[0048] It is understood that while the terms “first” and “second” may be used herein to describe various elements, these elements should not be limited by these terms. These terms are used only to distinguish one element from another. Therefore, without departing from the teachings of the example embodiments, the first element discussed below may be referred to as the second element.

[0049] It should be understood that when the component is “connected” or “coupled” to another component, it may be directly connected or coupled to other components, or there may be an intermediate component. In addition, “connected” or “coupled” as used herein may include wirelessly connected or wirelessly coupled. The term “and/or” or the expression “at least one/at least one of ……” as used herein includes any and all combinations of one or more relevant listed items.

[0050] Unless otherwise defined, all terms used herein, including technical terms and scientific terms, have the same meaning as generally understood by those skilled in the art to which this disclosure belongs.

[0051] FIG. 1 is a schematic diagram of a multi-link communication scenario.

[0052] In a wireless local area network, one BSS includes an AP and one or more stations (STAs) that communicate with the AP. The BSS may connect to a Distribution System (DS) via the AP and then access another BSS to form an Extended Service Set (ESS).

[0053] The AP is a wireless switch used for a wireless network, which is a core of the wireless network. The AP device can be used as a wireless base station and is mainly used as a bridge to connect the wireless network and a wired network. The AP is used to integrate wired and wireless networks.

[0054] The AP may include software applications and/or circuits to enable other types of nodes in the wireless network to perform internal and external communication using the wireless network via the AP. In some examples, as an example, the AP may be a terminal device or a network device provided with a Wireless Fidelity (Wi-Fi) chip.

[0055] As an example, the STA may include, but is not limited to: a cellular phone, a smart phone, a wearable device, a computer, a Personal Digital Assistant (PDA), a Personal Communication System (PCS) device, a Personal Information Manager (PIM), a Personal Navigation Device (PND), a global positioning system, a multimedia device, and an Internet of Things (IoT) device.

[0056] In an example embodiment of the disclosure, the AP and the STA may support the multi-link communication. For ease of description, the following contexts mainly describe an example of an AP communicating with a STA on multiple links, but the example embodiments of the disclosure are not limited thereto.

[0057] In FIG. 1, as exemplary only, an AP Multi-Link Device (MLD) may represent an AP supporting the multi-link communication function and a STA MLD may represent a STA supporting the multi-link communication function. As shown in FIG. 1, the AP MLD may operate on three links, such as AP1, AP2, and AP3 shown in FIG. 1, and the STA MLD may operate on three links, such as STA1, STA2, and STA3 shown in FIG. 1. In the example of FIG. 1, the AP1 communicates with the STA1 via Link 1. Similarly, the AP2 communicates with the STA2 via Link 2, and the AP3 communicates with the STA3 via Link 3. Moreover, Link 1 to Link 3 may be multiple links at different frequencies, e.g., a link at 2.4 GHz, a link at 5 GHz and a link at 6 GHz frequencies. In addition, each link may have multiple channels. However, it should be understood that the communication scenario shown in FIG. 1 is only exemplary and the disclosure concept is not limited thereto. For example, an AP MLD may be connected to one or more STA MLDs, or, an AP MLD may be connected to at least one STA that supports a single link (i.e., a STA that only supports the existing standard and may be referred to as: an old-style STA), or an AP may communicate with multiple STAs on different links.

[0058] As mentioned above, in order to identify the change of system information within a BSS, the change sequence information element is defined in the existing standard to identify the change of the system information, as shown in Table 1 below.

Table 1. change sequence information element format

	Element ID	Length	change sequence
Octet	1	1	1

[0059] The change sequence information element indicates the change of system information within a BSS. The Change Sequence field has 1 octet, which is defined as an unsigned integer and can be initialized to 0, and is increased when a critical update occurs to any of the elements in the beacon frame.

[0060] When a critical update occurs to any of the elements in the beacon frame, the AP will increase the value of the Change Sequence field (modulo 256) of the beacon frame to be sent next.

The following events may classify as a critical update:

[0061] a) inclusion of an extended channel switch announcement;

[0062] b) modification of Enhanced Distributed Channel Access (EDCA) parameters; or

[0063] c) modification of S1G operation element.

[0064] The multi-link communication means that an AP MLD will form a plurality of BSSs on different links, and the non-AP STA MLD will communicate with the AP MLD on multiple links. How to broadcast the AP quiet time for the BSSs formed by the same AP MLD to the Non-AP STA MLD needs to be defined. In the example embodiment of the disclosure, the AP MLD and the non-AP STA MLD may support the capability to send and/or receive simultaneously on multiple links at the same moment.

[0065] FIG. 2 is a flowchart of a communication method according to an example embodiment of the disclosure.

[0066] As shown in FIG. 2, at step 210, a first message frame may be determined. For example, the first message frame may be determined by the AP on one link of the multiple links supported by itself. In some examples, one or more links supported by the AP may be determined to send the first message frame. According to the example embodiment of the disclosure, the first message frame may be a beacon frame or a probe response frame broadcast by the AP, which is not limited in embodiments of the disclosure. The first message frame may be any other type of frame according to the communication environment. In an example embodiment, the first message frame may be determined based on the communication capability of the AP and the current communication environment. In another example embodiment, a pre-stored or pre-written first message frame may be obtained directly.

[0067] In the example embodiment of the disclosure, the first message frame (e.g., a beacon frame or a probe response frame) may include a change sequence field for indicating the quiet information for a plurality of links.

[0068] It is considered that an event update may occur when the quiet information of the AP has changed, and then the change of the quiet information for an AP can be represented by the change sequence field. The quiet information for the AP may include a quiet period or a quiet duration for the AP. That is, according to the example embodiment of the disclosure, the value of the change sequence field (e.g., the change sequence field shown in Table 2 below) may be set to

a first value to indicate the change of the quiet information for an AP of multiple links (i.e., the change of the quiet period or the quiet duration for the AP of multiple links). An example of the change sequence field will be described in detail below with reference to Table 2.

[0069] At step 220, the first message frame is sent on at least one link of the plurality of links. That is, the change sequence field is sent on the at least one link by carrying the change sequence field in the first message frame.

[0070] In some examples, the change sequence field only indicates whether quiet information of the AP has changed, and the specific quiet information may be further notified to the receiver (e.g., the STA) via quiet time information (which may also be referred to as, the quiet time information element), which will be described in detail below with reference to FIG. 3 and FIG. 4.

[0071] FIG. 3 is a flowchart of a communication method according to an example embodiment of the disclosure.

[0072] As shown in FIG. 3, at step 310, the change sequence information element and the quiet time information may be determined. For example, the change sequence information element and the quiet time information may be included in the first message frame (e.g., the beacon frame or the probe response frame). When the first message frame is determined at step 210 in FIG. 2, the change sequence information element and the quiet time information may also be determined. According to the example embodiment of the disclosure, the change sequence information element and the quiet time information may be carried in the same first message frame. In other examples, the change sequence information element and the quiet time information may be sent via the same first message frame. Or, the change sequence information element and the quiet time information may be carried in different first message frames. In other words, the change sequence information element and the quiet time information may be sent separately via different first message frames. As noted above, the examples of the first message frames are the beacon frame or the probe response frame, which is not limited in the disclosure.

[0073] According to the example embodiment of the disclosure, the change sequence information element may have the format as shown in Table 2 below.

Table 2: change sequence information element format

Element ID	Length	change sequence	Link ID /Link set ID

[0074] According to Table 2, the change sequence field described with reference to step 210 in FIG. 2 may be the Change Sequence field included in the change sequence information element. For example, when the value of Change Sequence field is set to “00000101”, its value is 5, and the value modulo 256 is used to indicate that the quiet time information on the multiple links has

changed.

[0075] In addition, according to the example embodiment of the disclosure, the change sequence information element may include a link ID. The link ID may correspond to a link with changed quiet information. In an example, the link ID may correspond to a single link (e.g., Link ID in Table 2). However, in another example, the link ID may correspond to a set of multiple links (e.g., Link set in Table 2).

[0076] In addition to identifying the change of the quiet information of the AP of multiple links by setting the value of the change sequence field to the first value as described at step 210 in FIG. 2, it is also possible to indicate, by the link ID, on which link or links the quiet information has changed.

[0077] In addition, considering that the change sequence information element shown in Table 2 is different from the related art (as shown in Table 1), the value of the Element ID is set to a value different from the value of the Element ID shown in Table 1, and thus a different value is set to indicate that the change sequence information element is a newly defined type of element to the receiver.

[0078] However, this is only exemplary and in other embodiments of the disclosure, the link ID may also be omitted, or the value of the Element ID in Table 2 may be the same as the value of the Element ID in Table 1.

[0079] The quiet time information determined at step 310 may have the format shown in Table 3 below.

Table 3: quiet time information

Element ID	Length	Quiet count	Quiet period	Quiet duration	Quiet offset	BSSID /link ID	Time shifting to reference link	……

[0080] According to Table 3, the quiet time information may include a second link ID, such as link ID in Table 3. The second link ID may correspond to the link with changed quiet information. In some embodiments, the quiet time information may include a BSSID. The BSSID corresponds to the link with changed quiet information. The BSSID may indicate to which BSS the link with the changed quiet information belongs.

[0081] In addition, the quiet time information may include a time offset corresponding to a

link for sending the quiet time information (e.g., Time shifting to reference link in Table 3), which may be used to represent a time difference between the link on which quiet occurs and the link on which the quiet time information is sent currently. For example, the link on which quiet occurs may be the Link 1 shown in FIG. 1 and a corresponding time is T1. If the quiet time information is sent on all three links (Link 1 to Link 3) shown in Figure 1, the time offset field in the quiet time information sent on the Link1 may be 0; the time offset field in the quiet time information sent on the Link2 may be s1; and the time offset field in the quiet time information sent on the Link3 may be s2. That is, the time at which each of Link 1 to Link 3 send the quiet time information respectively may correspond to T1, T1+s1, and T1+s2, which is only exemplary and is not limited in the example embodiment of the disclosure. For example, the time offset field of the quiet time information may directly indicate the specific time corresponding to the link on which the quiet time information is sent.

[0082] In an example, one link of the multiple links supported by the AP may be set as a reference link (e.g., the link on which the quiet occurs or any other link). When the quiet time information is sent on at least one link, the time offset in the quiet time information on each link of the at least one link may indicate a time offset of each link relative to the reference link when sending the quiet time information, which is not limited in the example embodiments of the disclosure. For example, instead of setting a reference link, a reference time may be set, and then the time offset may correspond to a time offset of sending the quiet time information on each link relative to the reference time. In other words, when the quiet time information is sent on at least one link, the time offset in the quiet time information on each link of the at least one link may indicate a time offset of each link relative to the reference time.

[0083] In addition, the quiet time information may include an Element ID indicating the type of the quiet time information (i.e., the Element ID in Table 3). That is, in the example embodiment of the disclosure, the quiet time information (in the format shown in Table 3) sent at step 310 may be identified by the Element ID as a newly defined type.

[0084] In addition, the quiet time information may include at least one of the following fields: length, quiet count, quiet period, quiet duration or quiet offset. These fields are used to define specific information when the quiet information has changed, and their meanings are similar to those of the related art, so that only some of these fields are described briefly below.

[0085] The Quiet Count field is set to the number of target beacon transmission times (TBTTa) until the beacon interval during which the next quiet interval starts.

[0086] The Quiet Period field is set to the number of beacon intervals between the start of regularly scheduled quiet intervals defined by the quiet time element (which can also be called a

[00111] According to the example embodiment of the disclosure, the quiet time information includes: a BSS ID, and the BSS ID corresponds to a link with changed quiet information.

[00112] According to the example embodiment, the quiet time information may include a time offset corresponding to the link for sending the quiet time information (e.g., time shifting to reference link in Table 3), which is configured to represent the time difference between the link on which the quiet occurs and the link on which the quiet time information is sent currently. For example, the link on which the quiet occurs may be Link 1 shown in FIG. 1 with a corresponding time of T1. Assuming that the quiet time information is sent on all three links (Link 1 to Link 3) shown in FIG. 1, the time offset field in the quiet time information sent on the Link1 can be 0; the time offset field in the quiet time information sent on the Link2 may be s1; and the time offset field in the quiet time information sent on the Link3 may be s2. That is, the time at which each of Link 1 to Link 3 send the quiet time information may correspond to T1, T1+s1 and T1+s2 respectively, which is only exemplary and is not limited by the example embodiments of the disclosure. For example, the time offset field of the quiet time information may directly indicate the specific time corresponding to the link on which the quiet time information is sent. In an example, one link of the plurality of links supported by the AP may be set as the reference link (e.g., the link on which the quiet occurs or any other link), and when the quiet time information is sent on at least one link, the time offset corresponding to the link on which the quiet time information is sent may indicate the time offset of the link relative to the reference link at the time the quiet time information is sent, which is not limited in the example embodiments of the disclosure. For example, instead of setting the reference link, a reference time may be set, and then the time offset may correspond to a time offset of sending the quiet time information on each link relative to the reference time. In other words, when the quiet time information is sent on at least one link, the time offset in the quiet time information on each link of the at least one link may indicate a time offset of each link relative to the reference time.

[00113] According to the example embodiment of the disclosure, the quiet time information includes: an element ID indicating a type of the quiet time information.

[00114] According to the example embodiment of the disclosure, the communicating module 520 is further configured to send quiet time information on links other than the at least one link, in which a format of the quiet time information is the same as a format of QEs (as shown in FIG. 4).

[00115] The configuration and structure of the communication device 500 shown in FIG. 5 is only exemplary, which is not limited to the example embodiments of the disclosure. For

WHAT IS CLAIMED IS:

1. A multi-link communication method, performed by an access point (AP), the method comprising:

determining a first message frame, wherein the first message frame comprises a change sequence field, and a value of the change sequence field is configured to indicate quiet information for a plurality of links; and

sending the first message frame on at least one link of the plurality of links to at least one station (STA).

2. The method of claim 1, wherein the value of the change sequence field is set to a first value, for indicating a change of the quiet information for the plurality of links.

3. The method of claim 2, wherein the change sequence field is included in a change sequence information element.

4. The method of claim 3, wherein the change sequence information element comprises: a first link ID, wherein the first link ID corresponds to a link with changed quiet information.

5. The method of claim 2, wherein the first message frame further comprises quiet information.

6. The method of claim 1, further comprising:

sending quiet information on the at least one link.

7. The method of claim 5 or 6, wherein the quiet information comprises a second link ID, wherein the second link ID corresponds to a link with changed quiet information.

8. The method of claim 5 or 6, wherein the quiet information comprises a basic service set ID, wherein the basic service set ID corresponds to a link with changed quiet information.

9. The method of claim 7, wherein the quiet information comprises a time offset corresponding to a link for sending the quiet time information.

10. The method of claim 7, wherein the quiet information comprises: an element ID indicating a type of the quiet information.

11. The method of claim 1, further comprising:

sending quiet information on at least one link other than the at least one link on which the first message frame is sent; wherein

a format of the quiet information is the same as a format of a quiet element.

12. A multi-link communication method, performed by a station (STA), the method comprising:

receiving a first message frame on at least one link sent by at least one access point (AP), wherein the first message frame comprises a change sequence field, and a value of the change sequence field is configured to indicate quiet information for a plurality of links.

13. The method of claim 12, wherein the value of the change sequence field is set to a first value, for indicating a change of the quiet information for the plurality of links.

14. The method of claim 13, wherein the change sequence field is included in a change sequence information element.

15. The method of claim 14, wherein the change sequence information element comprises: a first link ID, wherein the first link ID corresponds to a link with changed quiet information.

16. The method of claim 13, wherein the first message frame further comprises quiet information.

17. The method of claim 12, further comprising: receiving quiet information on the at least one link.

18. The method of claim 16 or 17, wherein the quiet information comprises a second link ID, wherein the second link ID corresponds to a link with changed quiet information.

19. The method of claim 16 or 17, wherein the quiet time information comprises a basic service set ID, wherein the basic service set ID corresponds to a link with changed quiet information.

20. An electronic device comprising: a memory, a processor and computer programs stored on the memory and executable by the processor, wherein when the computer programs are executed by the processor, the method of any one of claims 1-11 or the method of any one of claims 12-22 is implemented.