

TRIGGER HOLD METHOD AND TRIGGER HOLD APPARATUS

TECHNICAL FIELD

[0001] The present disclosure relates to the technical field of communication, and more particularly, to a triggering retaining method, a triggering retaining apparatus, an electronic device, and a computer-readable storage medium.

BACKGROUND

[0002] After triggering a buffer status report (BSR), user equipment may determine whether the BSR can be transmitted to a base station. Generally, an uplink shared channel (ULSCH) resource is required to carry the BSR. If there is no available ULSCH resource, it is needed to send a scheduling request (SR) to the base station to request a ULSCH resource, thereby triggering the SR.

[0003] In some cases, it is needed to cancel triggering of a BSR or triggering of a SR. The cancellation of triggering of a BSR is taken as an example. For example, as shown in Fig. 1, when receiving uplink resource allocation indication information (UL grant) corresponding to service A, user equipment may generate a media access control protocol data unit (MAC PDU) according to the UL grant for the service A. When the MAC PDU includes a BSR, triggering of the BSR may be canceled. After the UL grant for the service A is received, if a UL grant for service B is received, then a MAC PDU may be generated according to the UL grant for the service B. Since triggering of the BSR has been canceled, the MAC PDU generated at this moment does not include the BSR.

[0004] In this case, even if an uplink transmission opportunity for the UL grant for the service B precedes an uplink transmission opportunity for the UL grant for the service A (for example, a delay allowed by the service B is lower than a delay allowed by the service A), a MAC PDU generated at the uplink transmission opportunity for the UL grant for the service B does not include the BSR, but a MAC PDU required to be generated at the uplink transmission opportunity for the UL grant for the service A includes the BSR, and the BSR is transmitted. Therefore, a large delay is caused in the transmission of the BSR, thereby

adversely affecting the service B.

SUMMARY

[0005] In view of this, embodiments of the disclosure provide a triggering retaining method, a triggering retaining apparatus, an electronic device, and a computer-readable storage medium.

[0006] According to a first aspect of the embodiments of the disclosure, a triggering retaining method is provided, which is applied to user equipment. The method may include:

[0007] generating a MAC PDU according to a received UL grant; and

[0008] retaining, in response to determining that the MAC PDU includes a BSR or in response to determining that the MAC PDU includes all data to be transmitted but does not include a BSR, triggering of the BSR and/or an SR within a first predetermined duration.

[0009] Optionally, the UL grant may be a UL grant for a first service, and retaining triggering of the BSR and/or the SR within the first predetermined duration may include:

[0010] retaining triggering of a BSR and/or a SR for a second service within the first predetermined duration.

[0011] Optionally, retaining triggering of the BSR and/or the SR within the first predetermined duration may further include:

[0012] determining, before retaining triggering of the BSR and/or the SR for the second service within the first predetermined duration, whether the second service satisfies a predetermined condition.

[0013] In response to that the second service satisfies the predetermined condition, triggering of the BSR and/or the SR for the second service may be retained within the first predetermined duration.

[0014] The predetermined condition may be that a time parameter correlated to a required delay of the second service is less than a ULSCH duration corresponding to the UL grant for the first service or is less than a second predetermined duration corresponding to the UL grant for the first service or is prior to an uplink transmission timing corresponding to the UL grant for the first service. The second predetermined duration may be a duration between a timing at which the user equipment receives the UL grant for the first service and an uplink

transmission timing corresponding to the UL grant for the first service.

[0015] Optionally, the time parameter may be a maximum ULSCH duration in a priority limit parameter of a logical channel for the second service, and the predetermined condition may be that the time parameter is less than the ULSCH duration corresponding to the UL grant for the first service.

[0016] Optionally, when the priority limit parameter includes no maximum ULSCH duration, a maximum ULSCH duration allowed by the user equipment may be taken as the maximum ULSCH duration in the priority limit parameter.

[0017] Optionally, the time parameter may be a transmission cycle of an SR configured for a logical channel for the second service, and the predetermined condition may be that the time parameter is less than the second predetermined duration corresponding to the UL grant for the first service.

[0018] Optionally, the time parameter may be a third predetermined duration, and the predetermined condition may be that the time parameter is less than the second predetermined duration corresponding to the UL grant for the first service. The third predetermined duration may be configured by the base station for the user equipment in advance, or the SR may be triggered in response to there is no ULSCH available for BSR transmission within the third predetermined duration starting from a timing at which the BSR corresponding to the first service is triggered.

[0019] Optionally, the time parameter may be a maximum second predetermined duration configured for a logical channel for the second service, and the predetermined condition may be that the time parameter is less than the second predetermined duration corresponding to the UL grant for the first service.

[0020] Optionally, the time parameter may be an uplink transmission timing latest configured for a SR for a logical channel for triggering of a BSR after a logical channel for the second service triggers the BSR, and the predetermined condition may be that the time parameter is prior to the uplink transmission timing corresponding to the UL grant for the first service.

[0021] Optionally, the first predetermined duration may be from a timing at which it is determined that the MAC PDU includes the BSR or it is determined that the MAC PDU

does not include any BSR but includes all data to be transmitted to the uplink transmission timing corresponding to the UL grant for the first service.

[0022] Optionally, the first predetermined duration may be from a timing at which it is determined that the MAC PDU includes the BSR or it is determined that the MAC PDU does not include any BSR but includes all data to be transmitted to a target time preceding the uplink transmission timing corresponding to the UL grant for the first service by a fourth predetermined duration.

[0023] The fourth predetermined duration may be from an end timing of a physical downlink control channel (PDCCH) for the user equipment to receive the UL grant for the first service to a first uplink transmission timing supportable by the user equipment after the end timing.

[0024] Optionally, the method may further include:

[0025] canceling the BSR and/or the SR for which triggering is retained after the first predetermined duration.

[0026] According to a second aspect of the embodiments of the disclosure, a triggering retaining apparatus is provided, which is applied to user equipment. The apparatus includes:

[0027] a generation module, configured to generate a MAC PDU according to a received UL grant; and

[0028] a retaining module, configured to retain, in response to determining that the MAC PDU includes a BSR or in response to determining that the MAC PDU includes all data to be transmitted but does not include a BSR, triggering of the BSR and/or an SR within a first predetermined duration.

[0029] Optionally, the UL grant may be a UL grant for a first service, and the retaining module may include:

[0030] a retaining sub-module, configured to retain triggering of a BSR and/or a SR for a second service within the first predetermined duration.

[0031] Optionally, the retaining module may further include:

[0032] a determination sub-module, configured to determine, before retaining triggering of the BSR and/or the SR for the second service within the first predetermined

duration, whether the second service satisfies a predetermined condition.

[0033] In response to that the second service satisfies the predetermined condition, the retaining sub-module may be configured to retain triggering of the BSR and/or the SR for the second service within the first predetermined duration.

[0034] The predetermined condition may be that a time parameter correlated to a required delay of the second service is less than a ULSCH duration corresponding to the UL grant for the first service or is less than a second predetermined duration corresponding to the UL grant for the first service or is prior to an uplink transmission timing corresponding to the UL grant for the first service. The second predetermined duration may be a duration between a timing at which the user equipment receives the UL grant for the first service and an uplink transmission timing corresponding to the UL grant for the first service.

[0035] Optionally, the time parameter may be a maximum ULSCH duration in a priority limit parameter of a logical channel for the second service, and the predetermined condition may be that the time parameter is less than the ULSCH duration corresponding to the UL grant for the first service.

[0036] Optionally, when the priority limit parameter includes no maximum ULSCH duration, a maximum ULSCH duration allowed by the user equipment may be taken as the maximum ULSCH duration in the priority limit parameter.

[0037] Optionally, the time parameter may be a transmission cycle of an SR configured for a logical channel for the second service, and the predetermined condition may be that the time parameter is less than the second predetermined duration corresponding to the UL grant for the first service.

[0038] Optionally, the time parameter may be a third predetermined duration, and the predetermined condition may be that the time parameter is less than the second predetermined duration corresponding to the UL grant for the first service. The third predetermined duration is configured by the base station for the user equipment in advance, or, the SR may be triggered in response to there is no ULSCH available for BSR transmission within the third predetermined duration starting from a timing at which the BSR corresponding to the first service is triggered.

[0039] Optionally, the time parameter may be a maximum second predetermined

duration configured for a logical channel for the second service, and the predetermined condition may be that the time parameter is less than the second predetermined duration corresponding to the UL grant for the first service.

[0040] Optionally, the time parameter may be an uplink transmission timing latest configured for a SR for a logical channel for triggering of a BSR after a logical channel for the second service triggers the BSR, and the predetermined condition may be that the time parameter is prior to the uplink transmission timing corresponding to the UL grant for the first service.

[0041] Optionally, the first predetermined duration may be from a timing at which it is determined that the MAC PDU includes the BSR or it is determined that the MAC PDU does not include any BSR but includes all data to be transmitted to the uplink transmission timing corresponding to the UL grant for the first service.

[0042] Optionally, the first predetermined duration may be from a timing at which it is determined that the MAC PDU includes the BSR or it is determined that the MAC PDU does not include any BSR but includes all data to be transmitted to a target time preceding the uplink transmission timing corresponding to the UL grant for the first service by a fourth predetermined duration.

[0043] The fourth predetermined duration may be from an end timing of a PDCCH for the user equipment to receive the UL grant for the first service to a first uplink transmission timing supportable by the user equipment after the end timing.

[0044] Optionally, the apparatus may further include:

[0045] a cancellation module, configured to cancel the BSR and/or the SR for which triggering is retained after the first predetermined duration.

[0046] According to a third aspect of the embodiments of the disclosure, an electronic device is provided, which may include:

[0047] a processor; and

[0048] a memory configured to store instructions executable by the processor.

[0049] The processor may be configured to perform the triggering retaining method in any one of the above embodiments.

[0050] According to a fourth aspect of the embodiments of the disclosure, a

computer-readable storage medium is provided. The computer-readable storage medium may have stored a computer program that, when executed by a processor, implement the triggering retaining method in any one of the above embodiments.

[0051] According to the embodiments of the disclosure, when it is determined that a MAC PDU includes a BSR or it is determined that the MAC PDU includes all data to be transmitted but does not include a BSR, it may be determined that cancellation of the BSR is required, so that triggering of the BSR is retained within a first predetermined duration, and/or it may be determined that cancellation of an SR is required, so that triggering of the SR is retained within the first predetermined duration. Based on this, a service having lower requirements on a BSR transmission delay can be ensured, and a MAC PDU containing a BSR can be generated at an uplink transmission opportunity corresponding to a UL grant for the service, so that the BSR can be sent to a base station at the uplink transmission opportunity corresponding to the UL grant for the service in time, the BSR transmission can meet delay requirements of the service, and the good operation of the service is ensured.

BRIEF DESCRIPTION OF THE DRAWINGS

[0052] In order to more clearly illustrate the technical solutions in the embodiments of the present disclosure, the drawings to be used in the embodiment description will be briefly introduced below. It is apparent that the drawings in the following description are only part of the embodiments of the present disclosure, and those skilled in the art can obtain other drawings according to the drawings without any inventive labor.

Fig. 1 is a schematic diagram of trigger cancellation in the related art.

Fig. 2 is a schematic flowchart of a triggering retaining method according to an embodiment of the disclosure.

Fig. 3 is a schematic flowchart of retaining triggering of a BSR and/or triggering of an SR within a first predetermined duration according to an embodiment of the disclosure.

Fig. 4 is another schematic flowchart of retaining triggering of a BSR and/or triggering of an SR within a first predetermined duration according to an embodiment of the

disclosure.

Fig. 5 is a schematic flowchart of another triggering retaining method according to an embodiment of the disclosure.

Fig. 6 is a schematic block diagram of a triggering retaining apparatus according to an embodiment of the disclosure.

Fig. 7 is a schematic block diagram of a retaining module according to an embodiment of the disclosure.

Fig. 8 is a schematic block diagram of another retaining module according to an embodiment of the disclosure.

Fig. 9 is a schematic block diagram of another triggering retaining apparatus according to an embodiment of the disclosure.

Fig. 10 is a schematic block diagram of a device for triggering retaining according to an embodiment of the disclosure.

DETAILED DESCRIPTION

[0053] The technical solutions in the embodiments of the present disclosure will be described clearly and completely in conjunction with the accompanying drawings in the embodiments of the present disclosure. It is apparent that the described embodiments are only part of the embodiments of the present disclosure, but not all the embodiments. All other embodiments obtained by those of ordinary skill in the art based on the embodiments of the present disclosure without creative efforts shall fall within the scope of protection of the embodiments of the present disclosure.

[0054] Fig. 2 is a schematic flowchart of a triggering retaining method according to an embodiment of the disclosure. The triggering retaining method shown in the embodiment may be applied to user equipment, such as a mobile phone or a tablet computer. The user equipment may communicate with a base station (such as a 5G base station) to receive a UL grant from the base station, and may send a BSR, an SR and the like to the base station.

[0055] As shown in Fig. 2, the triggering retaining method may include the following operations.

[0056] In operation S1, a MAC PDU is generated according to a received UL grant.

[0057] In an implementation, the base station may send a UL grant to the user equipment to indicate an uplink transmission opportunity for the user equipment, for example, a time (such as a start time, an end timing and a duration) for a physical uplink shared channel (PUSCH).

[0058] In an implementation, the base station may send a UL grant to the user equipment through a PDCCH, or may also send a UL grant to the user equipment through a radio resource control (RRC) message.

[0059] In an implementation, after receiving a UL grant from the base station, the user equipment may generate a MAC PDU according to the received UL grant, and then may determine whether the generated MAC PDU includes a BSR or includes all data to be transmitted but does not include a BSR (for example, a remaining space of the MAC PDU is not enough to accommodate the BSR due to accommodation of all the data to be transmitted). The MAC PDU that cannot include a BSR may refer to a MAC control element (CE) that cannot include the BSR and a sub-packet header of the MAC CE.

[0060] In operation S2, in response to determining that the MAC PDU includes a BSR or in response to determining that the MAC PDU includes all data to be transmitted other than a BSR, triggering of the BSR and/or an SR is retained within a first predetermined duration.

[0061] In an implementation, when the MAC PDU includes a BSR or the MAC PDU includes all data to be transmitted but cannot include a BSR, triggering of the BSR may be canceled. In this case, before operation S2, the BSR has been triggered.

[0062] In an implementation, when the MAC PDU includes a BSR and the BSR includes a buffer status of each BSR trigger event from a BSR trigger time to a time of the last BSR trigger event, or when the MAC PDU includes all data to be transmitted but cannot include a BSR, triggering of an SR may be canceled. In this case, before operation S2, the SR has been triggered.

[0063] If the BSR is canceled or the SR is canceled, problems may occur.

[0064] In an example, when receiving a UL grant for a first service, the user equipment may generate a MAC PDU according to the UL grant for the first service. When the MAC PDU includes a BSR, triggering of the BSR may be canceled. After the UL grant

for the first service is received, when a UL grant for a second service is received, a MAC PDU may be generated according to the UL grant for the second service. Since triggering of the BSR has been canceled, the MAC PDU generated at this moment does not include the BSR.

[0065] In this case, if a delay allowed by the second service is less than a delay allowed by the first service, an uplink transmission opportunity corresponding to the UL grant for the second service may precede an uplink transmission opportunity corresponding to the UL grant for the first service. However, a MAC PDU generated at the uplink transmission opportunity corresponding to the UL grant for the second service may not include any BSR, only a MAC PDU generated at the uplink transmission opportunity corresponding to the UL grant for the first service can include a BSR, and the BSR may be transmitted. Therefore, a large delay may be caused in the transmission of the BSR, thereby adversely affecting the second service.

[0066] In an implementation, when it is determined that a MAC PDU includes a BSR or it is determined that the MAC PDU includes all data to be transmitted but cannot include a BSR, it may be determined that cancellation of the BSR is required, thereby still retaining triggering of the BSR within a first predetermined duration, and/or it may be determined that cancellation of an SR is required, thereby still retaining triggering of the SR within the first predetermined duration.

[0067] Based on this, a service (for example, the above second service) having lower requirements on a BSR transmission delay can be ensured, and a MAC PDU containing a BSR can be generated at an uplink transmission opportunity corresponding to a UL grant for the service, so that the BSR can be sent to a base station at the uplink transmission opportunity corresponding to the UL grant for the service in time, the BSR transmission can meet delay requirements of the service, and the good operation of the service is ensured.

[0068] Fig. 3 is a schematic flowchart of retaining triggering of a BSR and/or triggering of an SR within a first predetermined duration according to an embodiment of the disclosure. As shown in Fig. 3, on the basis of the embodiment shown in Fig. 2, the UL grant is a UL grant for a first service, and the operation that triggering of the BSR and/or the SR is retained within the first predetermined duration may include the following operation.

[0069] In operation S21, triggering of a BSR and/or a SR for a second service is retained within the first predetermined duration.

[0070] In an implementation, after the UL grant for the first service is received, since the BSR and/or the SR for which triggering is retained corresponding to the first service cannot solve the technical problem in the background part, triggering of the BSR and/or the SR corresponding to the first service can be normally canceled when trigger cancellation conditions are satisfied, and triggering of the BSR and/or the SR for the second service but does not include the first service may be retained within the first predetermined duration. For example, triggering of a BSR and/or a SR corresponding to a logical channel for the second service may be retained.

[0071] Accordingly, the user equipment may receive a UL grant for the second service after receiving the UL grant for the first service. When a delay allowed by the second service is less than a delay allowed by the first service, that is, an uplink transmission opportunity corresponding to the UL grant for the second service precedes an uplink transmission opportunity corresponding to the UL grant for the first service, since triggering of a BSR is retained, a MAC PDU including the BSR may be generated at the uplink transmission opportunity corresponding to the UL grant for the second service, so that the BSR can be sent to the base station in time at the uplink transmission opportunity corresponding to the UL grant for the second service, the transmission of the BSR meets a delay requirement of the service, and the good operation of the second service is ensured.

[0072] Fig. 4 is another schematic flowchart of retaining triggering of a BSR and/or triggering of an SR within a first predetermined duration according to an embodiment of the disclosure. As shown in Fig. 4, on the basis of the embodiment shown in Fig. 3, the operation that triggering of the BSR and/or the SR is retained within the first predetermined duration may further include the following operation.

[0073] In operation S22, before triggering of the BSR and/or the SR for the second service within the first predetermined duration is retained, it may be determined whether the second service satisfies a predetermined condition. When the second service satisfies the predetermined condition, operation S21 may be performed, and triggering of the BSR and/or the SR for the second service may be retained within the first predetermined duration.

[0074] The predetermined condition may be that a time parameter correlated (for example, positively correlated) to a required delay of the second service is less than a ULSCH duration corresponding to the UL grant for the first service or is less than a second predetermined duration corresponding to the UL grant for the first service or is prior to an uplink transmission timing corresponding to the UL grant for the first service. The second predetermined duration may be a duration between a timing at which the user equipment receives the UL grant for the first service and the uplink transmission timing corresponding to the UL grant for the first service.

[0075] In an implementation, not all services but does not include the first service needs triggering retaining of a BSR and/or a SR within the first predetermined duration. Trigger retain of a BSR and/or a SR within the first predetermined duration is only needed for the second service requiring lower delay relative to the first service.

[0076] Therefore, it may be determined whether the second service satisfies a predetermined condition. The predetermined condition may be that the time parameter correlated to the required delay of the second service is less than a PUSCH duration corresponding to the UL grant for the first service or is less than a second predetermined duration (hereinafter referred to as K2) corresponding to the UL grant for the first service. K2 may be a duration between a timing at which the user equipment receives the UL grant for the first service and an uplink transmission timing (that is, a start time of an uplink transmission opportunity) corresponding to the UL grant for the first service.

[0077] The PUSCH duration corresponding to the UL grant for the first service and the second predetermined duration corresponding to the UL grant for the first service may represent the delay allowed by the first service. The time parameter may represent the size of the delay allowed by the second service. Therefore, when the time parameter is less than the PUSCH duration corresponding to the UL grant for the first service or is less than K2 corresponding to the UL grant for the first service, it may be determined that the delay allowed by the second service is less than the delay allowed by the first service, so that triggering of the BSR and/or the SR for the second service may be retained for the second service within the first predetermined duration.

[0078] Optionally, the time parameter may be a maximum ULSCH duration in a

priority limit parameter of a logical channel for the second service, and the predetermined condition may be that the time parameter is less than the ULSCH duration corresponding to the UL grant for the first service.

[0079] In an implementation, a maximum PUSCH duration in a logical channel priority (LCP) limit parameter corresponding to the second service may act as a time parameter to represent the size of the delay allowed by the second service. In this case, the predetermined condition may be that the time parameter is less than the PUSCH duration corresponding to the UL grant for the first service.

[0080] Optionally, when the priority limit parameter includes no maximum ULSCH duration, a maximum ULSCH duration allowed by the user equipment is taken as the maximum ULSCH duration in the priority limit parameter.

[0081] In an implementation, since the LCP limit parameter does not necessarily include the maximum PUSCH duration, the maximum PUSCH duration allowed by the user equipment may be taken as the maximum PUSCH duration in the LCP limit parameter, so as to ensure that whether the second service satisfies the predetermined condition can be accurately determined.

[0082] Optionally, the time parameter may be a transmission cycle of an SR configured for a logical channel for the second service, and the predetermined condition may be that the time parameter is less than the second predetermined duration corresponding to the UL grant for the first service.

[0083] In an implementation, a transmission cycle of an SR of a logical channel for the second service may act as a time parameter to represent the size of the delay allowed by the second service. In this case, the predetermined condition may be that the time parameter is less than K2 corresponding to the UL grant for the first service.

[0084] Optionally, the time parameter may be a third predetermined duration, and the predetermined condition may be that the time parameter is less than the second predetermined duration corresponding to the UL grant for the first service. The third predetermined duration may be configured by the base station for the user equipment in advance, or, the SR may be triggered in response to there is no ULSCH available for BSR transmission within the third predetermined duration starting from a timing at which the BSR

corresponding to the first service is triggered.

[0085] In an implementation, the size of the delay allowed by the second service may be represented by a third predetermined duration as a time parameter. In this case, the predetermined condition may be that the time parameter is less than K2 corresponding to the UL grant for the first service.

[0086] The third predetermined duration may be configured by the base station for the user equipment in advance and dedicated for representing the size of the delay allowed by the second service. Or, the third predetermined duration may act as one of conditions for determining whether to trigger the SR, that is, the user equipment may trigger the SR in response to that there is no PUSCH available for transmitting the BSR (that is, there is no available uplink transmission opportunity) within a third duration range starting from a trigger time of the BSR corresponding to the first service.

[0087] Optionally, the time parameter may be a maximum second predetermined duration configured for a logical channel for the second service, and the predetermined condition may be that the time parameter is less than the second predetermined duration corresponding to the UL grant for the first service.

[0088] In an implementation, maximum K2 configured for a logical channel for the second service may act as a time parameter to represent the size of the delay allowed by the second service. In this case, the predetermined condition may be that the time parameter is less than K2 corresponding to the UL grant for the first service.

[0089] If the logical channel for the second service is not configured with the transmission cycle of the SR, and/or the second service is not configured with the third predetermined duration, and/or the logical channel for the second service is not configured with the maximum K2, it may be determined that the second service does not satisfy the predetermined condition.

[0090] Optionally, the time parameter may be an uplink transmission timing latest configured for a SR for a logical channel for triggering of a BSR after a logical channel for the second service triggers the BSR, and the predetermined condition may be that the time parameter is prior to the uplink transmission timing corresponding to the UL grant for the first service.

[0091] In an implementation, the size of the delay allowed by the second service may be represented by an uplink transmission timing latest configured for a SR for a logical channel for triggering of a BSR (such as a starting time of a PUCCH available for transmitting a SR) after a logical channel for the second service triggers the BSR. In this case, the predetermined condition may be that a time parameter is prior to the uplink transmission timing corresponding to the UL grant for the first service (such as a starting time of a PUSCH available for transmitting a BSR).

[0092] Optionally, the first predetermined duration may be from a timing at which it is determined that the MAC PDU includes a BSR or it is determined that the MAC PDU does not include any BSR but includes all data to be transmitted to the uplink transmission timing corresponding to the UL grant for the first service.

[0093] In an implementation, when the MAC PDU includes a BSR or the MAC PDU includes all data to be transmitted but cannot include a BSR, triggering of the BSR and/or the SR may be canceled. Since the MAC PDU generated at the uplink transmission timing corresponding to the UL grant for the first service may include the BSR, it is not necessary to retain triggering of the BSR and/or the SR to the uplink transmission timing corresponding to the UL grant for the first service, but triggering of the BSR and/or the SR may be retained within a period of time from determination of trigger cancellation of the BSR and/or the SR to the uplink transmission timing corresponding to the UL grant for the first service.

[0094] Optionally, the first predetermined duration may be from a timing at which it is determined that the MAC PDU includes a BSR or it is determined that the MAC PDU does not include any BSR but includes all data to be transmitted to a target time preceding the uplink transmission timing corresponding to the UL grant for the first service by a fourth predetermined duration.

[0095] The fourth predetermined duration may be from an end timing of a PDCCH for the user equipment to receive the UL grant for the first service to a first uplink transmission timing supportable by the user equipment after the end timing.

[0096] In an implementation, the fourth predetermined duration (referred to as N2) may be from an end timing of a PDCCH for the user equipment to receive the UL grant for the first service to a first uplink transmission timing supportable by the user equipment after

the end timing. That is, N2 may be a duration required for the user equipment to handle a transaction (for example, a duration from the end timing to a timing at which the MAC PDU including the BSR is generated), and N2 may be set at a base station side. For example, different N2 may be set for different subcarrier spacing (SCS).

[0097] N2 is at least required for the user equipment to handle the transaction, therefore, if the BSR of the logical channel for the second service is triggered at a certain time between N2 before the uplink transmission timing and the uplink transmission timing, the user equipment may start to generate a MAC PDU including the BSR for the UL grant for the second service, and then the MAC PDU including the BSR can be generated after the uplink transmission timing. Since the user equipment has been able to generate the MAC PDU including the BSR for the UL grant for the first service at the uplink transmission timing, it is not necessary to generate the MAC PDU including the BSR for the second service.

[0098] It can be seen that the retain of the BSR and/or the SR at a certain time between N2 before the uplink transmission timing and the uplink transmission timing cannot solve the technical problem in the background, so that the duration of retaining triggering of the BSR and/or the SR may only last until N2 before the uplink transmission timing.

[0099] Fig. 5 is a schematic flowchart of another triggering retaining method according to an embodiment of the disclosure. As shown in Fig. 5, on the basis of the embodiment shown in Fig. 2, the triggering retaining method may further include the following operation.

[00100] In operation S3, the BSR and/or the SR for which triggering is retained is canceled after the first predetermined duration.

[00101] In an implementation, since the user equipment generates the MAC PDU including the BSR at the uplink transmission timing corresponding to the UL grant for the first service when the BSR and/or the SR for which triggering is retained reaches the first predetermined duration, it is not necessary to continue retaining triggering of the BSR and/or the SR subsequently, so that the BSR and/or the SR for which triggering is retained can be canceled to avoid confusion in the subsequent triggering of the BSR and/or the SR.

[00102] Corresponding to the above embodiments of the triggering retaining method,

the disclosure also provides embodiments of a triggering retaining apparatus.

[00103] Fig. 6 is a schematic block diagram of a triggering retaining apparatus according to an embodiment of the disclosure. The triggering retaining apparatus shown in the present embodiment may be applied to user equipment, such as a mobile phone or a tablet computer. The user equipment may communicate with a base station (such as a 5G base station) to receive a UL grant from the base station, and may send a BSR, an SR and the like to the base station.

[00104] As shown in Fig. 6, the triggering retaining apparatus may include:

[00105] a generation module 1, configured to generate a MAC PDU according to a received UL grant; and

[00106] a retaining module 2, configured to retain, in response to determining that the MAC PDU includes a BSR or in response to determining that the MAC PDU includes all data to be transmitted but does not include a BSR, triggering of the BSR and/or an SR within a first predetermined duration.

[00107] Fig. 7 is a schematic block diagram of a retaining module according to an embodiment of the disclosure. As shown in Fig. 7, on the basis of the embodiment shown in Fig. 6, the UL grant is a UL grant for a first service, and the retaining module 2 may include:

[00108] a retaining sub-module 21, configured to retain triggering of a BSR and/or a SR for a second service within the first predetermined duration.

[00109] Fig. 8 is a schematic block diagram of another retaining module according to an embodiment of the disclosure. As shown in Fig. 8, on the basis of the embodiment shown in Fig. 7, the retaining module 2 may further include:

[00110] a determination sub-module 22, configured to determine, before retaining triggering of the BSR and/or the SR for the second service within the first predetermined duration, whether the second service satisfies a predetermined condition.

[00111] In response to the second service satisfies the predetermined condition, the retaining sub-module 21 is configured to retain triggering of the BSR and/or the SR for the second service within the first predetermined duration.

[00112] The predetermined condition may be that a time parameter correlated to a required delay of the second service is less than a ULSCH duration corresponding to the UL

grant for the first service or is less than a second predetermined duration corresponding to the UL grant for the first service or is prior to an uplink transmission timing corresponding to the UL grant for the first service. The second predetermined duration may be a duration between a timing at which the user equipment receives the UL grant for the first service and the uplink transmission timing corresponding to the UL grant for the first service.

[00113] Optionally, the time parameter may be a maximum ULSCH duration in a priority limit parameter of a logical channel for the second service, and the predetermined condition is that the time parameter is less than the ULSCH duration corresponding to the UL grant for the first service.

[00114] Optionally, when the priority limit parameter includes no maximum ULSCH duration, a maximum ULSCH duration allowed by the user equipment is taken as the maximum ULSCH duration in the priority limit parameter.

[00115] Optionally, the time parameter may be a transmission cycle of an SR configured for a logical channel for the second service, and the predetermined condition is that the time parameter is less than the second predetermined duration corresponding to the UL grant for the first service.

[00116] Optionally, the time parameter may be a third predetermined duration, and the predetermined condition may be that the time parameter is less than the second predetermined duration corresponding to the UL grant for the first service. The third predetermined duration may be configured by the base station for the user equipment in advance, or, the SR may be triggered in response to there is no ULSCH available for BSR transmission within the third predetermined duration starting from a timing at which the BSR corresponding to the first service is triggered.

[00117] Optionally, the time parameter may be a maximum second predetermined duration configured for a logical channel for the second service, and the predetermined condition is that the time parameter is less than the second predetermined duration corresponding to the UL grant for the first service.

[00118] Optionally, the time parameter may be an uplink transmission timing latest configured for a SR for a logical channel for triggering of a BSR after a logical channel for the second service triggers the BSR, and the predetermined condition may be that the time

parameter is prior to the uplink transmission timing corresponding to the UL grant for the first service.

[00119] Optionally, the first predetermined duration may be from a timing at which it is determined that the MAC PDU includes a BSR or it is determined that the MAC PDU does not include any BSR but includes all data to be transmitted to the uplink transmission timing corresponding to the UL grant for the first service.

[00120] Optionally, the first predetermined duration may be from a timing at which it is determined that the MAC PDU includes a BSR or it is determined that the MAC PDU does not include any BSR but includes all data to be transmitted to a target time preceding the uplink transmission timing corresponding to the UL grant for the first service by a fourth predetermined duration.

[00121] The fourth predetermined duration may be from an end timing of a PDCCH for the user equipment to receive the UL grant for the first service to a first uplink transmission timing supportable by the user equipment after the end timing.

[00122] Fig. 9 is a schematic block diagram of another triggering retaining apparatus according to an embodiment of the disclosure. As shown in Fig. 9, on the basis of the embodiment shown in Fig. 6, the triggering retaining apparatus may further include:

[00123] a cancellation module 3, configured to cancel the BSR and/or the SR for which triggering is retained after the first predetermined duration.

[00124] With respect to the triggering retaining apparatus in the above embodiments, the specific manners for performing operations for individual modules therein have been described in detail in the embodiment regarding the method, which will not be elaborated herein.

[00125] For the apparatus embodiments, reference will now be made in part to the description of the method embodiments since they substantially correspond to the method embodiments. The apparatus embodiments described above are only schematic. The units described as separate components may or may not be physically separated, and the components displayed as units may or may not be physical units, i.e., may be located in one place or may be distributed over multiple network units. Some or all of the modules can be selected according to actual needs to achieve the purpose of the scheme

of the embodiments. Those ordinarily skilled in the art would understand and practice without involving any inventive effort.

[00126] An embodiment of the disclosure also provides an electronic device, which includes:

[00127] a processor; and

[00128] a memory configured to store instructions executable by the processor.

[00129] The processor is configured to perform the triggering retaining method in any one of the above embodiments.

[00130] An embodiment of the disclosure further provides a computer-readable storage medium. The computer-readable storage medium has stored a computer program that, when executed by a processor, can implement the triggering retaining method in any one of the above embodiments.

[00131] Fig. 10 is a schematic block diagram of a device 1000 for triggering retaining according to an exemplary embodiment. For example, the device 1000 may be a mobile phone, a computer, a digital broadcasting terminal, a message transceiver device, a game console, a tablet device, a medical device, a fitness device, a personal digital assistant, and the like.

[00132] Referring to Fig. 10, the device 1000 may include one or more following components: a processing component 1002, a memory 1004, a power component 1006, a multimedia component 1008, an audio component 1010, an Input/Output (I/O) interface 1012, a sensor component 1014, and a communication component 1016.

[00133] The processing component 1002 is generally configured to control overall operations of the device 1000, such as operations related to displaying, telephone calls, data communications, camera operations, and recording operations. The processing component 1002 may include one or more processors 1020 to execute instructions to complete all or part of the operations of the method described above. In addition, the processing component 1002 may include one or more modules to facilitate the interaction between the processing component 1002 and other components. For example, the processing component 1002 may include a multimedia module to facilitate the interaction between the multimedia component 1008 and the processing component

1002.

[00134] The memory 1004 is configured to store various types of data to support the operations at the device 1000. Examples of such data include instructions for any application program or method operated on the device 1000, contact data, phone book data, messages, pictures, videos, and the like. The memory 1004 may be implemented by any type of volatile or non-volatile storage devices or a combination thereof, such as Static Random Access Memory (SRAM), an Electrically Erasable Programmable Read-Only Memory (EEPROM), a Programming Read-Only Memory (EPROM), a Programmable Read-Only Memory (PROM), a Read-Only Memory (ROM), a magnetic memory, a flash memory, a magnetic disk or an optical disk.

[00135] The power component 1006 is configured to provide power for various components of the device 1000. The power component 1006 may include a power management system, one or more power supplies, and other components associated with generating, managing, and distributing power for the device 1000.

[00136] The multimedia component 1008 may include a screen that provides an output interface between the device 1000 and a user. In some embodiments, the screen may include a Liquid Crystal Display (LCD) and a Touch Panel (TP). If it includes the TP, the screen may be implemented as a touch screen to receive an input signal from a user. The TP includes one or more touch sensors to sense touch, swipe, and gestures on the TP. The touch sensor may not only sense a boundary of a touch or swipe action, but also detect duration and pressure related to the touch or swipe operation. In some embodiments, the multimedia component 1008 includes a front camera and/or a rear camera. When the device 1000 is in an operation mode, such as a photographing mode or a video mode, the front camera and/or the rear camera may receive external multimedia data. Each front camera and each rear camera may be fixed optical lens systems or may have focal lengths and optical zoom capabilities.

[00137] The audio component 1010 is configured to output and/or input audio signals. For example, the audio component 1010 includes a microphone (MIC), and the microphone is configured to receive an external audio signal when the device 1000 is in an operation mode, such as a calling mode, a recording mode, and a voice identification

mode. The received audio signals may be further stored in the memory 1004 or transmitted via the communication component 1016. In some embodiments, the audio component 1010 may further include a speaker to output audio signals.

[00138] The I/O interface 1012 is configured to provide an interface between the processing component 1002 and a peripheral interface module. The peripheral interface module may be a keyboard, a click wheel, a button, and the like. These buttons may include, but not limited to: a home button, a volume button, a start button, and a lock button.

[00139] The sensor component 1014 may include one or more sensors configured to provide various aspects of state assessment for the device 1000. For example, the sensor component 1014 may detect an on/off state of the device 1000 and a relative position of components. For example, the components are a display and a small keypad of the device 1000. The sensor component 1014 may further detect a position change of the device 1000 or one component of the device 1000, the presence or absence of user contact with the device 1000, orientation or acceleration/deceleration of the device 1000, and temperature variations of the device 1000. The sensor component 1014 may include a proximity sensor configured to detect the presence of objects nearby without any physical contact. The sensor component 1014 may also include light sensors, such as CMOS or CCD image sensors, for use in imaging applications. In some embodiments, the sensor component 1014 may also include an acceleration sensor, a gyroscope sensor, a magnetic sensor, a pressure sensor, or a temperature sensor.

[00140] The communication component 1016 is configured to facilitate wired or wireless communications between the device 1000 and other devices. The device 1000 may access a wireless network based on a communication standard, such as Wi-Fi, 2G or 3G, or a combination thereof. In one exemplary embodiment, the communication component 1016 receives broadcast signals or broadcast related information from an external broadcast management system via a broadcast channel. In one exemplary embodiment, the communication component 1016 further includes an NFC module to facilitate short-range communications. For example, the NFC module may be implemented based on a Radio Frequency Identification (RFID) technology, an Infrared

Data Association (IrDA), an Ultra-Wide Band (UWB) technology, a Bluetooth (BT) technology and other technologies.

[00141] In exemplary embodiments, the device 1000 may be implemented with 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 elements, for performing the triggering retaining method according to any one of the above embodiments.

[00142] In the exemplary embodiment, a non-transitory computer-readable storage medium including instructions, such as a memory 1004 including instructions, is further provided. The instructions may be executed by a processor 1020 of a device 1000 to complete the above methods. For example, the non-transitory computer-readable storage medium may be an ROM, an RAM, a CD-ROM, a magnetic tape, a floppy disk, an optical data storage device, and the like.

[00143] Other embodiments of the disclosure will readily occur to those skilled in the art upon consideration of the specification and practice of the disclosure disclosed herein. The present disclosure is intended to cover any variation, use or adaptation of the disclosure, which follows the general principles of the disclosure and includes common knowledge or conventional technical means in the technical field not disclosed in the disclosure. The specification and the embodiments are considered as being exemplary only, with a true scope and spirit of the disclosure being indicated by the following claims.

[00144] It should be understood that the 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 can be made without departing from the scope thereof. The scope of the disclosure is limited only by the appended claims.

[00145] It should be noted that in this document, relational terms such as first and second, and the like are used solely to distinguish one entity or operation from another entity or operation without necessarily requiring or implying any such actual

relationship or order between such entities or operations. The terms 'includes', 'including', or any other variations thereof, are intended to cover a non-exclusive inclusion, such that a process, method, article, or equipment that includes a list of elements not only includes those elements but also may include other elements not expressly listed or inherent to such process, method, article, or equipment. An element defined by the phrase 'includes one...' does not, without more constraints, preclude the existence of additional identical elements in the process, method, article, or equipment that includes the element.

[00146] The method and device provided by the embodiments of the disclosure have been described in detail above. Specific examples are used to explain the principles and implementations of the disclosure herein. The descriptions of the above embodiments are only used to help understand the method and core idea of the disclosure. Meanwhile, for those of ordinary skill in the art, according to the idea of the disclosure, there will be changes in the specific implementation and the application scope. In summary, the content of this specification should not be construed as limiting the disclosure.

WHAT IS CLAIMED IS:

1. A triggering retaining method, applied to user equipment, the trigger retaining method comprising:

generating a media access control protocol data unit (MAC PDU) according to received uplink resource allocation indication information; and

retaining, in response to determining that the MAC PDU comprises a buffer status report (BSR) or in response to determining that the MAC PDU comprises all data to be transmitted but does not comprise a BSR, triggering of the BSR and/or a scheduling request (SR) within a first predetermined duration.

2. The triggering retaining method according to claim 1, wherein the uplink resource allocation indication information is for a first service, and retaining the triggering of the BSR and/or the SR within the first predetermined duration comprises:

retaining triggering of a BSR and/or a SR for a second service within the first predetermined duration.

3. The triggering retaining method according to claim 2, wherein retaining the triggering of the BSR and/or the SR within the first predetermined duration further comprises:

determining, before retaining triggering of the BSR and/or the SR for the second service within the first predetermined duration, whether the second service satisfies a predetermined condition,

in response to the second service satisfies the predetermined condition, retaining the triggering of the BSR and/or the SR for the second service within the first predetermined duration;

wherein the predetermined condition is that a time parameter correlated to a required delay of the second service is less than an uplink shared channel (ULSCH) duration corresponding to the uplink resource allocation indication information for the first service or is less than a second predetermined duration corresponding to the uplink resource allocation indication information for the first service or is prior to an uplink transmission timing

corresponding to the uplink resource allocation indication information for the first service, the second predetermined duration being a duration between a timing at which the user equipment receives the uplink resource allocation indication information for the first service and the uplink transmission timing corresponding to the uplink resource allocation indication information for the first service.

4. The triggering retaining method according to claim 3, wherein the time parameter is a maximum ULSCH duration in a priority limit parameter of a logical channel for the second service, and the predetermined condition is that the time parameter is less than the ULSCH duration corresponding to the uplink resource allocation indication information for the first service.

5. The triggering retaining method according to claim 4, wherein in response to that the priority limit parameter comprises no maximum ULSCH duration, a maximum ULSCH duration allowed by the user equipment is taken as the maximum ULSCH duration in the priority limit parameter.

6. The triggering retaining method according to claim 3, wherein the time parameter is a transmission cycle of an SR configured for a logical channel for the second service, and the predetermined condition is that the time parameter is less than the second predetermined duration corresponding to the uplink resource allocation indication information for the first service.

7. The triggering retaining method according to claim 3, wherein the time parameter is a third predetermined duration, and the predetermined condition is that the time parameter is less than the second predetermined duration corresponding to the uplink resource allocation indication information for the first service, wherein the third predetermined duration is configured by a base station for the user equipment in advance, or, the SR is triggered in response to there is no ULSCH available for BSR transmission within the third predetermined duration starting from a timing at which the BSR corresponding to the first

service is triggered.

8. The triggering retaining method according to claim 3, wherein the time parameter is a maximum second predetermined duration configured for a logical channel for the second service, and the predetermined condition is that the time parameter is less than the second predetermined duration corresponding to the uplink resource allocation indication information for the first service.

9. The triggering retaining method according to claim 3, wherein the time parameter is an uplink transmission timing latest configured for a SR for a logical channel for triggering of a BSR after a logical channel for the second service triggers the BSR, and the predetermined condition is that the time parameter is prior to the uplink transmission timing corresponding to the uplink resource allocation indication information for the first service.

10. The triggering retaining method according to any one of claims 2 to 9, wherein the first predetermined duration is from a timing, at which it is determined that the MAC PDU comprises the BSR or it is determined that the MAC PDU does not comprise any BSR but comprises all data to be transmitted, to the uplink transmission timing corresponding to the uplink resource allocation indication information for the first service.

11. The triggering retaining method according to any one of claims 2 to 9, wherein the first predetermined duration is from a timing at which it is determined that the MAC PDU comprises the BSR or it is determined that the MAC PDU does not comprise any BSR but comprises all data to be transmitted, to a target timing preceding the uplink transmission timing corresponding to the uplink resource allocation indication information for the first service by a fourth predetermined duration,

wherein the fourth predetermined duration is from an end timing of a physical downlink control channel (PDCCH) for the user equipment to receive the uplink resource allocation indication information for the first service to a first uplink transmission timing supportable by the user equipment after the end timing.

12. The triggering retaining method according to any one of claims 1 to 9, further comprising:

canceling the BSR and/or the SR for which triggering is retained after the first predetermined duration.

13. A triggering retaining apparatus, applied to user equipment, the triggering retaining apparatus comprising:

a generation module, configured to generate a media access control protocol data unit (MAC PDU) according to received uplink resource allocation indication information; and

a retaining module, configured to, in response to determining that the MAC PDU comprises a buffer status report (BSR) or in response to determining that the MAC PDU comprises all data to be transmitted but does not comprise a BSR, retain triggering of the BSR and/or a scheduling request (SR) within a first predetermined duration.

14. The triggering retaining apparatus according to claim 13, wherein the uplink resource allocation indication information is for a first service, and the retaining module comprises:

a retaining sub-module, configured to retain triggering of a BSR and/or a SR for a second service within the first predetermined duration.

15. The triggering retaining apparatus according to claim 14, wherein the retaining module further comprises:

a determination sub-module, configured to determine, before retaining triggering of the BSR and/or the SR for the second service within the first predetermined duration, whether the second service satisfies a predetermined condition,

wherein in response to the second service satisfies the predetermined condition, the retaining sub-module is configured to retain triggering of the BSR and/or the SR for the second service within the first predetermined duration; and

the predetermined condition is that a time parameter correlated to a required delay of the second service is less than an uplink shared channel (ULSCH) duration corresponding to the

uplink resource allocation indication information for the first service or is less than a second predetermined duration corresponding to the uplink resource allocation indication information for the first service or is prior to an uplink transmission timing corresponding to the uplink resource allocation indication information for the first service, and the second predetermined duration is a duration between a timing at which the user equipment receives the uplink resource allocation indication information for the first service and the uplink transmission timing corresponding to the uplink resource allocation indication information for the first service.

16. The triggering retaining apparatus according to claim 15, wherein the time parameter is a maximum ULSCH duration in a priority limit parameter of a logical channel for the second service, and the predetermined condition is that the time parameter is less than the ULSCH duration corresponding to the uplink resource allocation indication information for the first service.

17. The triggering retaining apparatus according to claim 16, wherein in response to that the priority limit parameter comprises no maximum ULSCH duration, a maximum ULSCH duration allowed by the user equipment is taken as the maximum ULSCH duration in the priority limit parameter.

18. The triggering retaining apparatus according to claim 15, wherein the time parameter is a transmission cycle of an SR configured for a logical channel for the second service, and the predetermined condition is that the time parameter is less than the second predetermined duration corresponding to the uplink resource allocation indication information for the first service.

19. The triggering retaining apparatus according to claim 15, wherein the time parameter is a third predetermined duration, and the predetermined condition is that the time parameter is less than the second predetermined duration corresponding to the uplink resource allocation indication information for the first service, wherein the third predetermined duration is

configured by the base station for the user equipment in advance, or, the SR is triggered in response to there is no ULSCH available for BSR transmission within the third predetermined duration starting from a timing at which the BSR corresponding to the first service is triggered.

20. The triggering retaining apparatus according to claim 15, wherein the time parameter is a maximum second predetermined duration configured for a logical channel for the second service, and the predetermined condition is that the time parameter is less than the second predetermined duration corresponding to the uplink resource allocation indication information for the first service.

21. The triggering retaining apparatus according to claim 15, wherein the time parameter is an uplink transmission timing latest configured for a SR for a logical channel for triggering of a BSR after a logical channel for the second service triggers the BSR, and the predetermined condition is that the time parameter is prior to the uplink transmission timing corresponding to the uplink resource allocation indication information for the first service.

22. The triggering retaining apparatus according to any one of claims 14 to 21, wherein the first predetermined duration is from a timing at which it is determined that the MAC PDU comprises a BSR or it is determined that the MAC PDU does not comprise any BSR but comprises all data to be transmitted to the uplink transmission timing corresponding to the uplink resource allocation indication information for the first service.

23. The triggering retaining apparatus according to any one of claims 14 to 21, wherein the first predetermined duration is from a timing at which it is determined that the MAC PDU comprises the BSR or it is determined that the MAC PDU does not comprise any BSR but comprises all data to be transmitted to a target time preceding the uplink transmission timing corresponding to the uplink resource allocation indication information for the first service by a fourth predetermined duration,

wherein the fourth predetermined duration is from an end timing of a physical downlink

control channel (PDCCH) for the user equipment to receive the uplink resource allocation indication information for the first service to a first uplink transmission timing supportable by the user equipment after the end timing.

24. The triggering retaining apparatus according to any one of claims 13 to 21, further comprising:

a cancellation module, configured to cancel the BSR and/or the SR for which triggering is retained after the first predetermined duration.

25. An electronic device, comprising:

a processor; and

a memory configured to store instructions executable by the processor,

wherein the processor is configured to perform the triggering retaining method according to any one of claims 1 to 12.

26. A computer-readable storage medium, have stored a computer program that, when executed by a processor, implements the triggering retaining method according to any one of claims 1 to 12.