COMMUNICATION APPARATUS AND COMMUNICATION METHOD FOR MULTI-AP JOINT RE-TRANSMISSION

BACKGROUND

1. TECHNICAL FIELD

[0001] The present disclosure generally relates to communication apparatus and methods for electronic devices and systems, and more particularly relates to joint re-transmission in multi-AP networks.

2. DESCRIPTION OF RELATED ART

[0002] Wireless networks that communicate via multi-AP joint transmission enable electronic devices to communication in networks with joint transmissions sent to multiple electronic devices. Such networks have advantages over other wireless networks in which wireless communication is limited to a single transmission to one electronic device.

SUMMARY

[0003] One non-limiting and exemplary embodiment facilitates providing joint transmission and re-transmission communication in multi-AP networks. By way of example, this communication includes joint re-transmission between two or more access points (APs) and one or more wireless stations (STAs).

One example embodiment is an access point (AP) that includes a receiver, which, in operation, receives a Joint Transmission (JT) Trigger frame from another AP that indicates MAC protocol data units (MPDUs) to be jointly transmitted to a communication apparatus; and a local memory that stores one or more MPDUs previously transmitted to the communication apparatus. In an aspect, there is access point, AP, (270) comprising: circuitry configured to encapsulate Joint Transmission, JT, data and generate a data frame including the encapsulated JT data and a JT Packet ID assigned to the encapsulated JT data; and a transmitter configured to transmit the data frame to a slave AP (280, 282), and transmit a first JT Trigger frame including the assigned JT Packet ID to initiate a JT transmission, characterized by the circuitry configured to determine that a communication apparatus (284) failed to receive one or more MAC protocol data units, MPDUs, of the data frame that were jointly transmitted by the AP and the slave AP to the communication apparatus in the JT transmission, and the transmitter configured to transmit a second JT Trigger frame including the assigned JT Packet ID to the slave AP without re-distributing the failed MPDUs to the slave AP. In an aspect, there is a

method comprising: encapsulating, at an access point, AP, (270) Joint Transmission, JT, data; generating, at the AP, a data frame including the encapsulated JT data and a JT Packet ID assigned to the encapsulated JT data; transmitting, at the AP, the data frame to a slave AP (280, 282);

transmitting, at the AP a first JT Trigger frame including the assigned JT Packet ID to initiate a JT transmission, characterized by determining, at the AP, that a communication apparatus (284) failed to receive one or more MAC protocol data units, MPDUs, of the data frame that were jointly transmitted by the AP and the slave AP to the communication apparatus in the JT transmission; and transmitting, by the AP, a second JT Trigger frame including the assigned JT Packet ID to the slave AP without re-distributing the failed MPDUs to the slave AP.

Claims

What is claimed is:

1. An access point (AP) comprising:

receiver, which, in operation, receives a Joint Transmission (JT) Trigger frame from another AP that indicates MAC protocol data units (MPDUs) to be jointly transmitted to a communication apparatus; and

a local memory that stores one or more MPDUs previously transmitted to the communication apparatus.

2. The AP of claim 1, wherein the JT Trigger frame includes an explicit indication whether the one or more MPDUs previously transmitted to the communication apparatus are to be deleted from the local memory.

3. The AP of claim 1, wherein the local memory stores the one or more MPDUs previously transmitted to the communication apparatus until receiving the JT Trigger frame.

4. The AP of claim 1, wherein the JT Trigger frame includes Sequence Number values of the MPDUs to be jointly transmitted to the communication apparatus, and the AP deletes from the local memory the previously transmitted MPDUs with the Sequence Number values that are not indicated in the JT Trigger frame.

5. The AP of claim 1 further comprising:

a transmitter, which in operation, transmits, upon not being in possession of the MPDUs that are indicated to be jointly transmitted in the JT Trigger frame, a frame to the another AP that includes Sequence Number values of MPDUs that have been deleted from the local memory and a reason for deleting the MPDUs from the local memory.

6. The AP of claim 1, wherein the receiver further operates to receive an Acknowledgment (ACK) frame or Block Ack (BA) frame from the communication apparatus acknowledging successfully received MPDUs that were jointly transmitted by the one or more other APs and

~~the AP, and the ACK frame or BA frame being addressed to the AP; and the AP further comprising:~~

~~a transmitter, which in operation, transmits a frame carrying the content of the ACK frame or the BA frame to the another AP.~~

17~~.~~ An access point, ~~(~~AP~~)~~, (270) comprising:

circuitry~~, which, in operation,~~ configured to encapsulate Joint Transmission, JT, data and generate a data frame including the encapsulated JT data and a JT Packet ID assigned to the encapsulated JT data; and

a transmitter configured to transmit the data frame to a slave AP (280, 282), and transmit a first JT Trigger frame including the assigned JT Packet ID to initiate a JT transmission,

characterized by

the circuitry configured to determine~~s~~ that a communication apparatus (284) failed to receive one or more MAC protocol data units, ~~(~~MPDUs,~~)~~ of the data frame that were jointly transmitted by the AP and ~~another~~ the slave AP to the communication apparatus in the JT transmission,~~;~~ and

the~~a~~ transmitter~~, which, in operation,~~ configured to transmit~~s~~ a second ~~Joint Transmission (~~JT~~)~~ Trigger frame including the assigned JT Packet ID to the ~~another~~ slave AP without re-distributing the failed MPDUs to the ~~another~~slave AP.

28~~.~~ The AP of claim 17~~,~~ wherein the second JT Trigger frame indicates the MPDUs to be jointly transmitted again to the communication apparatus.

~~9. A method comprising:~~

~~receiving, at an access point (AP) a Joint Transmission (JT) Trigger frame from another AP that indicates MAC protocol data units (MPDUs) to be jointly transmitted to a communication apparatus; and~~

~~storing, in a local memory of the AP, one or more MPDUs previously transmitted to the communication apparatus.~~

310~~.~~ A method comprising:

encapsulating, at an access point, AP, (270) Joint Transmission, JT, data;

generating, at the AP, a data frame including the encapsulated JT data and a JT Packet ID assigned to the encapsulated JT data;

transmitting, at the AP, the data frame to a slave AP (280, 282);

transmitting, at the AP a first JT Trigger frame including the assigned JT Packet ID to initiate a JT transmission,

characterized by

determining, at ~~an access point (~~the AP~~)~~, that a communication apparatus (284) failed to receive one or more MAC protocol data units, ~~(~~MPDUs,~~)~~ of the data frame that were jointly transmitted by the AP and the slave~~another~~ AP to the communication apparatus in the JT transmission; and

transmitting, by the AP, a second ~~Joint Transmission (~~JT~~)~~ Trigger frame including the assigned JT Packet ID to the ~~another~~ slave AP without re-distributing the failed MPDUs to the slave~~another~~ AP.