feedback at the HARQ feedback time point corresponding to the UL transmission ending time point.

[00345] It can be seen from the embodiment that, when the preset rule is that a HARQ feedback is made only when a blind detection result is successful demodulation, each HARQ feedback time point corresponding to each UL transmission ending time point may be determined at first. For a blind detection result at any UL transmission ending time point, when the blind detection result is successful demodulation, the first information representing successful demodulation may be sent to the terminal at the HARQ feedback time point

corresponding to the UL transmission ending time point. When the blind detection result is unsuccessful demodulation, HARQ feedback may be not made at the HARQ feedback time point corresponding to the UL transmission ending time point. Accordingly, a function of performing HARQ feedback only when the blind detection result is successful demodulation is realized, and on the premise of ensuring that the terminal may receive the correct HARQ information, a HARQ feedback content and a feedback frequency are reduced and the HARQ feedback efficiency is improved.

[00346] In an embodiment, based on the apparatus shown in FIG. 14, 16 and 18, the specified position may be configured by the base station and may be in a UL grant in an RAR sent to the terminal by the base station; or

[00347] the preset rule may include third information indicating the specified position, and the third information is configured to indicate a relative relationship between a HARQ feedback time point and a determined UL transmission ending time point.

[00348] FIG. 20 is a block diagram of a HARQ feedback apparatus according to an exemplary embodiment. The apparatus may be applicable to a terminal. A base station may allocate multiple available scheduling resources configured to provide EDT service to the terminal, and is configured to execute the HARQ feedback method shown in FIG. 7. As shown in FIG. 20, the HARQ feedback apparatus may include:

[00349] a selection module 201, configured to select an available scheduling resource from the multiple available scheduling resources and send EDT data to the base station on the selected available scheduling resource;

[00350] a second determination module 202, configured to determine a HARQ feedback time point for EDT data according to a preset rule; and

[00351] a third determination module 203, configured to, in response to that HARQ information sent by the base station is received at the HARQ feedback time point, determine a transmission result of the EDT data based on the HARQ information.

[00352] It can be seen from the embodiment that an available scheduling resource may be selected from multiple available scheduling resources, EDT data may be sent to the base station on the selected available scheduling resource, a HARQ feedback time point for the EDT data may be determined according to a preset rule. When the HARQ information sent

by the base station is received at the HARQ feedback time point, a transmission result of the EDT data may be determined based on the HARQ information. Accordingly, the HARQ feedback reliability is improved, and the EDT efficiency is also improved.

[00353] In an embodiment, based on the apparatus shown in FIG. 20, the EDT data may be UL data required to be transmitted by the terminal in a random access process and may be in a message 3 in the random access process.

[00354] In an embodiment, based on the apparatus shown in FIG. 20, the available scheduling resource may include a TBS and a UL transmission repetition count. As shown in FIG. 21, the selection module 201 may include:

[00355] a selection submodule 211, configured to select the available scheduling resource from the multiple available scheduling resources based on the TBS and the UL transmission repetition count of the multiple available scheduling resources; and

[00356] a sending submodule 212, configured to send the EDT data to the base station on the selected available scheduling resource.

[00357] It can be seen from the embodiment that an available scheduling resource may be selected from multiple available scheduling resources based on a TBS and UL transmission repetition count in each available scheduling resource and EDT data may be sent to the base station on the selected available scheduling resource. Accordingly, the available scheduling resource may be selected accurately.

[00358] In an embodiment, based on the apparatus shown in FIG. 21, the preset rule is that a HARQ feedback is made based on a maximum UL transmission repetition count. As shown in FIG. 22, the second determination module 202 may include:

[00359] a first time point determination submodule 221, configured to determine each UL transmission ending time point respectively for the selected available scheduling resource based on the TBS and the UL transmission repetition count of the selected available scheduling resource;

[00360] a repetition count determination submodule 222, configured to determine the maximum UL transmission repetition count according to the UL transmission repetition count in the selected available scheduling resource;

[00361] a second time point determination submodule 223, configured to determine the

UL transmission ending time point corresponding to the maximum UL transmission repetition count based on each UL transmission ending time point; and

[00362] a third time point determination submodule 224, configured to determine the HARQ feedback time point based on the UL transmission ending time point corresponding to the maximum UL transmission repetition count, the determined HARQ feedback time point being at a specified position after the UL transmission ending time point corresponding to the maximum UL transmission repetition count.

[00363] In an embodiment, based on the apparatus shown in FIG. 22, as shown in FIG. 23, the third determination module 203 may include:

[00364] a first receiving submodule 231, configured to receive the HARQ information from the base station at the HARQ feedback time point;

[00365] a first processing submodule 232, configured to determine that the transmission result of the EDT data is successful transmission in response to that the HARQ information is the first information; and

[00366] a second processing submodule 233, configured to determine that the transmission result of the EDT data is unsuccessful transmission in response to that the HARQ information is the second information.

[00367] It can be seen from the embodiment that, when the preset rule is that a HARQ feedback is made based on the maximum UL transmission repetition count, the maximum UL transmission repetition count may be determined based on the TBS and UL transmission repetition count in each available scheduling resource, each UL transmission ending time point may be determined respectively for each available scheduling resource, a UL transmission ending time point corresponding to the maximum UL transmission repetition count may be determined, and a HARQ feedback time point may be determined based on the UL transmission ending time point corresponding to the maximum UL transmission repetition count. The determined HARQ feedback time point may be at a specified position after the UL transmission ending time point corresponding to the maximum UL transmission repetition count. Accordingly, a function of performing HARQ feedback based on the maximum UL transmission repetition count is realized, the terminal can receive correct HARQ information, and the quality of service of HARQ feedback is also improved.

[00368] In an embodiment, based on the apparatus shown in FIG. 21, the preset rule is that a HARQ feedback is made for the UL transmission ending time point respectively for each available scheduling resource. As shown in FIG. 24, the second determination module 202 may include:

[00369] a fourth time point determination submodule 241, configured to determine a UL transmission ending time point corresponding to the selected available scheduling resource based on the TBS and UL transmission repetition count in the selected available scheduling resource; and

[00370] a fifth time point determination submodule 242, configured to, for the UL transmission ending time point corresponding to the selected available scheduling resource, determine a HARQ feedback time point corresponding to the UL transmission ending time point, the determined HARQ feedback time point being at a specified position after the UL transmission ending time point.

[00371] In an embodiment, based on the apparatus shown in FIG. 24, the HARQ information may include first information indicating successful demodulation or second information indicating unsuccessful demodulation. As shown in FIG. 25, the third determination module 203 may include:

[00372] a second receiving submodule 251, configured to receive the HARQ information from the base station at the HARQ feedback time point corresponding to the UL transmission ending time point;

[00373] a third processing submodule 252, configured to, when the HARQ information is the first information, determine that the transmission result of the EDT data is successful transmission; and

[00374] a fourth processing submodule 253, configured to, when the HARQ information is the second information, determine that the transmission result of the EDT data is unsuccessful transmission.

[00375] It can be seen from the embodiment that, when the preset rule is that a HARQ feedback is made for each UL transmission ending time point respectively for each available scheduling resource, a UL transmission ending time point corresponding to the selected available scheduling resource and a HARQ feedback time point corresponding to the UL

transmission ending time point may be determined only, the HARQ information sent by the base station may be received at the HARQ feedback time point corresponding to the UL transmission ending time point. When the HARQ information is the first information indicating successful demodulation, it may be determined that the transmission result of the EDT data is successful transmission. When the HARQ information is the second information indicating unsuccessful demodulation, it may be determined that the transmission result of the EDT data is unsuccessful transmission. Accordingly, the accuracy of the transmission result is improved.

[00376] In an embodiment, based on the apparatus shown in FIG. 21, the preset rule is that a HARQ feedback is made only when a blind detection result is successful demodulation. As shown in FIG. 26, the second determination module 202 may include:

[00377] a sixth time point determination submodule 261, configured to determine a UL transmission ending time point corresponding to the selected available scheduling resource based on the TBS and UL transmission repetition count in the selected available scheduling resource; and

[00378] a seventh time point determination submodule 262, configured to, for the UL transmission ending time point corresponding to the selected available scheduling resource, determine the HARQ feedback time point corresponding to the UL transmission ending time point, the determined HARQ feedback time point being at a specified position after the UL transmission ending time point.

[00379] In an embodiment, based on the apparatus shown in FIG. 26, as shown in FIG. 27, the third determination module 203 may include:

[00380] a fifth processing submodule 271, configured to, in response to receiving the HARQ information from the base station at the HARQ feedback time point corresponding to the UL transmission ending time point and the HARQ information being the first information, determine that the transmission result of the EDT data is successful transmission; and

[00381] a sixth processing submodule 272, configured to, in response to not receiving the HARQ information from the base station at the HARQ feedback time point corresponding to the UL transmission ending time point, determine that the transmission result of the EDT data is unsuccessful transmission.

[00382] It can be seen from the embodiment that, when the preset rule is that a HARQ feedback is made only when a blind detection result is successful demodulation, a UL transmission ending time point corresponding to the selected available scheduling resource and a HARQ feedback time point corresponding to the UL transmission ending time point may be determined only. In response to receiving the HARQ information from the base station at the HARQ feedback time point corresponding to the UL transmission ending time point and the HARQ information being the first information indicating successful demodulation, it may be determined that the transmission result of the EDT data is successful transmission. In response to not receiving the HARQ information at the HARQ feedback time point corresponding to the UL transmission ending time point, it may be determined that the transmission result of the EDT data is unsuccessful transmission. Accordingly, the accuracy of the transmission result is ensured, in addition, a HARQ feedback content and a feedback frequency are also reduced, and the HARQ feedback efficiency is improved.

[00383] In an embodiment, based on the apparatus shown in FIG. 22, or FIG. 24 or FIG. 26, the specified position may be configured by the base station and may be in a UL grant in an RAR sent to the terminal by the base station; or

[00384] the preset rule may include third information indicating the specified position, and the third information is configured to indicate a relative relationship between a HARQ feedback time point and a determined UL transmission ending time point.

[00385] The apparatus embodiments substantially correspond to the method embodiments, and thus related parts refer to part of descriptions of the method embodiments. The apparatus embodiments described above are only schematic, units described as separate parts therein may or may not be physically separated, and parts displayed as units may or may not be physical units, and namely may be located in the same place or may also be distributed to multiple network units. Part or all of the modules therein may be selected according to an actual requirement to achieve the purpose of the solutions of the present disclosure. Those of ordinary skill in the art may understand and implement without creative work.

[00386] The present disclosure also provides a non-transitory computer-readable storage medium which has stored a computer program configured to execute any HARQ

feedback method shown in FIG. 1 to FIG. 6C.

[00387] The present disclosure also provides a non-transitory computer-readable storage medium which has stored a computer program configured to execute any HARQ feedback method shown in FIG. 7 to FIG. 11.

[00388] The present disclosure also provides a HARQ feedback apparatus, which is applicable to a base station that allocates multiple available scheduling resources configured to provide EDT service to a terminal. The apparatus may include:

[00389] a processor; and

[00390] memory configured to store instructions executable by the processor,

[00391] wherein the processor is configured to:

[00392] perform blind detection on EDT data transmitted to the base station by the terminal on respective available scheduling resources;

[00393] determine a HARQ feedback time point for the blind detection according to a preset rule; and

[00394] send HARQ information about the blind detection to the terminal at the HARQ feedback time point.

[00395] As shown in FIG. 28, FIG. 28 is a structure diagram of a HARQ feedback apparatus according to an exemplary embodiment. The apparatus 2800 may be provided as a base station. Referring to FIG. 28, the apparatus 2800 includes a processing component 2828, a wireless transmission/receiving component 2824, an antenna component 2826 and a wireless interface-specific signal processing part, and the processing component 2828 may further include one or more processors.

[00396] One processor in the processing component 2828 may be configured to execute any HARQ feedback method.

[00397] The present disclosure also provides a HARQ feedback apparatus, which is applicable to a terminal, a base station allocating multiple available scheduling resources configured to provide EDT service to a terminal. The apparatus may include:

[00398] a processor; and

[00399] memory configured to store instructions executable by the processor,

[00400] wherein the processor is configured to:

[00401] select an available scheduling resource from the multiple available scheduling resources and send EDT data to the base station on the selected available scheduling resource;

[00402] determine a HARQ feedback time point for the EDT data according to a preset rule; and

[00403] when HARQ information sent by the base station is received at the HARQ feedback time point, determine a transmission result of the EDT data based on the HARQ information.

[00404] FIG. 29 is a structure diagram of a HARQ feedback apparatus according to an exemplary embodiment. FIG. 29 illustrates a HARQ feedback apparatus 2900 according to an exemplary embodiment. The HARQ feedback apparatus 2900 may be a terminal such as a computer, a mobile phone, a digital broadcast terminal, a messaging device, a gaming console, a tablet, a medical device, exercise equipment and a personal digital assistant.

[00405] Referring to FIG. 29, the HARQ feedback apparatus 2900 may include one or more of the following components: a processing component 2901, a memory 2902, a power component 2903, a multimedia component 2904, an audio component 2905, an Input/Output (I/O) interface 2906, a sensor component 2907, and a communication component 2908.

[00406] The processing component 2901 typically controls overall operations of the HARQ feedback apparatus 2900, such as the operations associated with display, telephone calls, data communications, camera operations, and recording operations. The processing component 2901 may include one or more processors 2909 to execute instructions to perform all or part of the operations in the abovementioned method. Moreover, the processing component 2901 may include one or more modules which facilitate interaction between the processing component 2901 and the other components. For instance, the processing component 2901 may include a multimedia module to facilitate interaction between the multimedia component 2904 and the processing component 2901.

[00407] The memory 2902 is configured to store various types of data to support the operation of the HARQ feedback apparatus 2900. Examples of such data include instructions for any applications or methods operated on the HARQ feedback apparatus 2900, contact data, phonebook data, messages, pictures, video, etc. The memory 2902 may be implemented

by any type of volatile or non-volatile memory devices, or a combination thereof, such as a Static Random Access Memory (SRAM), an Electrically Erasable Programmable Read-Only Memory (EEPROM), an Erasable Programmable Read-Only Memory (EPROM), a Programmable Read-Only Memory (PROM), a Read-Only Memory (ROM), a magnetic memory, a flash memory, and a magnetic or optical disk.

[00408] The power component 2903 may provide power for various components of the HARQ feedback apparatus 2900. The power component 2903 may include a power management system, one or more power supplies, and other components associated with generation, management and distribution of power for the HARQ feedback apparatus 2900.

[00409] The multimedia component 2904 may include a screen providing an output interface between the HARQ feedback apparatus 2900 and a user. In some embodiments, the screen may include a Liquid Crystal Display (LCD) and a Touch Panel (TP). If the screen includes the TP, the screen may be implemented as a touch screen to receive an input signal from the user. The TP includes one or more touch sensors to sense touches, swipes and gestures on the TP. The touch sensors may not only sense a boundary of a touch or swipe action but also detect a duration and pressure associated with the touch or swipe action. In some embodiments, the multimedia component 2904 includes a front camera and/or a rear camera. The front camera and/or the rear camera may receive external multimedia data when the HARQ feedback apparatus 2900 is in an operation mode, such as a photographing mode or a video mode. Each of the front camera and the rear camera may be a fixed optical lens system or have focusing and optical zooming capabilities.

[00410] The audio component 2905 is configured to output and/or input an audio signal. For example, the audio component 2905 includes a Microphone (MIC), and the MIC is configured to receive an external audio signal when the HARQ feedback apparatus 2900 is in the operation mode, such as a call mode, a recording mode and a voice recognition mode. The received audio signal may further be stored in the memory 2902 or sent through the communication component 2908. In some embodiments, the audio component 2905 further includes a speaker configured to output the audio signal.

[00411] The I/O interface 2906 may provide an interface between the processing component 2901 and a peripheral interface module, and the peripheral interface module may

be a keyboard, a click wheel, a button and the like. The button may include, but not limited to: a home button, a volume button, a starting button and a locking button.

[00412] The sensor component 2907 includes one or more sensors configured to provide status assessment in various aspects for the HARQ feedback apparatus 2900. For instance, the sensor component 2907 may detect an on/off status of the HARQ feedback apparatus 2900 and relative positioning of components, such as a display and small keyboard of the HARQ feedback apparatus 2900, and the sensor component 2907 may further detect a change in a position of the HARQ feedback apparatus 2900 or a component of the HARQ feedback apparatus 2900, presence or absence of contact between the user and the HARQ feedback apparatus 2900, orientation or acceleration/deceleration of the HARQ feedback apparatus 2900 and a change in temperature of the HARQ feedback apparatus 2900. The sensor component 2907 may include a proximity sensor configured to detect presence of an object nearby without any physical contact. The sensor component 2907 may also include a light sensor, such as a Complementary Metal Oxide Semiconductor (CMOS) or Charge Coupled Device (CCD) image sensor, configured for use in an imaging application. In some embodiments, the sensor component 2907 may also include an acceleration sensor, a gyroscope sensor, a magnetic sensor, a pressure sensor or a temperature sensor.

[00413] The communication component 2908 is configured to facilitate wired or wireless communication between the HARQ feedback apparatus 2900 and another apparatus. The HARQ feedback apparatus 2900 may access a communication-standard-based wireless network, such as a Wireless Fidelity (WiFi) network, a 2nd-Generation (2G) or 3rd-Generation (3G) network or a combination thereof. In an exemplary embodiment, the communication component 2908 receives a broadcast signal or broadcast associated information from an external broadcast management system through a broadcast channel. In an exemplary embodiment, the communication component 2908 further includes a Near Field Communication (NFC) module to facilitate short-range communication. For example, the NFC module may be implemented based on a Radio Frequency Identification (RFID) technology, an Infrared Data Association (IrDA) technology, an Ultra-Wide Band (UWB) technology, a Bluetooth (BT) technology and another technology.

[00414] In an exemplary embodiment, the HARQ feedback apparatus 2900 may be

implemented by one or more Application Specific Integrated Circuits (ASICs), Digital Signal Processors (DSPs), Digital Signal Processing Devices (DSPDs), Programmable Logic Devices (PLDs), Field Programmable Gate Arrays (FPGAs), controllers, micro-controllers, microprocessors or other electronic components, and is configured to execute the abovementioned method.

[00415] In an exemplary embodiment, there is also provided a non-transitory computer-readable storage medium including an instruction, such as the memory 2902 including an instruction, and the instruction may be executed by the processor 2909 of the HARQ feedback apparatus 2900 to implement the abovementioned method. For example, the non-transitory computer-readable storage medium may be a ROM, a Random Access Memory (RAM), a Compact Disc Read-Only Memory (CD-ROM), a magnetic tape, a floppy disc, an optical data storage device and the like.

[00416] The instruction in the storage medium is executed by the processor to enable the HARQ feedback apparatus 2900 to execute any HARQ feedback method.

[00417] It will be appreciated that the present disclosure is not limited to the exact construction that has been described above and illustrated in the accompanying drawings, and that various modifications and changes may be made without departing from the scope thereof. It is intended that the scope of the present disclosure only be limited by the appended claims.

WHAT IS CLAIMED IS:

1. A Hybrid Automatic Repeat reQuest (HARQ) feedback method, applicable to a base station that allocates, to a terminal, multiple available scheduling resources configured to provide Early Data Transmission (EDT) service, the method comprising:

performing blind detection on EDT data transmitted to the base station by the terminal on respective available scheduling resources;

determining a HARQ feedback time point for the blind detection according to a preset rule; and

sending HARQ information about the blind detection to the terminal at the HARQ feedback time point.

2. The method of claim 1, wherein the EDT data is uplink (UL) data transmitted by the terminal in a random access process and is in a message 3 in the random access process.

3. The method of claim 1, wherein the available scheduling resource comprises a Transmission Block Size (TBS) and a UL transmission repetition count; and

performing blind detection on the EDT data transmitted to the base station by the terminal on respective available scheduling resources comprises:

determining UL transmission ending time points for respective available scheduling resources based on the TBS and the UL transmission repetition count in respective available scheduling resources, and

performing blind detection on the EDT data at respective UL transmission ending time points.

4. The method of claim 3, wherein the preset rule is that a HARQ feedback is made based on a maximum UL transmission repetition count; and

determining the HARQ feedback time point for the blind detection according to the preset rule comprises:

determining the maximum UL transmission repetition count according to the UL

transmission repetition count in a respective available scheduling resource;

determining a UL transmission ending time point corresponding to the maximum UL transmission repetition count based on a respective UL transmission ending time point; and

determining the HARQ feedback time point based on the UL transmission ending time point corresponding to the maximum UL transmission repetition count, where the determined HARQ feedback time point is at a specified position after the UL transmission ending time point corresponding to the maximum UL transmission repetition count.

5. The method of claim 4, wherein the HARQ information about the blind detection comprises first information indicating successful demodulation or second information indicating unsuccessful demodulation; and

sending the HARQ information about the blind detection to the terminal at the HARQ feedback time point comprises:

sending the first information to the terminal at the HARQ feedback time point in response to determining that each blind detection result at each UL transmission ending time point comprises successful demodulation; and

sending the second information to the terminal at the HARQ feedback time point in response to determining that each blind detection result does not comprise successful demodulation.

6. The method of claim 3, wherein the preset rule is that a HARQ feedback is made for each UL transmission ending time point respectively for each available scheduling resource; and

determining the HARQ feedback time point for the blind detection according to the preset rule comprises:

determining a HARQ feedback time point corresponding to any UL transmission ending time point, where the determined HARQ feedback time point is at a specified position after the UL transmission ending time point.

7. The method of claim 6, wherein the HARQ information about the blind detection comprises first information indicating successful demodulation or second information

indicating unsuccessful demodulation; and

sending the HARQ information about the blind detection to the terminal at the HARQ feedback time point comprises:

in response to determining that a blind detection result at any UL transmission ending time point is successful demodulation, sending the first information to the terminal at the HARQ feedback time point corresponding to the UL transmission ending time point; and

in response to determining that the blind detection result is unsuccessful demodulation, sending the second information to the terminal at the HARQ feedback time point corresponding to the UL transmission ending time point.

8. The method of claim 3, wherein the preset rule is that a HARQ feedback is made only when a blind detection result is successful demodulation; and

determining the HARQ feedback time point for the blind detection according to the preset rule comprises:

determining a HARQ feedback time point corresponding to any UL transmission ending time point, where the determined HARQ feedback time point is at a specified position after the UL transmission ending time point.

9. The method of claim 8, wherein the HARQ information about the blind detection comprises the first information indicating successful demodulation; and

sending the HARQ information about the blind detection to the terminal at the HARQ feedback time point comprises:

in response to determining that a blind detection result at any UL transmission ending time point is successful demodulation, sending the first information to the terminal at the HARQ feedback time point corresponding to the UL transmission ending time point; and

in response to determining that the blind detection result is unsuccessful demodulation, not performing HARQ feedback at the HARQ feedback time point corresponding to the UL transmission ending time point.

10. The method of claim 4 or 6 or 8, wherein the specified position is configured by the base

station and is in a UL grant in a Random Access Response (RAR) sent to the terminal by the base station; or

the preset rule comprises third information indicating the specified position, and the third information indicates a relative relationship between a HARQ feedback time point and a determined UL transmission ending time point.

11. A Hybrid Automatic Repeat reQuest (HARQ) feedback method, applicable to a terminal, a base station allocating to the terminal multiple available scheduling resources configured to provide Early Data Transmission (EDT) service, the method comprising:

selecting an available scheduling resource from the multiple available scheduling resources;

sending EDT data to the base station on the selected available scheduling resource;

determining a HARQ feedback time point for the EDT data according to a preset rule; and

when HARQ information sent by the base station is received at the HARQ feedback time point, determining a transmission result of the EDT data based on the HARQ information.

12. The method of claim 11, wherein the EDT data is uplink (UL) data required to be transmitted by the terminal in a random access process and is in a message 3 in the random access process.

13. The method of claim 11, wherein the available scheduling resource comprises a Transmission Block Size (TBS) and a UL transmission repetition count; and

selecting the available scheduling resource from the multiple available scheduling resources and sending the EDT data to the base station on the selected available scheduling resource comprises:

selecting the available scheduling resource from the multiple available scheduling resources based on the TBS and the UL transmission repetition count of the multiple available scheduling resources; and

sending the EDT data to the base station on the selected available scheduling resource.

14. The method of claim 13, wherein the preset rule is that a HARQ information is made based on a maximum UL transmission repetition count; and

determining the HARQ feedback time point for the EDT data according to the preset rule comprises:

determining a UL transmission ending time point for the selected available scheduling resource based on the TBS and the UL transmission repetition count of the selected available scheduling resource;

determining the maximum UL transmission repetition count according to the UL transmission repetition count in the selected available scheduling resource;

determining a UL transmission ending time point corresponding to the maximum UL transmission repetition count based on the UL transmission ending time point; and

determining the HARQ feedback time point based on the UL transmission ending time point corresponding to the maximum UL transmission repetition count, where the determined HARQ feedback time point is at a specified position after the UL transmission ending time point corresponding to the maximum UL transmission repetition count.

15. The method of claim 14, wherein the HARQ information comprises first information indicating successful demodulation or second information indicating unsuccessful demodulation; and

determining the transmission result of the EDT data based on the HARQ information when the HARQ information sent by the base station is received at the HARQ feedback time point comprises:

receiving the HARQ information from the base station at the HARQ feedback time point;

determining that the transmission result of the EDT data is successful transmission in response to that the HARQ information is the first information; or

determining that the transmission result of the EDT data is unsuccessful transmission

in response to that the HARQ information is the second information.

16. The method of claim 13, wherein the preset rule is that a HARQ feedback is made for each UL transmission ending time point respectively for each available scheduling resource; and

determining the HARQ feedback time point for the EDT data according to the preset rule comprises:

determining a UL transmission ending time point corresponding to the selected available scheduling resource based on the TBS and the UL transmission repetition count in the selected available scheduling resource; and

determining a HARQ feedback time point corresponding to the UL transmission ending time point corresponding to the selected available scheduling resource, where the determined HARQ feedback time point is at a specified position after the UL transmission ending time point.

17. The method of claim 16, wherein the HARQ information comprises first information indicating successful demodulation or second information indicating unsuccessful demodulation; and

determining the transmission result of the EDT data based on the HARQ information when the HARQ information sent by the base station is received at the HARQ feedback time point comprises:

receiving the HARQ information from the base station at the HARQ feedback time point corresponding to the UL transmission ending time point;

determining that the transmission result of the EDT data is successful transmission in response to that the HARQ information is the first information; or

determining that the transmission result of the EDT data is unsuccessful transmission in response to that the HARQ information is the second information.

18. The method of claim 13, wherein the preset rule is that a HARQ feedback is made only when a blind detection result is successful demodulation; and

determining the HARQ feedback time point for the EDT data according to the preset rule comprises:

determining a UL transmission ending time point corresponding to the selected available scheduling resource based on the TBS and the UL transmission repetition count in the selected available scheduling resource; and

determining the HARQ feedback time point corresponding to the UL transmission ending time point corresponding to the selected available scheduling resource, where the determined HARQ feedback time point is at a specified position after the UL transmission ending time point.

19. The method of claim 18, wherein the HARQ information comprises the first information indicating successful demodulation; and

determining the transmission result of the EDT data based on the HARQ information when the HARQ information sent by the base station is received at the HARQ feedback time point comprises:

in response to receiving the HARQ information from the base station at the HARQ feedback time point corresponding to the UL transmission ending time point and the HARQ information being the first information, determining that the transmission result of the EDT data is successful transmission, and

in response to not receiving the HARQ information from the base station at the HARQ feedback time point corresponding to the UL transmission ending time point, determining that the transmission result of the EDT data is unsuccessful transmission.

20. The method of claim 14 or 16 or 18, wherein the specified position is configured by the base station and is in a UL grant in a Random Access Response (RAR) sent to the terminal by the base station; or

the preset rule comprises third information indicating the specified position, and the third information indicates a relative relationship between a HARQ feedback time point and a determined UL transmission ending time point.

21. A Hybrid Automatic Repeat reQuest (HARQ) feedback apparatus, applicable to a base station that allocates, to a terminal, multiple available scheduling resources configured to provide Early Data Transmission (EDT) service, the apparatus comprising:

a detection module, configured to perform blind detection on EDT data transmitted to the base station by the terminal on respective available scheduling resources;

a first determination module, configured to determine a HARQ feedback time point for the blind detection according to a preset rule; and

a sending module, configured to send HARQ information about the blind detection to the terminal at the HARQ feedback time point.

22. The apparatus of claim 21, wherein the EDT data is uplink (UL) data transmitted by the terminal in a random access process and is in a message 3 in the random access process.

23. The apparatus of claim 21, wherein the available scheduling resource comprises a Transmission Block Size (TBS) and a UL transmission repetition count; and

the detection module comprises:

a first determination submodule, configured to determine UL transmission ending time points for respective available scheduling resources based on the TBS and the UL transmission repetition count in respective available scheduling resources; and

a detection submodule, configured to perform blind detection on the EDT data at respective UL transmission ending time points.

24. The apparatus of claim 23, wherein the preset rule is that a HARQ feedback is made based on a maximum UL transmission repetition count; and

the first determination module comprises:

a second determination submodule, configured to determine the maximum UL transmission repetition count according to the UL transmission repetition count in a respective available scheduling resource;

a third determination submodule, configured to determine a UL transmission ending time point corresponding to the maximum UL transmission repetition count based on a

respective UL transmission ending time point; and

a fourth determination submodule, configured to determine the HARQ feedback time point based on the UL transmission ending time point corresponding to the maximum UL transmission repetition count, where the determined HARQ feedback time point is at a specified position after the UL transmission ending time point corresponding to the maximum UL transmission repetition count.

25. The apparatus of claim 24, wherein the HARQ information about the blind detection comprises first information indicating successful demodulation or second information indicating unsuccessful demodulation; and

the sending module comprises:

a first sending submodule, configured to send the first information to the terminal at the HARQ feedback time point in response to determining that each blind detection result at each UL transmission ending time point comprises successful demodulation, and

a second sending submodule, configured to send the second information to the terminal at the HARQ feedback time point in response to determining that each blind detection result does not comprise successful demodulation.

26. The apparatus of claim 23, wherein the preset rule is that a HARQ feedback is made for each UL transmission ending time point respectively for each available scheduling resource; and

the first determination module comprises:

a fifth determination submodule, configured to determine a HARQ feedback time point corresponding to any UL transmission ending time point, where the determined HARQ feedback time point is at a specified position after the UL transmission ending time point.

27. The apparatus of claim 26, wherein the HARQ information about the blind detection comprises first information indicating successful demodulation or second information indicating unsuccessful demodulation; and

the sending module comprises:

a third sending submodule, configured to, in response to determining that a blind detection result at any UL transmission ending time point is successful demodulation, send the first information to the terminal at the HARQ feedback time point corresponding to the UL transmission ending time point, and

a fourth sending submodule, configured to, in response to determining that the blind detection result is unsuccessful demodulation, send the second information to the terminal at the HARQ feedback time point corresponding to the UL transmission ending time point.

28. The apparatus of claim 23, wherein the preset rule is that a HARQ feedback is made only when a blind detection result is successful demodulation; and

the first determination module comprises:

a sixth determination submodule, configured to determine a HARQ feedback time point corresponding to any UL transmission ending time point, where the determined HARQ feedback time point is at a specified position after the UL transmission ending time point.

29. The apparatus of claim 28, wherein the HARQ information about the blind detection comprises the first information indicating successful demodulation; and

the sending module comprises:

a fifth sending submodule, configured to, in response to determining that a blind detection result at any UL transmission ending time point is successful demodulation, send the first information to the terminal at the HARQ feedback time point corresponding to the UL transmission ending time point, and

a sixth sending submodule, configured to, in response to determining that the blind detection result is unsuccessful demodulation, not perform HARQ feedback at the HARQ feedback time point corresponding to the UL transmission ending time point.

30. The apparatus of claim 24 or 26 or 28, wherein the specified position is configured by the base station and is in a UL grant in a Random Access Response (RAR) sent to the terminal by the base station; or

the preset rule comprises third information indicating the specified position, and the

third information indicates a relative relationship between a HARQ feedback time point and a determined UL transmission ending time point.

31. A Hybrid Automatic Repeat reQuest (HARQ) feedback apparatus, applicable to a terminal, a base station allocating to the terminal multiple available scheduling resources configured to provide Early Data Transmission (EDT) service, the apparatus comprising:

a selection module, configured to select an available scheduling resource from the multiple available scheduling resources and send EDT data to the base station on the selected available scheduling resource;

a second determination module, configured to determine a HARQ feedback time point for EDT data according to a preset rule; and

a third determination module, configured to, in response to that HARQ information sent by the base station is received at the HARQ feedback time point, determine a transmission result of the EDT data based on the HARQ information.

32. The apparatus of claim 31, wherein the EDT data is uplink (UL) data required to be transmitted by the terminal in a random access process and is in a message 3 in the random access process.

33. The apparatus of claim 31, wherein the available scheduling resource comprises a Transmission Block Size (TBS) and a UL transmission repetition count; and

the selection module comprises:

a selection submodule, configured to select the available scheduling resource from the multiple available scheduling resources based on the TBS and the UL transmission repetition count of the multiple available scheduling resources; and

a sending submodule, configured to send the EDT data to the base station on the selected available scheduling resource.

34. The apparatus of claim 33, wherein the preset rule is that a HARQ feedback is made based on a maximum UL transmission repetition count; and

the second determination module comprises:

a first time point determination submodule, configured to determine a UL transmission ending time point for the selected available scheduling resource based on the TBS and the UL transmission repetition count of the selected available scheduling resource;

a repetition count determination submodule, configured to determine the maximum UL transmission repetition count according to the UL transmission repetition count in the selected available scheduling resource;

a second time point determination submodule, configured to determine a UL transmission ending time point corresponding to the maximum UL transmission repetition count based on the UL transmission ending time point; and

a third time point determination submodule, configured to determine the HARQ feedback time point based on the UL transmission ending time point corresponding to the maximum UL transmission repetition count, where the determined HARQ feedback time point is at a specified position after the UL transmission ending time point corresponding to the maximum UL transmission repetition count.

35. The apparatus of claim 34, wherein the HARQ information comprises first information indicating successful demodulation or second information indicating unsuccessful demodulation; and

the third determination module comprises:

a first receiving submodule, configured to receive the HARQ information from the base station at the HARQ feedback time point;

a first processing submodule, configured to determine that the transmission result of the EDT data is successful transmission in response to that the HARQ information is the first information; and

a second processing submodule, configured to determine that the transmission result of the EDT data is unsuccessful transmission in response to that the HARQ information is the second information.

36. The apparatus of claim 33, wherein the preset rule is that a HARQ feedback is made for

each UL transmission ending time point respectively for each available scheduling resource; and

the second determination module comprises:

a fourth time point determination submodule, configured to determine a UL transmission ending time point corresponding to the selected available scheduling resource based on the TBS and the UL transmission repetition count in the selected available scheduling resource, and

a fifth time point determination submodule, configured to determine a HARQ feedback time point corresponding to the UL transmission ending time point corresponding to the selected available scheduling resource, where the determined HARQ feedback time point is at a specified position after the UL transmission ending time point.

37. The apparatus of claim 36, wherein the HARQ information comprises first information indicating successful demodulation or second information indicating unsuccessful demodulation; and

the third determination module comprises:

a second receiving submodule, configured to receive the HARQ information from the base station at the HARQ feedback time point corresponding to the UL transmission ending time point;

a third processing submodule, configured to determine that the transmission result of the EDT data is successful transmission when the HARQ information is the first information; and

a fourth processing submodule, configured to determine that the transmission result of the EDT data is unsuccessful transmission when the HARQ information is the second information.

38. The apparatus of claim 33, wherein the preset rule is that a HARQ feedback is made only when a blind detection result is successful demodulation; and

the second determination module comprises:

a sixth time point determination submodule, configured to determine a UL

transmission ending time point corresponding to the selected available scheduling resource based on the TBS and the UL transmission repetition count in the selected available scheduling resource, and

a seventh time point determination submodule, configured to determine the HARQ feedback time point corresponding to the UL transmission ending time point corresponding to the selected available scheduling resource, where the determined HARQ feedback time point is at a specified position after the UL transmission ending time point.

39. The apparatus of claim 38, wherein the HARQ information comprises the first information indicating successful demodulation; and

the third determination module comprises:

a fifth processing submodule, configured to, in response to receiving the HARQ information from the base station at the HARQ feedback time point corresponding to the UL transmission ending time point and the HARQ information being the first information, determine that the transmission result of the EDT data is successful transmission; and

a sixth processing submodule, configured to, in response to not receiving the HARQ information from the base station at the HARQ feedback time point corresponding to the UL transmission ending time point, determine that the transmission result of the EDT data is unsuccessful transmission.

40. The apparatus of claim 34 or 36 or 38, wherein the specified position is configured by the base station and is in a UL grant in a Random Access Response (RAR) sent to the terminal by the base station; or

the preset rule comprises third information indicating the specified position, and the third information indicates a relative relationship between a HARQ feedback time point and a determined UL transmission ending time point.

41. A non-transitory computer-readable storage medium, having stored computer instructions configured to execute the Hybrid Automatic Repeat reQuest (HARQ) feedback method of any one of claims 1-10.

42. A non-transitory computer-readable storage medium, having stored computer instructions configured to execute the Hybrid Automatic Repeat reQuest (HARQ) feedback method of any one of claims 11-20.

43. A Hybrid Automatic Repeat reQuest (HARQ) feedback apparatus, applicable to a base station that allocates to, a terminal, multiple available scheduling resources configured to provide Early Data Transmission (EDT) service, the apparatus comprising:

a processor; and

memory configured to store instructions executable by a processor,

wherein the processor is configured to:

perform blind detection on EDT data transmitted to the base station by the terminal on respective available scheduling resources;

determine a HARQ feedback time point for the blind detection according to a preset rule; and

send HARQ information about the blind detection to the terminal at the HARQ feedback time point.

44. A Hybrid Automatic Repeat reQuest (HARQ) feedback apparatus, applicable to a terminal, a base station allocating multiple available scheduling resources configured to provide Early Data Transmission (EDT) service to the terminal, the apparatus comprising:

a processor; and

memory configured to store instructions executable by a processor,

wherein the processor is configured to:

select an available scheduling resource from the multiple available scheduling resources;

send EDT data to the base station on the selected available scheduling resource;

determine a HARQ feedback time point for the EDT data according to a preset rule; and

when HARQ information sent by the base station is received at the HARQ feedback time point, determine a transmission result of the EDT data based on the HARQ information.