CLAIMS

What is claimed is:

1. A data transmission method, comprising:

determining, by a multi-link transmit end, buffer status report BSR signaling, wherein the BSR signaling indicates a multi-link receive end to schedule a station of the multi-link transmit end over one or more links; and

sending, by the multi-link transmit end, the BSR signaling to the multi-link receive end over the one or more links.

2. The method according to claim 1, wherein the method further comprises:

sending, by the multi-link transmit end, a request message to the multi-link receive end; and

receiving, by the multi-link transmit end, a response message from the multi-link receive end, wherein

the request message and the response message are used for negotiating to set up a service type and link TID-to-link mapping relationship.

3. A data transmission method, comprising:

sending, by a multi-link transmit end, a request message to a multi-link receive end; and

receiving, by the multi-link transmit end, a response message from the multi-link receive end, wherein

the request message and the response message are used for negotiating to set up a service type and link TID-to-link mapping relationship.

4. The method according to claim 3, wherein the method further comprises:

determining, by the multi-link transmit end, buffer status report BSR signaling, wherein the BSR signaling indicates the multi-link receive end to schedule a station of the multi-link transmit end over one or more links; and

sending, by the multi-link transmit end, the BSR signaling to the multi-link receive end over the one or more links.

5. The method according to claim 1, 2, or 4, wherein the BSR signaling comprises one or more of a queue size all field of a transmission link, a scaling factor field of the transmission link, a TID field, a queue size field, and a first scaling factor field; and

the queue size all field of the transmission link indicates a size of a first buffered service on

a link for sending the BSR signaling, the scaling factor field of the transmission link indicates a unit of the size of the first buffered service, the TID field indicates a reported first service type, the queue size field indicates a size of a second buffered service corresponding to the first service type, and the first scaling factor field indicates a unit of the size of the second buffered service.

6. The method according to claim 1, 2, or 4, wherein the BSR signaling comprises one or more of a first TID field, a first queue size field, a second TID field, a second queue size field, and a second scaling factor field; and

the first TID field indicates a reported second service type, the first queue size field indicates a size of a third buffered service corresponding to the second service type, the second TID field indicates a reported third service type, the second queue size field indicates a size of a fourth buffered service corresponding to the third service type, and the second scaling factor field indicates a unit of the size of the third buffered service and a unit of the size of the fourth buffered service.

7. The method according to claim 1, 2, or 4, wherein the BSR signaling comprises one or more of a third TID field, a third queue size field, a third scaling factor field, a fourth TID field, a fourth queue size field, and a scaling factor difference field; and

the third TID field indicates a reported fourth service type, the third queue size field indicates a size of a fifth buffered service corresponding to the fourth service type, the fourth TID field indicates a reported fifth service type, the fourth queue size field indicates a size of a sixth buffered service corresponding to the fifth service type, the third scaling factor field indicates a unit of the size of the fifth buffered service, and the third scaling factor field and the scaling factor difference field indicate a unit of the size of the sixth buffered service.

8. The method according to claim 2 or 3, wherein the request message and/or the response message comprise/comprises control information and mapping information, the control information is used for determining to set up the mapping relationship, and the mapping information indicates the mapping relationship.

9. The method according to claim 8, wherein the mapping information comprises N link identifier bitmaps, and N is a positive integer.

10. The method according to any one of claims 1 or 4 to 9, wherein before the sending, by the multi-link transmit end, the BSR signaling to the multi-link receive end over the one or more links, the method further comprises:

receiving, by the multi-link transmit end, trigger information from the multi-link receive end, wherein the trigger information is used for triggering the multi-link transmit end to send the BSR signaling over the one or more links.

11. The method according to any one of claims 1 or 4 to 10, wherein the sending, by the multi-link transmit end, the BSR signaling to the multi-link receive end over the one or more links comprises:

sending, by the multi-link transmit end, a quality of service QoS data packet to the multi-link receive end over the one or more links, wherein a media access control MAC header of the QoS data packet carries the BSR signaling.

12. The method according to claim 11, wherein a QoS control field of the QoS data packet further comprises buffer status indication information, and the buffer status indication information indicates a size of a buffered service of the multi-link transmit end.

13. The method according to claim 12, wherein the buffer status indication information comprises one bit of a TID field in the QoS control field and eight bits of a queue size field in the QoS control field.

14. A data transmission method, comprising:

receiving, by a multi-link receive end, buffer status report BSR signaling from a multi-link transmit end over one or more links; and

scheduling, by the multi-link receive end, a station of the multi-link transmit end over the one or more links based on the BSR signaling.

15. The method according to claim 14, wherein the method further comprises:

receiving, by the multi-link receive end, a request message from the multi-link transmit end; and

sending, by the multi-link receive end, a response message to the multi-link transmit end, wherein

the request message and the response message are used for negotiating to set up a service type and link TID-to-link mapping relationship.

16. A data transmission method, comprising:

receiving, by a multi-link receive end, a request message from a multi-link transmit end; and

sending, by the multi-link receive end, a response message to the multi-link transmit end, wherein

the request message and the response message are used for negotiating to set up a service type and link TID-to-link mapping relationship.

17. The method according to claim 16, wherein the method further comprises:

receiving, by the multi-link receive end, buffer status report BSR signaling from the multi-link transmit end over one or more links; and

scheduling, by the multi-link receive end, a station of the multi-link transmit end over the one or more links based on the BSR signaling.

18. The method according to claim 14, 15, or 17, wherein the BSR signaling comprises one or more of a queue size all field of a transmission link, a scaling factor field of the transmission link, a TID field, a queue size field, and a first scaling factor field; and

the queue size all field of the transmission link indicates a size of a first buffered service on a link for sending the BSR signaling, the scaling factor field of the transmission link indicates a unit of the size of the first buffered service, the TID field indicates a reported first service type, the queue size field indicates a size of a second buffered service corresponding to the first service type, and the first scaling factor field indicates a unit of the size of the second buffered service.

19. The method according to claim 14, 15, or 17, wherein the BSR signaling comprises one or more of a first TID field, a first queue size field, a second TID field, a second queue size field, and a second scaling factor field; and

the first TID field indicates a reported second service type, the first queue size field indicates a size of a third buffered service corresponding to the second service type, the second TID field indicates a reported third service type, the second queue size field indicates a size of a fourth buffered service corresponding to the third service type, and the second scaling factor field indicates a unit of the size of the third buffered service and a unit of the size of the fourth buffered service.

20. The method according to claim 14, 15, or 17, wherein the BSR signaling comprises one or more of a third TID field, a third queue size field, a third scaling factor field, a fourth TID field, a fourth queue size field, and a scaling factor difference field; and

the third TID field indicates a reported fourth service type, the third queue size field indicates a size of a fifth buffered service corresponding to the fourth service type, the fourth TID field indicates a reported fifth service type, the fourth queue size field indicates a size of a sixth buffered service corresponding to the fifth service type, the third scaling factor field indicates a unit of the

size of the fifth buffered service, and the third scaling factor field and the scaling factor difference field indicate a unit of the size of the sixth buffered service.

21. The method according to claim 15 or 16, wherein the request message and/or the response message comprise/comprises control information and mapping information, the control information is used for determining to set up the mapping relationship, and the mapping information indicates the mapping relationship.

22. The method according to claim 21, wherein the mapping information comprises N link identifier bitmaps, and N is a positive integer.

23. The method according to any one of claims 14 or 18 to 22, wherein before the receiving, by a multi-link receive end, BSR signaling from a multi-link transmit end over one or more links, the method further comprises:

sending, by the multi-link receive end, trigger information to the multi-link transmit end, wherein the trigger information is used for triggering the multi-link transmit end to send the BSR signaling over the one or more links.

24. The method according to any one of claims 14 or 18 to 23, wherein the receiving, by a multi-link receive end, buffer status report BSR signaling from a multi-link transmit end over one or more links comprises:

receiving, by the multi-link receive end, a quality of service QoS data packet from the multi-link transmit end over the one or more links, wherein a media access control MAC header of the QoS data packet carries the BSR signaling.

25. The method according to claim 24, wherein a QoS control field of the QoS data packet further comprises buffer status indication information, and the buffer status indication information indicates a size of a buffered service of the multi-link transmit end.

26. The method according to claim 25, wherein the buffer status indication information comprises one bit of a TID field in the QoS control field and eight bits of a queue size field in the QoS control field.

27. A data transmission apparatus, configured to implement the method according to any one of claims 1 to 13.

28. A data transmission apparatus, configured to implement the method according to any one of claims 14 to 26.

29. A communication apparatus, comprising:

a memory, configured to store computer instructions; and

a processor, configured to execute the computer instructions stored in the memory, to enable the communication apparatus to perform the method according to any one of claims 1 to 13, or to enable the communication apparatus to perform the method according to any one of claims 14 to 26.

30. A computer-readable storage medium, configured to store a computer program, wherein the computer program comprises instructions used for implementing the method according to any one of claims 1 to 13, or comprises instructions used for implementing the method according to any one of claims 14 to 26.

31. A computer program product, comprising computer program code, wherein when the computer program code is run on a computer, the computer implements the method according to any one of claims 1 to 13, or the computer implements the method according to any one of claims 14 to 26.

CLAIMS

What is claimed is:

1. A data transmission method, comprising:

determining, by a multi-link transmit end, buffer status report (BSR) signaling, wherein the BSR signaling indicates a multi-link receive end to schedule a station of the multi-link transmit end over one or more links; and

sending, by the multi-link transmit end, the BSR signaling to the multi-link receive end over the one or more links.

2. The method according to claim 1, wherein the method further comprises:

sending, by the multi-link transmit end, a request message to the multi-link receive end; and

receiving, by the multi-link transmit end, a response message from the multi-link receive end, wherein

the request message and the response message each carry information related to a TID-to-link mapping relationship between a TID and multiple links, and are used for negotiating to set up the traffic identifier-to-link (TID-to-link) mapping relationship.

3. A data transmission method, comprising:

sending, by a multi-link transmit end, a request message to a multi-link receive end; and

receiving, by the multi-link transmit end, a response message from the multi-link receive end, wherein

the request message and the response message are used for negotiating to set up a traffic identifier-to-link (TID-to-link) mapping relationship.

4. The method according to claim 3, wherein the method further comprises:

determining, by the multi-link transmit end, buffer status report (BSR) signaling, wherein the BSR signaling indicates the multi-link receive end to schedule a station of the multi-link transmit end over one or more links; and

sending, by the multi-link transmit end, the BSR signaling to the multi-link receive end over the one or more links.

5. The method according to claim 1, 2, or 4, wherein the BSR signaling comprises one or more of a queue size all field of a transmission link, a scaling factor field of the transmission link, a TID field, a queue size field, and a first scaling factor field; and

the queue size all field of the transmission link indicates a size of a first buffered service on a link for sending the BSR signaling, the scaling factor field of the transmission link indicates a unit of the size of the first buffered service, the TID field indicates a reported first service type, the queue size field indicates a size of a second buffered service corresponding to the first service type, and the first scaling factor field indicates a unit of the size of the second buffered service.

6. The method according to claim 1, 2, or 4, wherein the BSR signaling comprises one or more of a first TID field, a first queue size field, a second TID field, a second queue size field, and a second scaling factor field; and

the first TID field indicates a reported second service type, the first queue size field indicates a size of a third buffered service corresponding to the second service type, the second TID field indicates a reported third service type, the second queue size field indicates a size of a fourth buffered service corresponding to the third service type, and the second scaling factor field indicates a unit of the size of the third buffered service and a unit of the size of the fourth buffered service.

7. The method according to claim 1, 2, or 4, wherein the BSR signaling comprises one or more of a third TID field, a third queue size field, a third scaling factor field, a fourth TID field, a fourth queue size field, and a scaling factor difference field; and

the third TID field indicates a reported fourth service type, the third queue size field indicates a size of a fifth buffered service corresponding to the fourth service type, the fourth TID field indicates a reported fifth service type, the fourth queue size field indicates a size of a sixth buffered service corresponding to the fifth service type, the third scaling factor field indicates a unit of the size of the fifth buffered service, and the third scaling factor field and the scaling factor difference field indicate a unit of the size of the sixth buffered service.

8. The method according to claim 2 or 3, wherein the request message and/or the response message comprise/comprises mapping information, and the mapping information indicates the mapping relationship between a TID and multiple links.

9. The method according to claim 8, wherein the mapping information comprises N link identifier bitmap fields, N is a positive integer, and a length of the link identifier bitmap field is fixed.

10. The method according to claim 8, wherein the mapping information comprises a TID bitmap field, and a quantity of bits that are set to a first value in the TID bitmap field is a quantity

N of link identifier bitmap fields.

11. The method according to claim 10, wherein if a bit in the TID bitmap field is set to the first value, it indicates that a link identifier bitmap field corresponding to a TID corresponding to the bit exists; or if a bit in the TID bitmap field is set to a second value, it indicates that a link identifier bitmap field corresponding to a TID corresponding to the bit does not exist.

12. The method according to claim 10, wherein if a bit in the TID bitmap field is set to a second value, it indicates that a TID corresponding to the bit is mapped to all links.

13. The method according to claim 10, wherein if bits of the TID bitmap are all set to a second value, it indicates that each TID is mapped to all links.

14. The method according to claim 2 or 3, wherein the request message and/or the response message comprise/comprises control information, and the control information indicates that a TID-to-Link mapping is accepted (accept TID-to-link mapping).

15. The method according to claim 2 or 3, wherein the request message and/or the response message comprise/comprises control information, and the control information indicates that a TID-to-Link mapping is rejected (reject TID-to-link mapping).

16. The method according to claim 2 or 3, wherein the request message and/or the response message comprise/comprises control information, and the control information indicates that a TID-to-Link mapping is suggested (suggest TID-to-link mapping).

17. The method according to any one of claims 1 or 4 to 16, wherein before the sending, by the multi-link transmit end, the BSR signaling to the multi-link receive end over the one or more links, the method further comprises:

receiving, by the multi-link transmit end, trigger information from the multi-link receive end, wherein the trigger information is used for triggering the multi-link transmit end to send the BSR signaling over the one or more links.

18. The method according to any one of claims 1 or 4 to 17, wherein the sending, by the multi-link transmit end, the BSR signaling to the multi-link receive end over the one or more links comprises:

sending, by the multi-link transmit end, a quality of service (QoS) data packet to the multi-link receive end over the one or more links, wherein a media access control (MAC) header of the QoS data packet carries the BSR signaling.

19. The method according to claim 18, wherein a QoS control field of the QoS data packet

further comprises buffer status indication information, and the buffer status indication information indicates a size of a buffered service of the multi-link transmit end.

20. The method according to claim 19, wherein the buffer status indication information comprises one bit of a TID field in the QoS control field and eight bits of a queue size field in the QoS control field.

21. A data transmission method, comprising:

receiving, by a multi-link receive end, buffer status report (BSR) signaling from multi-link transmit end over one or more links; and

scheduling, based on the BSR signaling by the multi-link receive end, a station of the multi-link transmit end over the one or more links.

22. The method according to claim 21, wherein the method further comprises:

receiving, by the multi-link receive end, a request message from the multi-link transmit end; and

sending, by the multi-link receive end, a response message to the multi-link transmit end, wherein

the request message and the response message each carry information related to a TID-to-link mapping relationship between a TID and multiple links, and are used for negotiating to set up the traffic identifier-to-link (TID-to-link) mapping relationship.

23. A data transmission method, comprising:

receiving, by a multi-link receive end, a request message from a multi-link transmit end; and

sending, by the multi-link receive end, a response message to the multi-link transmit end, wherein

the request message and the response message are used for negotiating to set up the traffic identifier-to-link TID-to-link mapping relationship.

24. The method according to claim 23, wherein the method further comprises:

receiving, by the multi-link receive end, buffer status report (BSR) signaling from the multi-link transmit end over one or more links; and

scheduling, based on the BSR signaling by the multi-link receive end, a station of the multi-link transmit end over the one or more links.

25. The method according to claim 21, 22, or 24, wherein the BSR signaling comprises one

or more of a queue size all field of a transmission link, a scaling factor field of the transmission link, a TID field, a queue size field, and a first scaling factor field; and

the queue size all field of the transmission link indicates a size of a first buffered service on a link for sending the BSR signaling, the scaling factor field of the transmission link indicates a unit of the size of the first buffered service, the TID field indicates a reported first service type, the queue size field indicates a size of a second buffered service corresponding to the first service type, and the first scaling factor field indicates a unit of the size of the second buffered service.

26. The method according to claim 21, 22, or 24, wherein the BSR signaling comprises one or more of a first TID field, a first queue size field, a second TID field, a second queue size field, and a second scaling factor field; and

the first TID field indicates a reported second service type, the first queue size field indicates a size of a third buffered service corresponding to the second service type, the second TID field indicates a reported third service type, the second queue size field indicates a size of a fourth buffered service corresponding to the third service type, and the second scaling factor field indicates a unit of the size of the third buffered service and a unit of the size of the fourth buffered service.

27. The method according to claim 21, 22, or 24, wherein the BSR signaling comprises one or more of a third TID field, a third queue size field, a third scaling factor field, a fourth TID field, a fourth queue size field, and a scaling factor difference field; and

the third TID field indicates a reported fourth service type, the third queue size field indicates a size of a fifth buffered service corresponding to the fourth service type, the fourth TID field indicates a reported fifth service type, the fourth queue size field indicates a size of a sixth buffered service corresponding to the fifth service type, the third scaling factor field indicates a unit of the size of the fifth buffered service, and the third scaling factor field and the scaling factor difference field indicate a unit of the size of the sixth buffered service.

28. The method according to claim 22 or 23, wherein the request message and/or the response message comprise/comprises mapping information, and the mapping information indicates the mapping relationship between a TID and multiple links.

29. The method according to claim 28, wherein the mapping information comprises N link identifier bitmap fields, N is a positive integer, and a length of the link identifier bitmap field is fixed.

30. The method according to claim 29, wherein the mapping information comprises a TID bitmap field, and a quantity of bits that are set to a first value in the TID bitmap field is a quantity N of link identifier bitmap fields.

31. The method according to claim 30, wherein if a bit in the TID bitmap field is set to the first value, it indicates that a link identifier bitmap field corresponding to a TID corresponding to the bit exists; or if a bit in the TID bitmap field is set to a second value, it indicates that a link identifier bitmap field corresponding to a TID corresponding to the bit does not exist.

32. The method according to claim 30, wherein if a bit in the TID bitmap field is set to a second value, it indicates that a TID corresponding to the bit is mapped to all links.

33. The method according to claim 28, wherein if bits of the TID bitmap are all set to a second value, it indicates that each TID is mapped to all links.

34. The method according to claim 20 or 21, wherein the request message and/or the response message comprise/comprises control information, and the control information indicates that a TID-to-Link mapping is accepted (accept TID-to-link mapping).

35. The method according to claim 20 or 21, wherein the request message and/or the response message comprise/comprises control information, and the control information indicates that a TID-to-Link mapping is rejected (reject TID-to-link mapping).

36. The method according to claim 20 or 21, wherein the request message and/or the response message comprise/comprises control information, and the control information indicates that a TID-to-Link mapping is suggested (suggest TID-to-link mapping).

37. The method according to claim 21 or 25-36, wherein before the receiving, by the multi-link receive end, BSR signaling from the multi-link transmit end over one or more links, the method further comprises:

sending, by the multi-link receive end, trigger information to the multi-link transmit end, wherein the trigger information is used for triggering the multi-link transmit end to send the BSR signaling over the one or more links.

38. The method according to any one of claims 21 or 25 to 37, wherein the receiving, by the multi-link receive end, BSR signaling from the multi-link transmit end over one or more links comprises:

receiving, by the multi-link receive end, a quality of service (QoS) data packet from the multi-link transmit end over the one or more links, wherein a media access control (MAC) header of the

QoS data packet carries the BSR signaling.

39. The method according to claim 38, wherein a QoS control field of the QoS data packet further comprises buffer status indication information, and the buffer status indication information indicates a size of a buffered service of the transmit end of the first multi-link device.

40. The method according to claim 39, wherein the buffer status indication information comprises one bit of a TID field in the QoS control field and eight bits of a queue size field in the QoS control field.

41. A data transmission method, comprising:

sending, by a multi-link transmit end, an add block acknowledgment (ADDBA) request frame to a multi-link receive end, wherein the ADDBA request frame comprises an acknowledgment parameter set field and an ADDBA extension element; and

receiving, by the multi-link transmit end, an ADDBA response frame from the multi-link receive end, wherein the ADDBA response frame comprises the block acknowledgment parameter field and the ADDBA extension element, wherein

a 10-bit buffer size field in the block acknowledgment parameter field and n bits of the ADDBA extension element jointly indicate a size of a buffered service of a TID indicated by a TID field in the block acknowledgment parameter set.

42. The method according to claim 41, wherein the 10-bit buffer size field in the block acknowledgment parameter field is least significant 10 bits in the block acknowledgment parameter field.

43. The method according to claim 41 or 42, wherein the n bits of the ADDBA extension element are most significant n bits in the ADDBA extension element.

44. The method according to claim 41 or 42, wherein if the transmit end of the first multi-link device does not support an aggregate MAC protocol data unit (A-MSDU), a size of each buffered service is equal to a maximum quantity of MAC protocol data units (MSDUs); or

if the multi-link transmit end supports an A-MSDU, a size of each buffered service is equal to a maximum quantity of A-MSDUs.

45. A data transmission method, comprising:

receiving, by a multi-link receive end, an add block acknowledgment (ADDBA) request frame from a multi-link transmit end, wherein the ADDBA request frame comprises an acknowledgment parameter set field and an ADDBA extension element; and

sending, by the multi-link receive end, an ADDBA response frame to the multi-link transmit end, wherein the ADDBA response frame comprises the block acknowledgment parameter field and the ADDBA extension element, wherein

a 10-bit buffer size field in the block acknowledgment parameter field and n bits of the ADDBA extension element jointly indicate a size of a buffered service of a TID indicated by a TID field in the block acknowledgment parameter set.

46. The method according to claim 45, wherein the 10-bit buffer size field in the block acknowledgment parameter field is least significant 10 bits in the block acknowledgment parameter field.

47. The method according to claim 45 or 46, wherein the n bits of the ADDBA extension element are most significant n bits in the ADDBA extension element.

48. The method according to any one of claims 45 and 47, wherein if the multi-link transmit end does not support an aggregate MAC protocol data unit (A-MSDU), a size of each buffered service is equal to a maximum quantity of MAC protocol data units (MSDUs); or

if the multi-link transmit end supports an A-MSDU, a size of each buffered service is equal to a maximum quantity of A-MSDUs.

49. A data transmission apparatus, configured to implement the method according to any one of claims 1 to 20, or configured to implement the method according to any one of claims 41 to 44.

50. A data transmission apparatus, configured to implement the method according to any one of claims 21 to 40, or configured to implement the method according to any one of claims 45 to 48.

51. A communication apparatus, comprising:

a memory, configured to store computer instructions; and

a processor, configured to execute the computer instructions stored in the memory, to enable the communication apparatus to perform the method according to any one of claims 1 to 20, or enable the communication apparatus to perform the method according to any one of claims 21 to 40, or enable the communication apparatus to perform the method according to any one of claims 41 to 44, or enable the communication apparatus to perform the method according to any one of claims 45 to 48.

52. A computer-readable storage medium, configured to store a computer program, wherein the computer program comprises instructions used for implementing the method according to any

one of claims 1 to 18, or comprises instructions used for implementing the method according to any one of claims 19 to 36.

53. A computer program product, comprising computer program code, wherein when the computer program code is run on a computer, the computer implements the method according to any one of claims 1 to 20, or the computer implements the method according to any one of claims 21 to 40, or the computer implements the method according to any one of claims 41 to 44, or the computer implements the method according to any one of claims 45 to 48.