SDU service data unit

URLLC ultra-reliable low latency communications

[0004] Advantages of 5th Generation (5G) New Radio (NR) communications technology are envisaged to include supporting expanded and diversified usage scenarios and applications in current and future mobile network generations. Present releases of the 5G NR communications technology includes ultra-reliable low-latency communications (URLLC) with strict requirements.

[0005] It is noted that example embodiments as described herein relate to improving at least latency and reliability operations associated with the ultra-reliable low-latency communications.

SUMMARY:

[0006] In an aspect, there is a method, comprising: determining a grant for data to be communicated, wherein the determining comprises identifying one or more logical channels to be multiplexed into a medium access control protocol data unit for the data to be communicated, wherein a length field of at least one logical channel service data unit is configured to be omitted from the medium access control protocol data unit, wherein the length field is omitted based on determining that the logical channel service data unit is~~for~~ a common control channel service data unit of the medium access control protocol data unit, wherein multiple logical channel identifiers are linked to different fixed sizes such that a logical channel identifier is configured to indicate a respective size of the common control channel service data unit. In an aspect, there is an apparatus, comprising means for determining a grant for data to be communicated, wherein the determining comprises identifying one or more logical channels to be multiplexed into a medium access control protocol data unit for the data to be communicated, wherein a length field of at least one logical channel service data unit is configured to be omitted from the medium access control protocol data unit, wherein the length field is omitted based on determining that the logical channel service data unit is ~~for~~ a common control channel service data unit of the medium access control protocol data unit, wherein multiple logical channel identifiers are linked to different fixed sizes such that a logical channel identifier is configured to indicate a respective size of the common control channel service data unit~~.~~. In an aspect, there is a method, comprising: receiving a grant for data to be communicated, comprising one or more logical channels multiplexed into a medium access control protocol data unit for the

data to be communicated, wherein a length field of at least one logical channel service data unit is configured to be omitted from the medium access control protocol data unit, wherein the grant omits the length field based on determining that the logical channel service data unit is ~~for~~ a common control channel service data unit of the medium access control protocol data unit, wherein multiple logical channel identifiers are linked to different fixed sizes such that a logical channel identifier is configured to indicate a respective size of the common control channel service data unit. In an aspect, there is an apparatus, comprising: means for receiving a grant for data to be communicated, comprising one or more logical channels multiplexed into a medium access control protocol data unit for the data to be communicated, wherein based on the grant fulfilling at least one pre-established condition a length field of at least one logical channel service data unit is configured to be omitted from the medium access control protocol data unit, wherein the length field is omitted based on determining that the logical channel service data unit is ~~for~~ a common control channel service data unit of the medium access control protocol data unit, wherein multiple logical channel identifiers are linked to different fixed sizes such that a logical channel identifier is configured to indicate a respective size of the common control channel service data unit. In an example ~~aspect of an embodiment of the invention~~, there is a method comprising: determining a grant for data to be communicated, comprising identifying logical channels to be multiplexed into a medium access control protocol data unit for the data to be communicated, wherein at least one of a logical channel identifier for at least one logical channel of the multiplexed logical channels and length of at least one logical channel service data unit is configured to be omitted from the medium access control protocol data unit.

[0007] A further example ~~aspect of an embodiment of the invention~~ is a method comprising the method of the previous paragraph, the method where there is determining that the grant is fulfilling at least one pre-established condition, where the grant is for use with only one logical channel, and wherein based on the pre-established condition the configuring comprises a logical channel identifier for the one logical channel is omitted from the medium access control protocol data unit; the metho where the configuring further comprises a Length field of a medium access control subheader is set to all zeros to indicate that no more service data units for the at least one logical channel configured to omit logical channel identity will follow; the method where the configuring further comprises a one bit data control field is set to indicate that one of a Length field follows for a service data unit of a logical channel configured with

WHAT IS CLAIMED IS:

1. A method, comprising:

determining a grant for data to be communicated, wherein the determining comprises identifying one or more logical channels to be multiplexed into a medium access control protocol data unit for the data to be communicated,

wherein a length field of at least one logical channel service data unit is configured to be omitted from the medium access control protocol data unit, wherein the length field is omitted based on determining that the logical channel service data unit is~~for~~ a common control channel service data unit of the medium access control protocol data unit, wherein multiple logical channel identifiers are linked to different fixed sizes such that a logical channel identifier is configured to indicate a respective size of the common control channel service data unit.

2. The method of claim 1, wherein further a logical channel identifier for at least one logical channel of the multiplexed logical channels is configured to be omitted from the medium access control protocol data unit, the method comprising:

determining that the grant is fulfilling at least one pre-established condition, wherein the at least one pre-established condition comprises the grant is for use with only one logical channel, and wherein based on the pre-established condition the grant comprises a logical channel identifier for the one logical channel is omitted from the medium access control protocol data unit.

3. The method of claim 2, wherein the grant further comprises a Length field of a medium access control subheader is set to all zeros to indicate that no more service data units for the at least one logical channel configured to omit logical channel identity will follow.

4. The method of claim 2, wherein the grant further comprises a one bit data control field is set to indicate that one of a Length field follows for a service data unit of a logical channel configured with logical channel identity omit, or a logical channel identifier subheader follows for at least one of a control element or a service data unit of a logical channel not configured with omitted logical channel identity.

5. The method of claim 2, wherein the at least one pre-established condition comprises the identified logical channels being more than one logical channel and only one logical channel of the more than one logical channel has no data to send, and wherein based on the pre-established condition the grant comprises a logical channel identifier for the only one logical channel is omitted, and a one-byte length field is set to all zeros.

6. The method of claim 2, wherein logical channel identifier for more than one logical channels configured to be omitted from the medium access control protocol data unit, wherein the grant comprises those logical channels in a pre-established order.

7. The method of claim 2, comprising:

determining a subset of the more than one logical channel with no data to send; and

based on the determining, configuring a Length to be set to all zeros to indicate a start of a next logical channel without a logical channel identifier for the subset of the more than one logical channel.

~~8. The method of claim 1, wherein one or more logical channel identifiers are configured to indicate a size of the common control channel service data unit.~~

~~9~~8. The method of claim 1 ~~or 8~~, wherein the length field is omitted based on determining that the length field for the common control channel service data unit meets an exact size criterion.

~~10. The method of claim 1, wherein the length field is omitted based on at least one of determining that a same logical channel identifier is used for common control channel service data units of different sizes and determining that a grant size for Msg3 meets an exact size criterion of a size of the common control channel service data unit + at least one octet.~~

~~11. The method of claim 10, wherein the common control channel service data units of different sizes using the same logical channel identifier are indicated by a random access preamble group identifier.~~

~~12. The method of claim 1 or 8, wherein the common control channel service data unit for the medium access control protocol data unit is configured with several logical channel identifiers linked to different fixed sizes for one or more logical channels of the multiplexed logical channels.~~

~~13. The method of claim 10, wherein the determining that the grant size for Msg3 meets an exact size criterion comprises determining that the common control channel service data unit size plus an R/LCID subheader of the medium access control protocol data unit is equal to Msg3 size.~~

9~~14~~. An apparatus, comprising:

means for determining a grant for data to be communicated, wherein the determining comprises identifying one or more logical channels to be multiplexed into a medium access control protocol data unit for the data to be communicated,

wherein a length field of at least one logical channel service data unit is configured to be omitted from the medium access control protocol data unit, wherein the length field is omitted based on determining that the logical channel service data unit is~~for~~ a common control channel service data unit of the medium access control protocol data unit, wherein multiple logical channel identifiers are linked to different fixed sizes such that a logical channel identifier is configured to indicate a respective size of the common control channel service data unit.

10~~15~~. The apparatus of claim 9~~14~~, wherein further a logical channel identifier for at least one logical channel of the multiplexed logical channels is configured to be omitted from the medium access control protocol data unit, and wherein the determining comprises:

determining that the grant is fulfilling at least one pre-established condition, wherein the at least one pre-established condition comprises the grant is for use with only one logical channel, and wherein based on the pre-established condition the grant comprises a logical channel identifier for the one logical channel is omitted from the medium access control protocol data unit.

11~~16~~. The apparatus of claim 10~~15~~, wherein the grant further comprises a Length field of a medium access control subheader is set to all zeros to indicate that no more service data units for the at least one logical channel configured to omit logical channel identity will follow.

12~~17~~. The apparatus of claim 10~~15~~, wherein the grant further comprises a one bit data control field is set to indicate that one of a Length field follows for a service data unit of a logical channel configured with logical channel identity omit, or a logical channel identifier subheader follows for at least one of a control element or a service data unit of a logical channel not configured with omitted logical channel identity.

13~~18~~. The apparatus of claim 10~~15~~, wherein the at least one pre-established condition comprises the identified logical channels being more than one logical channel and only one logical channel of the more than one logical channel has no data to send, and wherein based on the pre-established condition the grant comprises a logical channel identifier for the only one logical channel is omitted, and a one-byte length field is set to all zeros.

14~~19~~. The apparatus of claim 10~~15~~, wherein logical channel identifier for more than one logical channels configured to be omitted from the medium access control protocol data unit, wherein the grant comprises those logical channels in a pre-established order.

15~~20~~. The apparatus of claim 10~~15~~, comprising:

means for determining a subset of the more than one logical channel with no data to send; and

means, based on the determining, for configuring a Length to be set to all zeros to indicate a start of a next logical channel without a logical channel identifier for the subset of the more than one logical channel.

~~21. The apparatus of claim 14, wherein one or more logical channel identifiers are configured to indicate a size of the common control channel service data unit.~~

~~22~~16. The apparatus of claim ~~14 9or 21~~, wherein the length field is omitted based on determining that the length field for the common control channel service data unit meets an

exact size criterion.

~~23. The apparatus of claim 14, wherein the length field is omitted based on at least one of determining that a same logical channel identifier is used for common control channel service data units of different sizes and determining that a grant size for Msg3 meets an exact size criterion of a size of the common control channel service data unit + at least one octet.~~

~~24. The apparatus of claim 23, wherein the common control channel service data units of different sizes using the same logical channel identifier are indicated by a random access preamble group identifier.~~

~~25. The apparatus of claim 14 or 21, wherein the common control channel service data unit for the medium access control protocol data unit is configured with several logical channel identifiers linked to different fixed sizes for one or more logical channels of the multiplexed logical channels.~~

~~26. The apparatus of claim 23, wherein the determining that the grant size for Msg3 meets an exact size criterion comprises determining that the common control channel service data unit size plus an R/LCID subheader of the medium access control protocol data unit is equal to Msg3 size.~~

17~~27~~. A method, comprising:

receiving a grant for data to be communicated, comprising one or more logical channels multiplexed into a medium access control protocol data unit for the data to be communicated,

wherein a length field of at least one logical channel service data unit is configured to be omitted from the medium access control protocol data unit, wherein the grant omits the length field based on determining that the logical channel service data unit is~~for~~ a common control channel service data unit of the medium access control protocol data unit, wherein multiple logical channel identifiers are linked to different fixed sizes such that a logical channel identifier is configured to indicate a respective size of the common control channel

service data unit.

1828. The method of claim 1727, wherein further a logical channel identifier for at least one logical channel of the multiplexed logical channels is configured to be omitted from the medium access control protocol data unit, the method comprising:

determining that the grant is fulfilling at least one pre-established condition, wherein the at least one pre-established condition comprises the grant is for use with only one logical channel, and wherein based on the pre-established condition the grant comprises a logical channel identifier for the one logical channel is omitted from the medium access control protocol data unit.

1929. The method of claim 1828, wherein the grant further comprises a Length field of a medium access control subheader set to all zeros to indicate that no more service data units for the at least one logical channel configured to omit logical channel identity will follow.

~~30. The method of claim 28, wherein the at least one pre-established condition comprises the identified logical channels being more than one logical channel and only one logical channel of the more than one logical channel has no data to send, and wherein based on the pre-established condition the grant comprises a logical channel identifier for the only one logical channel is omitted, and a one-byte length field is set to all zeros.~~

3121. The method of claim 2818, wherein logical channel identifiers for the more than one logical channels are omitted from the medium access control protocol data unit, wherein the grant comprises those logical channels in a pre-established order.

~~32. The method of claim 31, wherein one or more logical channel identifiers are configured to indicate a size of the common control channel service data unit.~~

~~33. The method of claim 27 or 32, wherein the length field is omitted based on at least one of that a same logical channel identifier is used for common control channel service data units of different sizes and that a grant size for Msg3 meets an exact size criterion of a size of the common control channel service data unit + at least one octet.~~

~~34. The method of claim 32, wherein the common control channel service data units of different sizes using the same logical channel identifier are indicated by a random access preamble group identifier.~~

~~35. The method of claim 27 or 32, wherein the common control channel service data unit for the medium access control protocol data unit is configured with several logical channel identifiers linked to different fixed sizes for one or more logical channels of the multiplexed logical channels.~~

~~36. The method of claim 35, wherein the determining that the grant size for Msg3 meets an exact size criterion comprises determining that the common control channel service data unit size plus an R/LCID subheader of the medium access control protocol data unit is equal to Msg3 size.~~

2237. An apparatus, comprising:

means for receiving a grant for data to be communicated, comprising one or more logical channels multiplexed into a medium access control protocol data unit for the data to be communicated,

wherein based on the grant fulfilling at least one pre-established condition a length field of at least one logical channel service data unit is configured to be omitted from the medium access control protocol data unit, wherein the length field is omitted based on determining that the logical channel service data unit is~~for~~ a common control channel service data unit of the medium access control protocol data unit, wherein multiple logical channel identifiers are linked to different fixed sizes such that a logical channel identifier is configured to indicate a respective size of the common control channel service data unit.

2338. The apparatus of claim 2237, wherein further a logical channel identifier for at least one logical channel of the multiplexed logical channels is configured to be omitted from the medium access control protocol data unit, and wherein the determining comprises:

determining that the grant is fulfilling at least one pre-established condition, wherein the at least one pre-established condition comprises the grant is for use with only one logical

channel, and wherein based on the pre-established condition the grant comprises a logical channel identifier for the one logical channel is omitted from the medium access control protocol data unit.

2439. The apparatus of claim 2338, wherein the grant further comprises a Length field of a medium access control subheader set to all zeros to indicate that no more service data units for the at least one logical channel configured to omit logical channel identity will follow.

2540. The apparatus of claim 2338, wherein the at least one pre-established condition comprises the grant is for use with more than one logical channel and only one logical channel of the more than one logical channel has no data to send, and wherein based on the pre-established condition the grant comprises a logical channel identifier for the only one logical channel is omitted, and a one-byte length field is set to all zeros.

2641. The apparatus of claim 2330, wherein logical channel identifiers for the more than one logical channels are omitted from the medium access control protocol data unit, wherein the grant comprises those logical channels in a pre-established order.

~~42. The apparatus of claim 37, wherein one or more logical channel identifiers are configured to indicate a size of the common control channel service data unit.~~

~~43. The apparatus of claim 37 or 42, wherein the length field is omitted based on at least one of that a same logical channel identifier is used for common control channel service data units of different sizes and that a grant size for Msg3 meets an exact size criterion of a size of the common control channel service data unit + at least one octet.~~

~~44. The apparatus of claim 37, wherein the common control channel service data units of different sizes using the same logical channel identifier are indicated by a random access preamble group identifier.~~

~~45. The apparatus of claim 44, wherein the common control channel service data unit for the medium access control protocol data unit is configured with several logical channel~~

identifiers linked to different fixed sizes for one or more logical channels of the multiplexed logical channels.

46. The apparatus of claim 40, wherein the determining that the grant size for Msg3 meets an exact size criterion comprises determining that the common control channel service data unit size plus an R/LCID subheader of the medium access control protocol data unit is equal to Msg3 size.