

System and Method for Allocating Periodic Resources

~~[0001]~~ This application claims the benefit of Non-U.S. Provisional Application No. 13/925,365, filed on June 24, 2013, entitled “System and Method for Allocating Periodic Resources,” which claims the benefit of U.S. Provisional Application No. 61/664,455, filed on June 26, 2012, entitled “System and Method for Periodic Resource Allocation,” both of which application are hereby incorporated herein by reference.

TECHNICAL FIELD

[0002] The present disclosure relates generally to digital communications, and more particularly to a system and method for allocating periodic resources.

BACKGROUND

[0003] Currently, Task Group ah (TGah) of the IEEE 802.11 technical standards is operating on defining the local area network protocol, to be referred to as 802.11ah, with specific focus on sub 1 GHz carrier frequencies. Main requirements of TGah include a larger coverage area of up to 1 kilometer (km), a physical (PHY) layer data rate of at least 100 kilo bits per second (kbps), a maximum aggregate multi-station data rate of 20 mega bits per second (Mbps), the use of orthogonal frequency division multiplexing (OFDM) PHY modulation, and support for more than 2007 associations. However, overhead is a critical issue for 802.11ah. The PHY of 802.11ah uses a 10 times slower clock than the normal 802.11 protocol. Hence, each symbol is 10 times longer than in the normal 802.11 protocol. Efficiency of the protocol is thus important for 802.11ah.

WHAT IS CLAIMED IS:

1. A method for operating an access point, the method comprising:
reserving, by the access point, resources for a periodic group resource;
broadcasting, by the access point, reservation information for the periodic group resource;
5 assigning, by the access point, a resource in the periodic resource to a first station;
transmitting, by the access point, information about the resource in the periodic group
resource assigned to the first station to the first station, wherein the transmitting occurs during one
of an association procedure with the first station and a reconfiguration of a resource assignment for
the first station; and
10 exchanging, by the access point, data with the first station during the resource in the periodic
group resource assigned to the first station.
2. The method of claim 1, wherein the reservation information comprises information about a
duration of the periodic group resource, a period of the periodic group resource, and a time to a first
resource of the periodic group resource.
- 15 3. The method of claim 1, wherein the information about the resource comprises a start time of
the resource, a duration of the resource, and a period of the resource.
4. The method of claim 1, further comprising transmitting the reservation information with the
information about the resource in the periodic group resource assigned to the first station.
5. The method of claim 1, wherein reservation information further comprises a number of slots
20 within the periodic group resource, and a duration of each slot within the periodic group resource.
6. The method of claim 1, wherein reservation information further comprises a first indicator of
allowed stations permitted to exchange data during the periodic group resource.
7. The method of claim 1, wherein the reservation information is transmitted at a greater period
than that of a beacon frame.
- 25 8. The method of claim 1, wherein the reservation information is transmitted in one of a beacon
frame and a probe response frame.

9. A method for operating a station, the method comprising:
receiving, by the station, reservation information for a periodic group resource;
receiving, by the station, a list of allowed stations permitted to utilize an access window;
determining, by the station, if the station is in the list of allowed stations permitted to utilize
5 the access window;
exchanging, by the station, data with an access point within the access window if the station
is in the list of allowed stations permitted to utilize the access window; and
exchanging, by the station, data with the access point using a resource not reserved for the
periodic group resource and not in the access window if the station is not in the list of allowed
10 stations.
10. The method of claim 9, wherein the reservation information comprises information about a
duration of the periodic group resource, a period of the periodic group resource, and a time to a first
resource of the periodic group resource.
11. The method of claim 9, wherein the reservation information further comprises a number of
15 slots within the periodic group resource, and a duration of each slot within the periodic group
resource.
12. The method of claim 9, wherein the reservation information further comprises a first
indicator of allowed long sleep stations permitted to exchange data during the periodic group
resource.
- 20 13. The method of claim 9, wherein the reservation information is transmitted in a beacon frame,
and wherein the list of allowed stations is transmitted in a short beacon frame.
14. The method of claim 9, wherein the reservation information is received at a greater period
than the list of allowed stations.
15. An access point comprising:
25 a processor configured to reserve resources for a periodic group resource, assign a resource
in the periodic group resource to a first station, and to exchange data with the first station during the
resource in the periodic group resource allocated to the first station; and

a transmitter operatively coupled to the processor, the transmitter configured to broadcast reservation information for the periodic group resource, and to transmit information about the resource in the periodic group resource allocated to the first station to the first station, wherein the transmitting occurs during one of an association procedure with the first station and a reconfiguration of a resource assignment for the first station.

16. The access point of claim 15, wherein the reservation information comprises information about a duration of the periodic group resource, a period of the periodic group resource, and a time to a first resource of the periodic group resource.

17. The access point of claim 15, wherein the information about the resource comprises a start time of the resource, a duration of the resource, and a period of the resource.

18. The access point of claim 15, wherein the transmitter is configured to transmit the reservation information with the information about the resource in the periodic group resource assigned to the first station.

19. A station comprising:

a receiver configured to receive reservation information for a periodic group resource, and to receive a list of allowed stations permitted to utilize an access window; and

a processor operatively coupled to the receiver, the processor configured to determine if the station is in the list of allowed stations permitted to utilize the access window, to exchange data with an access point within the access window if the station is in the list of allowed stations permitted to utilize the access window, and to exchange data with the access point using a resource not reserved for the periodic group resource and not in the access window if the station is not in the list of allowed stations.

20. The station of claim 19, wherein the reservation information comprises information about a duration of the periodic group resource, a period of the periodic group resource, and a time to a first resource of the periodic group resource.

21. The station of claim 19, wherein the reservation information further comprises a number of slots within the periodic group resource, and a duration of each slot within the periodic group resource.

22. The station of claim 19, wherein the reservation information further comprises a first indicator of allowed long sleep stations permitted to exchange data during the periodic group resource.

23. The station of claim 19, wherein the station is a regular station.

24. A method for operating an access point in an IEEE 802.11 compliant communications system, the method comprising:

reserving, by the access point, resources of a communications channel for a periodic restricted access window;

periodically broadcasting, by the access point, one of a Beacon frame, a short Beacon frame, and a Probe Response frame including reservation information about the periodic restricted access window;

transmitting, by the access point, a management frame to a first station during one of an association procedure and a rescheduling of a resource assignment to the first station, the management frame including information about a resource in the periodic restricted access window assigned to the first station; and

exchanging, by the access point, data with the first station during the resource in the periodic restricted access window assigned to the first station.

25. The method of claim 24, wherein the management frame is an association response frame.

26. The method of claim 24, wherein the reservation information comprises at least one of a group identifier of the periodic restricted access window, a start time of the periodic restricted access window, a duration of the periodic restricted access window, a periodicity of the periodic restricted access window, and a start offset of the periodic restricted access window.

27. The method of claim 24, wherein the first station is a long sleep station.

CLAIMS

1. A method for operating an access point, the method comprising:
reserving, by the access point, resources for a periodic group resource;
broadcasting, by the access point, reservation information for the periodic group resource;
assigning, by the access point, a resource in the periodic group resource to a first station;
transmitting, by the access point, information about the resource in the periodic group resource assigned to the first station to the first station, wherein the transmitting occurs during one of an association procedure with the first station and a reconfiguration of a resource assignment for the first station; and
exchanging, by the access point, data with the first station on the resource in the periodic group resource assigned to the first station.
2. The method of claim 1, wherein the reservation information comprises information about a duration of the periodic group resource, a period of the periodic group resource, and a time to a first resource of the periodic group resource.
3. The method of claim 1, wherein the information about the resource comprises a start time of the resource, a duration of the resource, and a period of the resource.
4. The method of claim 1, further comprising transmitting the reservation information with the information about the resource in the periodic group resource assigned to the first station.
5. The method of claim 1, wherein reservation information further comprises a number of slots within the periodic group resource, and a duration of each slot within the periodic group resource.
6. The method of claim 1, wherein reservation information further comprises a first indicator of allowed stations permitted to exchange data during the periodic group resource.

7. The method of claim 1, wherein the reservation information is transmitted at a greater period than that of a beacon frame.
8. The method of claim 1, wherein the reservation information is transmitted in one of a beacon frame and a probe response frame.
9. A method for operating a station, the method comprising:
 - receiving, by the station, reservation information for a periodic group resource;
 - receiving, by the station, a list of allowed stations permitted to utilize an access window;
 - determining, by the station, if the station is in the list of allowed stations permitted to utilize the access window;
 - exchanging, by the station, data with an access point within the access window if the station is in the list of allowed stations permitted to utilize the access window; and
 - exchanging, by the station, data with the access point using a resource not reserved for the periodic group resource and not in the access window if the station is not in the list of allowed stations.
10. The method of claim 9, wherein the reservation information comprises information about a duration of the periodic group resource, a period of the periodic group resource, and a time to a first resource of the periodic group resource.
11. The method of claim 9, wherein the reservation information further comprises a number of slots within the periodic group resource, and a duration of each slot within the periodic group resource.
12. The method of claim 9, wherein the reservation information further comprises a first indicator of allowed long sleep stations permitted to exchange data during the periodic group resource.

13. The method of claim 9, wherein the reservation information is transmitted in a beacon frame, and wherein the list of allowed stations is transmitted in a short beacon frame whose transmission period is shorter than that of the beacon frame.

14. The method of claim 9, wherein the reservation information is received at a greater period than a period at which the list of allowed stations is received.

15. An access point comprising:

a processor configured to reserve resources for a periodic group resource, assign a resource in the periodic group resource to a first station, and to exchange data with the first station on the resource in the periodic group resource allocated to the first station; and

a transmitter operatively coupled to the processor, the transmitter configured to broadcast reservation information for the periodic group resource, and to transmit information about the resource in the periodic group resource allocated to the first station to the first station, wherein the transmitting occurs during one of an association procedure with the first station and a reconfiguration of a resource assignment for the first station.

16. The access point of claim 15, wherein the reservation information comprises information about a duration of the periodic group resource, a period of the periodic group resource, and a time to a first resource of the periodic group resource.

17. The access point of claim 15, wherein the information about the resource comprises a start time of the resource, a duration of the resource, and a period of the resource.

18. The access point of claim 15, wherein the transmitter is configured to transmit the reservation information with the information about the resource in the periodic group resource assigned to the first station.

19. A station comprising:

a receiver configured to receive reservation information for a periodic group resource, and to receive a list of allowed stations permitted to utilize an access window; and

a processor operatively coupled to the receiver, the processor configured to determine

if the station is in the list of allowed stations permitted to utilize the access window, to exchange data with an access point within the access window if the station is in the list of allowed stations permitted to utilize the access window, and to exchange data with the access point using a resource not reserved for the periodic group resource and not in the access window if the station is not in the list of allowed stations.

20. The station of claim 19, wherein the reservation information comprises information about a duration of the periodic group resource, a period of the periodic group resource, and a time to a first resource of the periodic group resource.

21. The station of claim 19, wherein the reservation information further comprises a number of slots within the periodic group resource, and a duration of each slot within the periodic group resource.

22. The station of claim 19, wherein the reservation information further comprises a first indicator of allowed long sleep stations permitted to exchange data during the periodic group resource.

23. The station of claim 19, wherein the station is a regular station.

24. A method for operating an access point in an IEEE 802.11 compliant communications system, the method comprising:

reserving, by the access point, resources of a communications channel for a periodic restricted access window;

periodically broadcasting, by the access point, one of a Beacon frame, a short Beacon frame, and a Probe Response frame including reservation information about the periodic restricted access window;

transmitting, by the access point, a management frame to a first station during one of an association procedure and a rescheduling of a resource assignment to the first station, the management frame including information about a resource in the periodic restricted access window assigned to the first station; and

exchanging, by the access point, data with the first station on the resource in the periodic restricted access window assigned to the first station.

25. The method of claim 24, wherein the management frame is an association response frame.

26. The method of claim 24, wherein the reservation information comprises at least one of a group identifier of the periodic restricted access window, a start time of the periodic restricted access window, a duration of the periodic restricted access window, a periodicity of the periodic restricted access window, and a start offset of the periodic restricted access window.

27. The method of claim 24, wherein the first station is a long sleep station.