System and Method for Downlink Transmission in a Wireless Network

~~[0001] This application claims the benefit of U.S. Non-Provisional Application No. 13/798,472 filed March 13, 2013, entitled "System and Method for Downlink Transmission in a Wireless Network," which claims the benefit of U.S. Provisional Application No. 61/623,418 filed April 12, 2012, entitled "System and Method for Transmitting a Reference Signal," both of which are incorporated herein by reference as if reproduced in its entirety.~~

TECHNICAL FIELD

[0002] The present invention relates to a system and method for wireless communications, and, in particular, to a system and method for downlink transmission in a wireless network.

BACKGROUND

[0003] Currently, IEEE 802.11ah defines a local area network protocol especially for sub 1 GHz carrier frequencies. The main requirements of IEEE 802.11ah include a large coverage area (e.g., up to 1km), a physical (PHY) layer data rate of at least 100 kbps, a maximum aggregate multi-station data rate of 20 Mbps, the use of orthogonal frequency division multiplexing (OFDM) PHY modulation, and support of a number of associations beyond 2007 for outdoor applications.

[0004] Overhead is an issue under the 802.11ah protocol. The physical layer of 802.11ah uses a slower clock than that used in the normal 802.11 protocol. Therefore, each symbol length under 802.11ah is ten times as long as under the normal 802.11 protocol.

[0005] For a downlink traffic transmission scheme in the 802.11 protocol, at every beacon frame, an access point (AP) broadcasts a traffic indication map (TIM) that has information on whether the downlink packet is buffered to each of the stations. If the downlink packet is buffered, a station, after reading the TIM, transmits a power save (PS)-Poll message indicating that the station

WHAT IS CLAIMED IS:

1. A method of communicating in a wireless network, the method comprising:

transmitting, by a station, a null data packet (NDP) power save (PS)-Poll frame comprising

a short training field,

a long training field, and

a signaling field comprising

a message type indicator,

a transmitter address (TA),

a receiver address (RA), and

a cyclic redundancy check (CRC); and

receiving, by the station, buffered data in accordance with the NDP PS-Poll frame.

2. The method of claim 1, wherein the signaling field further comprises a preferred modulation and coding scheme (MCS) subfield.

3. The method of claim 2, wherein the method further comprises decoding the received buffered data using the preferred MCS subfield.

4. The method of claim 2, wherein the preferred MCS subfield comprises a direct indicator of a modulation and coding scheme level.

5. The method of claim 2, wherein the preferred MCS subfield comprises a difference between a preferred MCS level and an MCS level of a packet previously received by the station from an access point.

6. The method of claim 2, further comprising:

receiving, by the station, a packet from an access point; and

determining the preferred MCS subfield in accordance with a quality of the packet.

7. The method of claim 1, wherein the signaling field further comprises tail bits.

8. The method of claim 1, wherein the signaling field further comprises a preferred number of concurrent streams.

9. The method of claim 1, further comprising receiving, by the station, a traffic indication map.

10. The method of claim 1, further comprising receiving, by the station, an acknowledgment frame prior to receiving the buffered data.

11. The method of claim 1, wherein the signaling field is fewer than 49 bits.

12. The method of claim 11, wherein the signaling field is fewer than 37 bits.

13. The method of claim 1, wherein the TA is generated in accordance with a portion of an association ID (AID).

14. The method of claim 1, wherein the RA is generated in accordance with a portion of a basic service set ID (BSSID).

15. A method of communicating in a wireless network, the method comprising:

receiving, by an access point, a null data packet (NDP) PS-Poll frame comprising

a short training field,

a long training field, and

a signaling field comprising

a message type indicator,

a receiver address (RA),

a transmitter address (TA), and

a cyclic redundancy check (CRC);

decoding, by the access point, the NDP PS-Poll frame; and

transmitting, by the access point, buffered data in accordance with the NDP PS-Poll frame.

16. The method of claim 15, wherein a plurality of stations have a plurality of addresses, wherein the plurality of stations is configured to receive buffered data from the access point, and wherein the TA is different than the plurality of addresses of the plurality of stations.

17. The method of claim 15, further comprising:

monitoring, by the access point, packets from a plurality of access points have a plurality of receiver addresses;

changing the receiver address when the receiver address matches one of the plurality of receiver addresses; and

broadcasting a management packet, by the access point, wherein the management packet comprises a code indicating whether the receiver address is generated in accordance with a portion of a basic service set ID (BSSID).

18. The method of claim 17, wherein the packet further comprises the portion of the BSSID.

19. The method of claim 15, further comprising decoding the NDP PS-Poll frame using a lowest modulation and coding scheme (MCS) level.

20. The method of claim 15, wherein the signaling field further comprises a preferred modulation and coding scheme (MCS) subfield.

21. The method or claim 20, wherein the preferred MCS subfield comprises a difference in level between a preferred MCS level and an MCS level of a packet previously transmitted by the access point to a station .

22. The method of claim 20, wherein the method further comprises encoding the buffered data using the preferred MCS subfield.

23. The method of claim 15, further comprising broadcasting, by the access point, information indicating a presence of downlink traffic buffered at the access point.

24. The method of claim 15, further comprising transmitting, by the access point, a traffic indication map.

25. The method of claim 15, further comprising transmitting, by the access point, an acknowledgment frame prior to transmitting the buffered data.

26. The method of claim 25, wherein the signaling field is fewer than 49 bits.

27. A station comprising:

a processor; and

a computer readable storage medium storing programming for execution by the processor, the programming including instructions to

transmit a null data packet (NDP) PS-Poll frame comprising

a short training field,

a long training field, and

a signaling field comprising

a message type indicator,

a receiver address (RA),

a transmitter address (TA)

a cyclic redundancy check (CRC), and

receive buffered data in accordance with the NDP PS-Poll frame.

28. The station of claim 27, wherein the signaling field further comprises a preferred modulation and coding scheme (MCS) subfield.

29. The station of claim 27, wherein the programming further includes instructions to receive, by the station, an acknowledgment frame prior to receiving the buffered data.

30. The station of claim 27, wherein the signaling field is fewer than 49 bits.

31. An access point comprising:

a processor; and

a computer readable storage medium storing programming for execution by the processor, the programming including instructions to

receive a null data packet (NDP) PS-Poll frame comprising

a short training field,

a long training field, and

a signaling field comprising

a message type indicator,

a receiver address (RA),

a transmitter address (TA), and

a cyclic redundancy check (CRC),

decode the null data packet, and

transmit buffered data in accordance with the NDP PS-Poll frame.

32. The access point of claim 31, wherein the signaling field further comprises a preferred modulation and coding scheme (MCS) subfield.

33. The access point of claim 31, wherein the programming further includes instructions to transmit, by the access point, an acknowledgment frame prior to transmitting the buffered data.

34. The access point of claim 31, wherein the signaling field is fewer than 49 bits.

CLAIMS

1. A method of communicating in a wireless network, the method comprising:

transmitting (132), by a station, a null data packet (NDP) power save (PS)-Poll frame comprising

a short training field,

a long training field, and

a signaling field comprising

a message type indicator,

a transmitter address (TA),

a receiver address (RA), and

a cyclic redundancy check (CRC);

wherein the signaling field further comprises a preferred modulation and coding scheme (MCS) subfield; and

receiving (140), by the station, buffered data in accordance with the NDP PS-Poll frame.

2. The method of claim 1, wherein the method further comprises decoding the received buffered data using the preferred MCS subfield.

3. The method of claim 1, wherein the preferred MCS subfield comprises a direct indicator of a modulation and coding scheme level; or

a difference between a preferred MCS level and an MCS level of a packet previously received by the station from an access point.

4. The method of claim 1, wherein the signaling field has fewer than 37 bits.

5. The method of claim 1, wherein the TA is generated in accordance with a portion of an association ID (AID).

6. The method of claim 1, wherein the RA is generated in accordance with a portion of a basic service set ID (BSSID).

7. A method of communicating in a wireless network, the method comprising:

receiving (132), by an access point, a null data packet (NDP) PS-Poll frame comprising

a short training field,

a long training field, and

a signaling field comprising

a message type indicator,

a receiver address (RA),

a transmitter address (TA), and

a cyclic redundancy check (CRC);

wherein the signaling field further comprises a preferred modulation and coding scheme (MCS) subfield;

decoding, by the access point, the NDP PS-Poll frame; and

transmitting (140), by the access point, buffered data in accordance with the NDP PS-Poll frame.

8. The method or claim 7, wherein the preferred MCS subfield comprises a direct indicator of a modulation and coding scheme level; or

a difference in level between a preferred MCS level and an MCS level of a packet previously transmitted by the access point to a station.

9. The method of claim 7, wherein the method further comprises encoding the buffered data using the preferred MCS subfield.

10. The method of claim 7, wherein the signaling field has fewer than 37 bits.

11. The method of claim 7, wherein the TA is generated in accordance with a portion of an association ID (AID).

12. The method of claim 7, wherein the RA is generated in accordance with a portion of a basic service set ID (BSSID).

13. A station comprising:

a processor; and

a computer readable storage medium storing programming for execution by the processor, the programming including instructions to

transmit (132) a null data packet (NDP) PS-Poll frame comprising

a short training field,

a long training field, and

a signaling field comprising

a message type indicator,

a receiver address (RA),

a transmitter address (TA)

a cyclic redundancy check (CRC),

wherein the signaling field further comprises a preferred modulation and coding scheme (MCS) subfield; and

receive (140) buffered data in accordance with the NDP PS-Poll frame.

14. The station of claim 13, wherein the signaling field has fewer than 37 bits.

15. The station of claim 13, wherein the TA is generated in accordance with a portion of an association ID (AID).

16. The station of claim 13, wherein the RA is generated in accordance with a portion of a basic service set ID (BSSID).

17. An access point comprising:

a processor; and

a computer readable storage medium storing programming for execution by the processor, the programming including instructions to

receive (132) a null data packet (NDP) PS-Poll frame comprising

a short training field,

a long training field, and

a signaling field comprising

a message type indicator,

a receiver address (RA),

a transmitter address (TA), and

a cyclic redundancy check (CRC);

wherein the signaling field further comprises a preferred modulation and coding scheme (MCS) subfield;

decode the null data packet, and

transmit (140) buffered data in accordance with the NDP PS-Poll frame.

18. The access point of claim 17, wherein the signaling field has fewer than 37 bits.

19. The access point of claim 17, wherein the TA is generated in accordance with a portion of an association ID (AID).

20. The access point of claim 17, wherein the RA is generated in accordance with a portion of a basic service set ID (BSSID).