WIRELESS COMMUNICATION METHOD AND RELATED APPARATUS

TECHNICAL FIELD

[0001] This application relates to the field of communication technologies, and in particular, to a wireless communication method and related apparatus.

BACKGROUND

[0002] A WLAN (Wireless Local Area Network, wireless local area network) develops from the 802.11a/g to the 802.11n, the 802.11ac, and now reaches the 802.11ax and the 802.11be that are under discussion. A bandwidth and a quantity of space-time streams that are allowed to be transmitted by the WLAN are as follows:

Table 1 Maximum transmission bandwidth and maximum transmission rate allowed in each IEEE 802.11 version

	802.11a/g	802.11n (HT)	802.11ac (VHT)	802.11ax (HE)	802.11be (EHT) (target)
Bandwidth	20 MHz	20/40 MHz	20/40/80/160 MHz	20/40/80/160 MHz	20/40/80/160/240/ 320 MHz
Supported maximum data rate	54 Mbps	600 Mbps	6.9 Gbps	9.6 Gbps	Not less than 30 Gbps

[0003] The 802.11n standard is also referred to as HT (High Throughput, high throughput). The 802.11ac standard is referred to as VHT (Very High Throughput, very high throughput). The 802.11ax (Wi-Fi 6) standard is referred to as HE (High Efficiency, high efficiency). The 802.11be (Wi-Fi 7) standard is referred to as EHT (Extremely High Throughput, extremely high throughput).

trigger frame according to an implementation;

[0020] FIG. 7a to FIG. 7b are simple schematic diagrams of positions of resource units according to an implementation;

[0021] FIG. 8 is a simple schematic diagram of a frame structure of an uplink multi-user PPDU according to an implementation;

[0022] FIG. 9 is a simple schematic diagram of six puncturing patterns in an 80 MHz bandwidth according to an implementation; and

[0023] FIG. 10 is a simple schematic diagram of a structure of an Acknowledgement frame according to an implementation.

DESCRIPTION OF EMBODIMENTS

[0024] The following further describes specific embodiments of this application in detail with reference to accompanying drawings.

[0025] FIG. 1A is used as an example to describe a network structure to which a data transmission method in this application is applicable. FIG. 1A is a schematic diagram of a network structure according to an embodiment of this application. The network structure may include one or more access point (access point, AP) stations and one or more non-access-point stations (non-access point station, non-AP STA). For ease of description, an access point station is referred to as an access point (AP), and a non-access point station is referred to as a station (STA) in this specification. The APs are, for example, AP 1 and AP 2 in FIG. 1A, and the STAs are, for example, STA 1, STA 2, and STA 3 in FIG. 1A.

[0026] The access point may be an access point used by a terminal device (such as a mobile phone) to access a wired (or wireless) network, and is mainly deployed at home, in a building, and in a campus. A typical coverage radius is tens of meters or more than 100 meters. Certainly, the access point may alternatively be deployed outdoors. The access point is equivalent to a bridge that connects the wired network and the wireless network. A main function of the access point is to connect various wireless network clients together and then connect the wireless network to the Ethernet. Specifically, the access point may be a terminal device (such as a mobile phone) or a network device (such as a router) with a wireless fidelity (wireless-fidelity, Wi-Fi) chip. The access point may be a device that supports the 802.11be standard. Alternatively, the access point may be

a device that supports a plurality of wireless local area network (wireless local area network, WLAN) standards of the 802.11 family such as the 802.11be, 802.11ax, 802.11ac, 802.11n, 802.11g, 802.11b, and 802.11a. The access point in this application may be a high efficiency (high efficiency, HE) AP or an extremely high throughput (extremely high throughput, EHT) AP, or may be an access point applicable to a future Wi-Fi standard.

[0027] The access point may include a processor and a transceiver. The processor is configured to control and manage an action of the access point, and the transceiver is configured to receive or send information.

[0028] The station may be a wireless communications chip, a wireless sensor, a wireless communications terminal, or the like, and may also be referred to as a user. For example, the station may be a mobile phone supporting a Wi-Fi communications function, a tablet computer supporting a Wi-Fi communications function, a set-top box supporting a Wi-Fi communications function, a smart television supporting a Wi-Fi communications function, an intelligent wearable device supporting a Wi-Fi communications function, a vehicle-mounted communications device supporting a Wi-Fi communications function, a computer supporting a Wi-Fi communications function, or the like. Optionally, the station may support the 802.11be standard. The station may also support a plurality of wireless local area network (wireless local area network, WLAN) standards of the 802.11 family such as the 802.11be, 802.11ax, 802.11ac, 802.11n, 802.11g, 802.11b, and 802.11a.

[0029] The station may include a processor and a transceiver. The processor is configured to control and manage an action of the access point, and the transceiver is configured to receive or send information.

[0030] The station in this application may be a high efficiency (high efficiency, HE) STA or an extremely high throughput (extremely high throughput, EHT) STA, or may be a STA applicable to a future Wi-Fi standard.

[0031] For example, the access point and the station may be devices used in the Internet of vehicles, nodes or sensors in the Internet of things (IoT, internet of things), smart cameras, smart remote controls, and smart water meters in a smart home, and sensors in a smart city.

[0032] The access point and the station in embodiments of this application may also be collectively referred to as communications apparatuses. The communications apparatus may include a hardware structure and a software module, and the foregoing functions are implemented

[0045] A revised IEEE 802.11ax standard allows an access point (Access Point, AP) and a non-access-point station (non-AP Station, non-AP STA, STA) to enable, by using a target wake time (Target Wake Time, TWT) agreement mechanism, the STA to switch to another 20 MHz or 80 MHz channel in a service period (Service Period), to sense and obtain an AP service, which is referred to as subchannel selective transmission (Subchannel Selective Transmission, SST). The IEEE 802.11be may also introduce the SST mechanism to enable one or more STAs to park (park) on different channels. Further, in downlink multi-user transmission, a multi-segment preamble transmission mechanism is to be introduced in the 802.11be. In downlink multi-user transmission, for example, OFDMA, content of an EHT physical layer preamble (including a U-SIG (universal signal) field and an EHT (extremely high throughput) field) transmitted on each 80 MHz frequency segment is different. In large bandwidth (for example, 160 MHz, 240 MHz, and 320 MHz) transmission, different physical layer preamble fields U-SIG and EHT-SIG are used for each 80 MHz frequency segment, so that total physical layer signal fields are distributed to each 80 MHz for transmission. In this way, preamble transmission time can be saved, which may be understood as reducing overheads. In addition, a STA parks on an 80 MHz needs to receive only U-SIG and EHT-SIG corresponding to the 80 MHz frequency segment to obtain resource allocation information, for example, resource allocation information for OFDMA transmission.

[0046] It should be noted that a physical layer preamble of each EHT PPDU further includes a legacy preamble field (a legacy short training field (L-STF, legacy short training field), a legacy long training field (L-LTF, legacy long training field), a legacy signal field (L-SIG, legacy signal field)), and a repeated signal field RL-SIG field, which are all located before an EHT preamble. Duplicate transmission is performed on both the legacy preamble field and the repeated signal field on each 20 MHz in a PPDU bandwidth (regardless of a rotation factor applied to each 20 MHz).

[0047] For uplink multi-user transmission, for example, uplink OFDMA, some issues are not considered, such as whether flexible frequency multi-segment transmission is performed, and how to support a low bandwidth station (for example, an 80 MHz station) in a large bandwidth (for example, 320 MHz) PPDU for transmission.

Embodiment 1

[0048] In Embodiment 1 of this application, a channel bandwidth used to transmit an uplink

interval) and EHT-LTF type field, a pre-FEC padding factor field, a PE ambiguity field, and a AP TX power (AP TX Power) field.

[0071] The uplink length field (UL Length) indicates a length of an L-SIG field in a legacy preamble of an uplink TB PPDU scheduled by the trigger frame.

[0072] The more trigger frame field (More TF) indicates whether there is still a trigger frame to be sent.

[0073] The GI (guard interval, guard interval) and EHT-LTF type field indicates a length of a GI and a type of an EHT-LTF.

[0074] The pre-FEC padding factor field and the PE ambiguity field jointly indicate a physical layer padding length of an EHT PPDU, including a post-FEC padding length and a PE field length (FEC: Forward Error Correction, forward error correction; PE: packet extension, packet extension).

[0075] The TX power field indicates a TX power in the unit of dBm of a station. A value of the power is generally normalized to 20 MHz.

[0076] Optionally, common fields of the trigger frame may further include a trigger type dependent common information field. For example, in a basic trigger type, the trigger type dependent common information field includes fields such as an MPDU spacing factor, a TID (traffic identifier) aggregation limit, and a preferred AC (access category).

[0077] Optionally, the common fields of the trigger frame may further include information such as uplink space-time block coding or uplink spatial multiplexing.

[0078] Preferably, different trigger frames in a bandwidth of a PPDU carrying the trigger frame may further carry a puncturing information field of the PPDU bandwidth. For example, a punctured bitmap indicates which 20 MHz is punctured in the bandwidth. Punctured means that content such as a physical layer preamble and a data field (including a MAC frame) is not transmitted in a corresponding 20 MHz of the PPDU. The punctured bitmap may have a fixed quantity of bits. For example, the quantity of bits is the same as a quantity of 20 MHz included in a maximum bandwidth of the PPDU. For example, 320 MHz includes sixteen 20 MHz. The quantity of bits of the punctured bitmap change with the PPDU bandwidth. For example, when the PPDU bandwidth is 80 MHz, the quantity of bits of the punctured bitmap is 4; when the PPDU bandwidth is 160 MHz, the quantity of bits of the punctured bitmap is 8. After the station receives the trigger frame, when sending the uplink PPDU, the station may correspondingly transmit, based on the puncturing information field of the PPDU bandwidth, a U-SIG in a physical layer preamble

CLAIMS

What is claimed is:

1. A method for sending a trigger frame in a wireless local area network, comprising:

generating, by an AP, a physical layer protocol data unit PPDU, wherein the PPDU comprises one or more trigger frames, each trigger frame corresponds to one frequency segment, and each trigger frame is used to schedule at least one or more stations parking on the corresponding frequency segment; and

sending the one or more trigger frames in the PPDU, wherein each trigger frame is carried in the corresponding frequency segment.

2. The method according to claim 1, wherein each trigger frame is used to schedule only one or more stations parking on the corresponding frequency segment.

3. The method according to claim 1, wherein different trigger frames have different content but a same length.

4. An uplink PPDU sending method, comprising:

sending an uplink common physical layer preamble only on each 20 MHz channel on a frequency segment on which a common physical layer preamble of an uplink PPDU of a station is located and that is indicated in the trigger frame, or only on each 20 MHz channel in one or more 80 MHz channels in which an allocated resource unit is located; and

sending a data part of the uplink PPDU on the resource unit allocated to the station.

5. An Acknowledgement frame sending method, comprising:

receiving, by an AP, an uplink multi-user PPDU; and

replying with Acknowledgement information of the uplink multi-user PPDU based on a frequency segment.

6. The method according to claim 5, wherein the Acknowledgement frames replied on different frequency segments are different.

7. The method according to claim 5, wherein on a frequency segment, only an Acknowledgement frame of an uplink PPDU of a station parking on the frequency segment is sent.

8. The method according to claim 6, wherein the Acknowledgement frames on different frequency segments have different content but a same length.

9. A method for receiving a trigger frame in a wireless local area network, comprising:

receiving, by a station, a trigger frame only on a frequency segment on which a sensed 20 MHz is located; and

determining, based on the trigger frame, whether the station is scheduled.

10. The method according to claim 9, comprising:

sending an uplink common physical layer preamble only on each 20 MHz channel on a frequency segment on which a common physical layer preamble of an uplink PPDU of a station is located and that is indicated in the trigger frame, or only on each 20 MHz channel in one or more 80 MHz channels in which an allocated resource unit is located; and

sending a data part of the uplink PPDU on the resource unit allocated to the station.

11. The method according to claim 9, comprising:

after sending the uplink PPDU, receiving Acknowledgement information of the uplink PPDU only on the frequency segment on which the 20 MHz sensed by the station is located.

12. A communications apparatus, wherein the communications apparatus comprises one or more modules, and is configured to perform the method according to any one of claims 1 to 8.

13. A communications apparatus, wherein the communications apparatus comprises one or more modules, and is configured to perform the method according to any one of claims 9 to 11.

14. A computer-readable storage medium, wherein the computer-readable storage medium is configured to store instructions, and when the instructions are executed, the method according to any one of claims 1 to 11 is implemented.

15. A computer program product comprising instructions, wherein when the computer program product runs on a computer, the method according to claims 1 to 11 is implemented.