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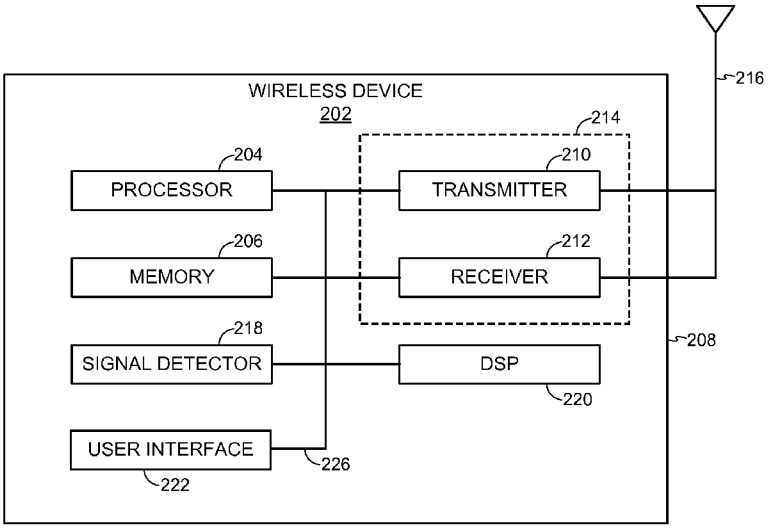

FIG. 2

(57) Abstract: Systems and methods for wireless communication are disclosed. In one aspect an access point includes a processor configured to generate a message identifying a time period during which the apparatus is to communicate data with one or more wireless devices, the message further including an indicator indicating a wireless communication flow direction during the time period. The access point further includes a transmitter configured to transmit the generated message.

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SYSTEM AND METHOD FOR IMPROVED COMMUNICATION ON A WIRELESS NETWORK

BACKGROUND

Field

[0001] The present application relates generally to wireless communications, and more specifically to systems, methods, and devices for saving power using restricted access windows.

Background

[0002] In many telecommunication systems, communications networks are used to exchange messages among several interacting spatially-separated devices. Networks may be classified according to geographic scope, which could be, for example, a metropolitan area, a local area, or a personal area. Such networks would be designated respectively as a wide area network (WAN), metropolitan area network (MAN), local area network (LAN), or personal area network (PAN). Networks also differ according to the switching/routing technique used to interconnect the various network nodes and devices (e.g. circuit switching vs. packet switching), the type of physical media employed for transmission (e.g. wired vs. wireless), and the set of communication protocols used (e.g. Internet protocol suite, SONET (Synchronous Optical Networking), Ethernet, etc.).

[0003] Wireless networks are often preferred when the network elements are mobile and thus have dynamic connectivity needs, or if the network architecture is formed in an ad hoc, rather than fixed, topology. Wireless networks employ intangible physical media in an unguided propagation mode using electromagnetic waves in the radio, microwave, infra-red, optical, etc. frequency bands. Wireless networks advantageously facilitate user mobility and rapid field deployment when compared to fixed wired networks.

[0004] The devices in a wireless network may transmit/receive information between each other. The information may comprise packets, which in some aspects may be referred to as data units. The packets may include overhead information (e.g., header

information, packet properties, etc.) that helps in routing the packet through the network, identifying the data in the packet, processing the packet, etc., as well as data, for example user data, multimedia content, etc. as might be carried in a payload of the packet.

SUMMARY

[0005] Various implementations of systems, methods and devices within the scope of the appended claims each have several aspects, no single one of which is solely responsible for the desirable attributes described herein. Without limiting the scope of the appended claims, some prominent features are described herein. After considering this discussion, and particularly after reading the section entitled "Detailed Description" one will understand how the features of various implementations allow sleep time for an access point.

[0006] One aspect of the disclosure provides a method of wireless communication. The method includes generating, by an apparatus, a message identifying a time period during which the apparatus is to communicate data with one or more wireless devices, the message further comprising an indicator indicating a wireless communication flow direction during the time period; and transmitting, by an apparatus, the generated message.

[0007] Another aspect disclosed is an apparatus. The apparatus includes a processing system configured to generate a message identifying a time period during which the apparatus is to communicate data with one or more wireless devices, the message further comprising an indicator indicating a wireless communication flow direction during the time period, and a transmitter configured to transmit the generated message.

[0008] Another aspect disclosed is an access point. The access point includes an antenna, a processing system configured to generate a message identifying a time period during which the access point is to communicate data with one or more wireless devices, the message further comprising an indicator indicating a wireless communication flow direction during the time period; and a transmitter configured to transmit the generated message using the antenna.

[0009] Another aspect disclosed is an apparatus. The apparatus includes means for generating a message identifying a time period during which the apparatus is to communicate data with one or more wireless devices, the message further comprising an

indicator indicating a wireless communication flow direction during the time period; and means for transmitting the generated message.

[0010] Another aspect disclosed is a computer program product. The computer program product includes a computer readable storage device encoded thereon with instructions that when executed cause an apparatus to perform a method of wireless communication, said method including generating a message identifying a time period during which the apparatus is to communicate data with one or more wireless devices, the message further comprising an indicator indicating a wireless communication flow direction during the time period; and transmitting the generated message.

[0011] Another aspect of the disclosure provides a method of wireless communication The method of wireless communication includes receiving, by an apparatus, a message identifying a time period during which a first device communicates data with one or more second devices, the message further comprising an indicator indicating a wireless communication flow direction during the time period; and communicating data, by an apparatus, with the first device based on the wireless communication flow direction indicator.

[0012] Another aspect disclosed is an apparatus. The apparatus includes a receiver configured to receive a message identifying a time period during which a first device communicates data with one or more second devices, the message further comprising an indicator indicating a wireless communication flow direction during the time period; and a processing system configured to communicate data with the first device based on the wireless communication flow direction indicator.

[0013] Another aspect disclosed is a station. The station includes an antenna; a receiver configured to receive a message using the antenna and identifying a time period during which a first device communicates data with one or more second devices, the message further comprising an indicator indicating a wireless communication flow direction during the time period; and a processing system configured to communicate data with the first device based on the wireless communication flow direction indicator.

[0014] Another aspect disclosed is an apparatus. The apparatus includes means for receiving a message identifying a time period during which a first device communicates data with one or more second devices, the message further comprising an indicator indicating a wireless communication flow direction during the time period; and means

for communicating data with the first device based on the wireless communication flow direction indicator.

[0015] Another aspect disclosed is a computer program product. The computer program product comprising a computer readable storage device encoded thereon with instructions that when executed cause an apparatus to perform a method of wireless communication, said method including receiving a message identifying a time period during which a first device communicates data with one or more second devices, the message further comprising an indicator indicating a wireless communication flow direction during the time period; and communicating data with the first device based on the wireless communication flow direction indicator.

[0016] Another aspect of the disclosure provides a method of wireless communication The method of wireless communication includes generating, by an apparatus, a message comprising an indicator indicating whether one or more devices that are not associated with an apparatus are permitted to communicate with the apparatus during a time period defined by the message; and transmitting, by an apparatus, the generated message.

[0017] Another aspect disclosed is an apparatus. The apparatus includes a processing system configured to generate a message indicating whether one or more devices that are not associated with the apparatus are permitted to communicate with the apparatus during a time period defined by the message; and a transmitter configured to transmit the generated message.

[0018] Another aspect disclosed is an access point. The access point includes an antenna; a processing system configured to generate a message indicating whether one or more devices that are not associated with the access point are permitted to communicate with the access point during a time period defined by the message; and a transmitter configured to transmit the generated message using the antenna.

[0019] Another aspect disclosed is an apparatus. The apparatus includes means for generating a message indicating whether one or more devices that are not associated with the apparatus are permitted to communicate with the apparatus during a time period defined by the message; and means for transmitting the generated message.

[0020] Another aspect disclosed is a computer program product. The computer program product includes a computer readable storage device encoded thereon with instructions that when executed cause an apparatus to perform a method of wireless

communication, said method includes generating a message indicating whether one or more devices that are not associated with an apparatus are permitted to communicate with the apparatus during a time period defined by the message; and transmitting the generated message.

[0021] Another aspect of the disclosure provides a method of wireless communication The method includes receiving, by an apparatus, a message indicating whether devices that are not associated with an apparatus are permitted to communicate with the apparatus during a time period defined by the message; and selectively transmitting, by an apparatus, a message to the apparatus based on the indication.

[0022] Another aspect disclosed is an apparatus. The apparatus includes a receiver configured to receive a message indicating whether devices that are not associated with a second apparatus are permitted to communicate with the second apparatus during a time period defined by the message; and a transmitter configured to selectively transmit a message to the second apparatus based on the indication.

[0023] Another aspect disclosed is a station. The station includes an antenna; a receiver configured to receive a message using the antenna and indicating whether devices that are not associated with an apparatus are permitted to communicate with the apparatus during a time period defined by the message; and a transmitter configured to selectively transmit a message to the apparatus based on the indication.

[0024] Another aspect disclosed is an apparatus. The apparatus includes means for receiving a message indicating whether devices that are not associated with a second apparatus are permitted to communicate with the second apparatus during a time period defined by the message; and means for selectively transmitting a message to the second apparatus based on the indication.

[0025] Another aspect disclosed is a computer program product. The computer program product includes a computer readable storage device encoded thereon with instructions that when executed cause an apparatus to perform a method of wireless communication, said method includes receiving a message indicating whether devices that are not associated with a apparatus are permitted to communicate with the apparatus during a time period defined by the message; and selectively transmitting a message to the apparatus based on the indication.

[0026] Another aspect of the disclosure provides a method of wireless communication. The method includes generating, by an apparatus, a message indicating

an expiration time of a window during which one or more identified devices are permitted to communicate with an apparatus, wherein the expiration time is indicated based on a number of beacon intervals; and transmitting, by an apparatus, the generated message.

[0027] Another aspect disclosed is an apparatus. The apparatus includes a processing system configured to generate a message indicating an expiration time of a window during which one or more identified devices are permitted to communicate with the apparatus, wherein the expiration time is indicated based on a number of beacon intervals; and a transmitter configured to transmit the generated message.

[0028] Another aspect disclosed is an access point. The access point includes an antenna; a processing system configured to generate a message indicating an expiration time of a window during which one or more identified devices are permitted to communicate with the access point, wherein the expiration time is indicated based on a number of beacon intervals; and a transmitter configured to transmit the generated message using the antenna.

[0029] Another aspect disclosed is an apparatus. The apparatus includes means for generating a message indicating an expiration time of a window during which one or more identified devices are permitted to communicate with the apparatus, wherein the expiration time is indicated based on a number of beacon intervals; and means for transmitting the generated message.

[0030] Another aspect disclosed is a computer program product. The computer program product comprising a computer readable storage device encoded thereon with instructions that when executed cause an apparatus to perform a method of wireless communication, said method includes generating message indicating an expiration time of a window during which one or more identified devices are permitted to communicate with the apparatus, wherein the expiration time is indicated based on a number of beacon intervals; and transmitting the generated message.

[0031] Another aspect of the disclosure provides a method of wireless communication. The method includes receiving, by an apparatus, a message indicating an expiration time of a window during which one or more identified devices are permitted to communicate with an access point, the expiration time being based on a number of beacon intervals; and transmitting, by an apparatus, a message during the window.

[0032] Another aspect disclosed is an apparatus. The apparatus includes a receiver configured to receive a message indicating an expiration time of a window during which one or more identified devices are permitted to communicate with an access point, the expiration time being based on a number of beacon intervals; and a transmitter configured to transmit a message during the window.

[0033] Another aspect disclosed is an access point. The access point includes an antenna; a receiver configured to receive a message with the antenna indicating an expiration time of a window during which one or more identified devices are permitted to communicate with an access point, the expiration time being based on a number of beacon intervals; and a transmitter configured to transmit a message during the window using the antenna.

[0034] Another aspect disclosed is a computer program product. The computer program product includes a computer readable storage device encoded thereon with instructions that when executed cause an apparatus to perform a method of wireless communication, said method including receiving a message indicating an expiration time of a window during which one or more identified devices are permitted to communicate with an access point, the expiration time being based on a number of beacon intervals; and transmitting a message during the window.

[0035] Another aspect of the disclosure provides a method of wireless communication. The method includes generating, by an apparatus, a message indicating a start time of a window during which one or more identified devices are permitted to communicate with the apparatus, the start time being based on a time reference maintained by the apparatus; and transmitting, by an apparatus, the generated message.

[0036] Another aspect disclosed is an apparatus. The apparatus includes a processing apparatus configured to generate a message indicating a start time of a window during which one or more identified devices are permitted to communicate with the apparatus, the start time being based on a time reference maintained by the apparatus; and a transmitter configured to transmit the generated message.

[0037] Another aspect disclosed is an access point. The access point includes an antenna; a processing apparatus configured to generate a message indicating a start time of a window during which one or more identified devices are permitted to communicate with the access point, the start time being based on a time reference maintained by the

access point; and a transmitter configured to transmit the generated message with the antenna.

[0038] Another aspect disclosed is an apparatus. The apparatus includes means for generating a message indicating a start time of a window during which one or more identified devices are permitted to communicate with the apparatus, the start time being based on a time reference maintained by the apparatus; and means for transmitting the generated message.

[0039] Another aspect disclosed is a computer program product. The computer program product includes a computer readable storage device encoded thereon with instructions that when executed cause an apparatus to perform a method of wireless communication, said method includes generating a message indicating a start time of a window during which one or more identified devices are permitted to communicate with an apparatus, the start time being based on a time reference maintained by the apparatus; and transmitting the generated message.

[0040] Another aspect of the disclosure provides a method of wireless communication. The method of wireless communication includes receiving, by an apparatus, a message from a wireless communication network indicating a start time of a window during which one or more identified devices are permitted to communicate with an access point, the start time being based on a time reference maintained by the access point; and limiting, by an apparatus, communications on the wireless communication network based on the message.

[0041] Another aspect disclosed is an apparatus. The apparatus includes a receiver configured to receive a message from a wireless communication network indicating a start time of a window during which one or more identified devices are permitted to communicate with an access point, the start time being based on a time reference maintained by the access point; and a processing system configured to limit communications on the wireless communication network based on the message.

[0042] Another aspect disclosed is a station. The station includes an antenna; a receiver configured to receive a message from a wireless communication network using the antenna and indicating a start time of a window during which one or more identified devices are permitted to communicate with an access point, the start time being based on a time reference maintained by the access point; and a processing system configured to limit communications on the wireless communication network based on the message.

[0043] Another aspect disclosed is an apparatus. The apparatus, includes means for receiving a message from a wireless communication network indicating a start time of a window during which one or more identified devices are permitted to communicate with an access point, the start time being based on a time reference maintained by the access point; and means for limiting communications on the wireless communication network based on the message.

[0044] Another aspect disclosed is a computer program product. The computer program product includes a computer readable storage device encoded thereon with instructions that when executed cause an apparatus to perform a method of wireless communication, said method includes receiving a message from a wireless communication network indicating a start time of a window during which one or more identified devices are permitted to communicate with an access point, the start time being based on a time reference maintained by the access point; and limiting communications on the wireless communication network based on the message.

[0045] Another aspect disclosed is a method of wireless communication. The method includes generating, by an apparatus, a message identifying a specific device or an unrestricted group of devices, and identifying a time period during which the identified specific device or unrestricted group of devices are permitted to communicate with the apparatus; and transmitting, by an apparatus, the generated message.

[0046] Another aspect disclosed is an apparatus. The apparatus includes a processing system configured to generate a message identifying a specific device or an unrestricted group of devices, and identifying a time period during which the identified specific device or unrestricted group of devices are permitted to communicate with the apparatus; and a transmitter configured to transmit the generated message.

[0047] Another aspect disclosed is an access point. The access point includes an antenna; a processing system configured to generate a message identifying a specific device or an unrestricted group of devices, and identifying a time period during which the identified specific device or unrestricted group of devices are permitted to communicate with the apparatus; and a transmitter configured to transmit the generated message using the antenna.

[0048] Another aspect disclosed is an apparatus. The apparatus includes means for generating a message identifying a specific device or an unrestricted group of devices, and identifying a time period during which the identified specific device or unrestricted

group of devices are permitted to communicate with the apparatus; and means for transmitting the generated message.

[0049] Another aspect disclosed is a computer program product. The computer program product includes a computer readable storage device encoded thereon with instructions that when executed cause an apparatus to perform a method of wireless communication, said method includes generating a message identifying a specific device or an unrestricted group of devices, and identifying a time period during which the identified specific device or unrestricted group of devices are permitted to communicate with the apparatus; and transmitting the generated message.

[0050] Another aspect of the disclosure provides a method of wireless communication The method includes receiving, by an apparatus, a message from a wireless communication network identifying a specific device or an unrestricted group of device, and identifying a time period during which the identified device or the identified unrestricted group of devices are permitted to communicate with an access point; and limiting, by an apparatus, communication on the wireless communication network during the time period.

[0051] Another aspect disclosed is an apparatus. The apparatus includes a receiver configured to receive a message from a wireless communication network identifying a specific device or an unrestricted group of device, and identifying a time period during which the identified device or the identified unrestricted group of devices are permitted to communicate with an access point; and a processing system configured to limit communication on the wireless communication network during the time period.

[0052] Another aspect disclosed is a station. The station includes an antenna; a receiver configured to receive a message from a wireless communication network with the antenna, the message identifying a specific device or an unrestricted group of device, and identifying a time period during which the identified device or the identified unrestricted group of devices are permitted to communicate with an access point; and a processing system configured to limit communication on the wireless communication network during the time period.

[0053] Another aspect disclosed is an apparatus. The apparatus includes means for receiving a message from a wireless communication network identifying a specific device or an unrestricted group of device, and identifying a time period during which the identified device or the identified unrestricted group of devices are permitted to

communicate with an access point; and means for limiting communication on the wireless communication network during the time period.

[0054] Another aspect disclosed is a computer program product. The computer program product includes a computer readable storage device encoded thereon with instructions that when executed cause an apparatus to perform a method of wireless communication, said method including receiving a message from a wireless communication network identifying a specific device or an unrestricted group of device, and identifying a time period during which the identified device or the identified unrestricted group of devices are permitted to communicate with an access point; and limiting communication on the wireless communication network during the time period.

[0055] Another aspect of the disclosure provides a method of wireless communication The method includes transmitting, by an apparatus, a message including a target wake time and an identifier for the target wake up time; and transmitting, by an apparatus, a paging message including the identifier for the target wake up time.

[0056] Another aspect disclosed is an apparatus. The apparatus includes a transmitter configured to transmit a message including a target wake time and an identifier for the target wake up time, wherein the transmitter is further configured to transmit a paging message including the identifier for the target wake up time.

[0057] Another aspect disclosed is an access point. The access point includes an antenna; a transmitter configured to transmit a message using the antenna, the message including a target wake time and an identifier for the target wake up time, wherein the transmitter is further configured to transmit a paging message using the antenna and including the identifier for the target wake up time.

[0058] Another aspect disclosed is an apparatus. The apparatus includes means for transmitting a message including a target wake time and an identifier for the target wake up time; and means for transmitting a paging message including the identifier for the target wake up time.

[0059] Another aspect disclosed is a computer program product. The computer program product includes a computer readable storage device encoded thereon with instructions that when executed cause an apparatus to perform a method of wireless communication, said method includes transmitting a message including a target wake time and an identifier for the target wake up time; and transmitting a paging message including the identifier for the target wake up time.

[0060] Another aspect of the disclosure provides a method of wireless communication The method includes receiving, by an apparatus, a message indicating a target wake time and an identifier for the target wake up time, wherein the receiver is further configured to receive a paging message indicating the identifier for the target wake up time; entering, by an apparatus, a sleep state; and waking, by an apparatus, at the target wake time based on receiving the paging message indicating the identifier for the target wake up time.

[0061] Another aspect disclosed is an apparatus. The apparatus includes a receiver configured to receive a message indicating a target wake time and an identifier for the target wake up time, wherein the receiver is further configured to receive a paging message indicating the identifier for the target wake up time; and a processing apparatus configured to enter a sleep state and wake at the target wake time based on receiving the paging message indicating the identifier for the target wake up time.

[0062] Another aspect disclosed is a station. The station includes an antenna; a receiver configured to receive a message using the antenna, the message indicating a target wake time and an identifier for the target wake up time, wherein the receiver is further configured to receive a paging message indicating the identifier for the target wake up time; a processing apparatus configured to enter a sleep state and wake at the target wake time based on receiving the paging message indicating the identifier for the target wake up time.

[0063] Another aspect disclosed is an apparatus. The apparatus includes means for receiving a message indicating a target wake time and an identifier for the target wake up time, wherein the means for receiving is further configured to receive a paging message indicating the identifier for the target wake up time; and means for entering a sleep state and wake at the target wake time based on receiving the paging message indicating the identifier for the target wake up time.

[0064] Another aspect disclosed is a computer program product. The computer program product includes a computer readable storage device encoded thereon with instructions that when executed cause an apparatus to perform a method of wireless communication, said method including receiving a message indicating a target wake time and an identifier for the target wake up time, wherein the receiver is further configured to receive a paging message indicating the identifier for the target wake up

time; entering a sleep state; and waking at the target wake time based on receiving the paging message indicating the identifier for the target wake up time.

[0065] Another aspect of the disclosure provides a method of wireless communication The method includes generating, by an apparatus, a message indicating a target wake time and an uplink direction indicator, wherein the message further indicates whether a request-to-send message should be transmitted before transmitting uplink data; and transmitting, by an apparatus, the generated message.

[0066] Another aspect disclosed is an apparatus. The apparatus includes a processing apparatus configured to generate a message indicating a target wake time and an uplink direction indicator, wherein the message further indicates whether a request-to-send message should be transmitted before transmitting uplink data; and a transmitter configured to transmit the generated message.

[0067] Another aspect disclosed is an access point. The access point includes an antenna; a processing apparatus configured to generate a message indicating a target wake time and an uplink direction indicator, wherein the message further indicates whether a request-to-send message should be transmitted before transmitting uplink data; and a transmitter configured to transmit the generated message using the antenna.

[0068] Another aspect disclosed is an apparatus. The apparatus includes means for generating a message indicating a target wake time and an uplink direction indicator, wherein the message further indicates whether a request-to-send message should be transmitted before transmitting uplink data; and means for transmitting the generated message.

[0069] Another aspect disclosed is a computer program product. The computer program product includes a computer readable storage device encoded thereon with instructions that when executed cause an apparatus to perform a method of wireless communication, said method includes generating a message indicating a target wake time and an uplink direction indicator, wherein the message further indicates whether a request-to-send message should be transmitted before transmitting uplink data; and transmitting the generated message.

[0070] Another aspect of the disclosure provides a method of wireless communication The method includes receiving, by an apparatus, a message indicating a target wake time and an uplink direction indicator, wherein the message further indicates whether a request-to-send message should be transmitted before transmitting

uplink data; and selectively transmitting, by an apparatus, a request-to-send message based on whether the message indicates a request-to-send message should be transmitted before transmitting uplink data.

[0071] Another aspect disclosed is an apparatus. The apparatus includes a receiver configured to receive a message indicating a target wake time and an uplink direction indicator, wherein the message further indicates whether a request-to-send message should be transmitted before transmitting uplink data; and a transmitter configured to selectively transmit a request-to-send message based on whether the message indicates a request-to-send message should be transmitted before transmitting uplink data.

[0072] Another aspect disclosed is a station. The station includes an antenna; a receiver configured to receive a message using the antenna, the message indicating a target wake time and an uplink direction indicator, wherein the message further indicates whether a request-to-send message should be transmitted before transmitting uplink data; and a transmitter configured to selectively transmit a request-to-send message based on whether the message indicates a request-to-send message should be transmitted before transmitting uplink data.

[0073] Another aspect disclosed is an apparatus. The apparatus includes means for receiving a message indicating a target wake time and an uplink direction indicator, wherein the message further indicates whether a request-to-send message should be transmitted before transmitting uplink data; and means for selectively transmitting a request-to-send message based on whether the message indicates a request-to-send message should be transmitted before transmitting uplink data.

[0074] Another aspect disclosed is a computer program product. The computer program product includes a computer readable storage device encoded thereon with instructions that when executed cause an apparatus to perform a method of wireless communication, said method including receiving a message indicating a target wake time and an uplink direction indicator, wherein the message further indicates whether a request-to-send message should be transmitted before transmitting uplink data; and selectively transmitting a request-to-send message based on whether the message indicates a request-to-send message should be transmitted before transmitting uplink data.

[0075] Another aspect disclosed is a method. The method includes generating, by an apparatus, a message indicating an expiration time of a window during which one or

more identified devices are permitted to communicate with an apparatus, wherein the expiration time is indicated based on a number of beacon intervals, and transmitting, by the apparatus, the generated message. In some aspects, the method further includes indicating the window does not expire by generating the message to indicate a particular number of beacon intervals. In some aspects, the method further includes generating the message to indicate the window does not expire; generating a second message indicating an expiration time of the window, wherein the expiration time is indicated based on a second number of beacon intervals that is not equal to the particular value, and transmitting, by the apparatus, the second message. In some aspects, the method further includes generating the message as a restricted access window (RAW) message, where the restricted access window message defines a period of time that an access point declares as reserved for a selected group of wireless stations. In some aspects, the method also includes generating the restricted access window (RAW) message to indicate a start time and duration of the restricted access window.

[0076] Another aspect disclosed is an apparatus. The apparatus includes a processing system configured to generate a message indicating an expiration time of a window during which one or more identified devices are permitted to communicate with the apparatus, wherein the expiration time is indicated based on a number of beacon intervals, and the processing system is further configured to transmit the generated message. In some aspects, the expiration time indicates the window does not expire if the number of beacon intervals equals a particular value. In some aspects, the processing system is further configured to generate the message to indicate the window does not expire, and the processing system is further configured to generate a second message indicating an expiration time of the window, wherein the expiration time is indicated based on a number of beacon intervals not equal to the particular value, and wherein the processing system is further configured to transmit the second message.

[0077] In some aspects of the apparatus, the processing system is further configured to generate the message as a restricted access window (RAW) message, wherein the restricted access window message defines a period of time that an access point declares as reserved for a selected group of wireless stations. In some aspects, the processing system is further configured to generate the restricted access window (RAW) message to indicate a start time and duration of the restricted access window.

[0078] Another aspect disclosed is a method. The method includes receiving, by an apparatus, a first message, decoding the first message to determine a first number of beacon intervals, determining an expiration time of a window during which one or more identified devices are permitted to communicate with an access point based on the first number of beacon intervals; and transmitting, by the apparatus, a second message during the window. In some aspects, the method also includes determining the window does not expire if the first number of beacon intervals equals a particular value. In some aspects, the method also includes determining that the window does not expire based on the first number of beacon intervals, receiving a third message, determining a second number of beacon intervals based on the second message; and determining the window does expire based on the second number of beacon intervals not equaling the particular value. Some aspects of the method also include decoding the received message as a restricted access window message, wherein the restricted access window message defines a period of time that an access point declares as reserved for a selected group of wireless stations. In some aspects, the method also includes decoding the restricted access window (RAW) message to determine a start time and duration of a restricted access window.

[0079] Another aspect disclosed is an apparatus. The apparatus includes a processing system configured to receive a first message; decode the first message to determine a first number of beacon intervals; determine an expiration time of a window during which one or more identified devices are permitted to communicate with an access point based on the first number of beacon intervals; and transmit a second message during the window. In some aspects, the processing system is further configured to determine the window does not expire if the first number of beacon intervals equals a particular value. In some aspects, the processing system is further configured to determine the window does not expire based on the first number of beacon intervals, receive a third message; determine a second number of beacon intervals based on the third message; and determine the window does expire based on the second number of beacon intervals being not equal to the particular value.

[0080] In some aspects of the apparatus, the processing system is further configured to decode the received message as a restricted access window message, wherein the restricted access window message defines a period of time that an access point declares as reserved for a selected group of wireless stations. In some aspects of the apparatus,

the processing system is further configured to decode the restricted access window (RAW) message to determine a start time and duration of a restricted access window.

[0081] Another aspect disclosed is a method for wireless communication. The method includes generating, by an apparatus, a restricted access window (RAW) message identifying a time period during which the apparatus is to communicate data with one or more wireless devices, the message further comprising an indicator indicating a wireless communication flow direction during the time period, transmitting, by the apparatus, the generated message. In some aspects, the indicator indicates whether the data communicated during the time period is uplink or downlink data. In some aspects, the indicator indicates whether the data communicated during the time period is uplink, downlink, or bidirectional data. In some aspects, the method further comprises generating the restricted access window message to comprise a priority indicator indicating a priority between uplink data and downlink data communicated during the time period. In some aspects, the wireless communication flow direction indicator has a bit length of one or two bits. In some aspects, the time period identifies a target wake time (TWT). In some aspects, the method also includes generating the restricted access window (RAW) message to comprise a start time indicator and a duration indicator, wherein the start time indicator indicates a start time of the RAW and the duration indicator indicates a duration of the RAW.

[0082] Another aspect disclosed is an apparatus for wireless communication. The apparatus includes a processing system configured to generate a restricted access window (RAW) message identifying a time period during which the apparatus is to communicate data with one or more wireless devices, the message further generated to comprise an indicator indicating a wireless communication flow direction during the time period; and a transmitter configured to transmit the generated message. In some aspects, the indicator indicates whether the data communicated during the time period is uplink or downlink data. In some aspects, the indicator indicates whether the data communicated during the time period is uplink, downlink, or bidirectional data. In some aspects, the processing system is further configured to generate the restricted access window message to comprise a priority indicator indicating a priority of uplink data and downlink data communicated during the time period. In some aspects, the wireless communication flow direction indicator has a bit length of either one or two bits. In some aspects, the time period identifies a target wake time (TWT).

[0083] In some aspects, the processing system is further configured to generate the restricted access window (RAW) message to comprise a start time indicator and a duration indicator, wherein the start time indicator indicates a start time of the RAW and the duration indicator indicates a duration of the RAW.

[0084] Another aspect disclosed is a method of wireless communication. The method includes receiving, by an apparatus, a restricted access window (RAW) message identifying a time period during which a first device communicates data with one or more second devices, the message further comprising an indicator indicating a wireless communication flow direction; and communicating data, by the apparatus, with the first device based on the wireless communication flow direction indicator. In some aspects, the method also includes decoding the restricted access window (RAW) message to determine whether the data communicated is uplink or downlink data. In some aspects, the method also includes decoding the restricted access window (RAW) message to determine whether the data communicated is uplink, downlink, or bidirectional data. In some aspects, the method also includes decoding the restricted access window (RAW) message to determine a priority of uplink data and downlink data communicated during the time period. In some aspects, the method also includes decoding the wireless communication flow direction indicator based on either one or two bits of the received RAW message. In some aspects, the time period identifies a target wake time (TWT). In some aspects, the method also includes decoding a start time of the RAW and a duration of the RAW based on the restricted access window message.

[0085] Another aspect disclosed is an apparatus for wireless communication. The apparatus includes a processing system configured to receive a restricted access window (RAW) message identifying a time period during which a first device communicates data with one or more second devices, the message further comprising an indicator indicating a wireless communication flow direction during the time period. The processing system is further configured to communicate data with the first device based on the wireless communication flow direction indicator. In some aspects, the processing system is further configured to decode the restricted access window message to determine whether the data communicated is uplink or downlink data. In some aspects, the processing system is further configured to decode the restricted access window message to determine whether the data communicated is uplink, downlink, or bidirectional data. In some aspects, the processing system is further configured to

decode the restricted access window message to determine a priority of uplink data and downlink data communicated during the time period. In some aspects, the processing system is further configured to decode the wireless communication flow direction indicator based on either one or two bits of the received message. In some aspects, the time period identifies a target wake time (TWT). In some aspects, the processing system is further configured to decode a start time of the RAW and a duration of the RAW based on the restricted access window message.

[0086] Another aspect disclosed is a method of wireless communication. The method includes generating, by an apparatus, a restricted access window message indicating devices not associated with the apparatus are permitted to communicate with the apparatus during a time period defined by the message; and transmitting, by the apparatus, the generated message. In some aspects, the method also includes inhibiting a sleep or doze state during the time period. In some aspects, the method includes generating the restricted access window message to indicate whether associated devices may also use the time period for communication with the apparatus. In some aspects, the method further includes generating the restricted access window message to comprise a unique device identifier of a device permitted to communicate with the apparatus during the time period. In some aspects, the method includes receiving a first message from a first non-associated device during the time period, transmitting a response to the first message if the first message is received during the time period. In some aspects, the method further includes generating the restricted access window message further comprises generating the message to comprise an indicator indicating a start time of the time period, the start time being based on an absolute time reference.

[0087] Another aspect disclosed is an apparatus for wireless communication. The apparatus includes a processing system configured to generate a restricted access window (RAW) message indicating devices not associated with the apparatus are permitted to communicate with the apparatus during a time period defined by the message; and a transmitter configured to transmit the generated message. In some aspects, the processing system is further configured to inhibit a sleep or doze state during the time period. In some aspects, the processing system is further configured to generate the restricted access window message to comprise a unique device identifier of a device permitted to communicate with the apparatus during the time period. In some aspects, the processing system is further configured to generate the restricted access

window message to indicate whether associated devices may also use the time period for communication with the apparatus. In some aspects, the processing system is further configured to receive a first message from a first non-associated device during the time period, and where in the transmitter is further configured to transmit a response to the first message if the first message is received during the time period. In some aspects, the processing system is further configured to generate the restricted access window message to further comprise an indicator indicating a start time of the time period, the start time being based on an absolute time reference.

[0088] Another aspect disclosed is a method for wireless communication. The method includes decoding, by a first apparatus, a restricted access window (RAW) message to determine that devices not associated with a second apparatus are permitted to communicate with the second apparatus during a time period defined by the restricted access window message; and transmitting, by the first apparatus, another message to the second apparatus during the time period based on whether the first apparatus is associated with the second apparatus. In some aspects, the transmission comprises transmitting an association message to the second apparatus if the first apparatus is not associated with the second apparatus. In some aspects, the method also includes decoding the restricted access window (RAW) message to determine whether devices associated with the second apparatus are permitted to communicate with the second apparatus during the time period, wherein the transmission comprises transmitting the other message to the second apparatus during the time period if devices associated with the second apparatus are permitted to communicate with the second apparatus during the time period and the first apparatus is associated with the second apparatus.

[0089] In some aspects, the method includes determining whether the first apparatus is permitted to communicate with the second apparatus during the time period based on whether a unique device identifier of the first apparatus is included in the restricted access window message. In some aspects, the method further includes decoding the restricted access window message to identify an indicator of a start time of the time period, the start time being based on an absolute time reference.

[0090] Another aspect disclosed is a first apparatus for wireless communication. The first apparatus includes a processing system configured to receive a restricted access window message indicating devices not associated with a second apparatus are permitted to communicate with the second apparatus during a time period defined by the

restricted access window message; and a transmitter configured to transmit another message to the second apparatus during the time period based on whether the first apparatus is associated with the second apparatus. In some aspects, the transmitter is further configured to transmit an association message to the second apparatus if the first apparatus is not associated with the second apparatus. In some aspects, the processing system is further configured to: decode the restricted access window (RAW) message to determine whether devices associated with the second apparatus are permitted to communicate with the second apparatus during the time period, and the transmitter is further configured to transmit the other message to the second apparatus during the time period if devices associated with the second apparatus are permitted to communicate with the second apparatus during the time period and the first apparatus is associated with the second apparatus. In some aspects, the processing system is further configured to determine whether the first apparatus is permitted to communicate with the second apparatus during the time period based on whether a unique device identifier of the first apparatus is included in the restricted access window message. In some aspects, the processing system is further configured to decode the restricted access window message to identify an indicator of a start time of the time period, the start time being based on an absolute time reference.

[0091] Another aspect disclosed is a method for wireless communication. The method includes generating, by an apparatus, a message indicating a start time of a window during which one or more devices are permitted to communicate with the apparatus, the start time being based on an absolute time reference; and transmitting, by the apparatus, the generated message. In some aspects, the absolute time reference is based on a target beacon transmit time (TBTT). In some aspects, the absolute time reference is based on a timing synchronization function (TSF). In some aspects, generating the message further comprises generating a restricted access window message to indicate a start time and duration of a restricted access window. In some aspects, the message is generated as a target wake time information element (TWT IE). In some aspects, the message is generated to further comprise an indicator of a wireless communication flow direction during the window. In some aspects, the indicator of a wireless communication flow direction indicates whether the apparatus transmits or receives data during the window.

[0092] Another aspect disclosed is an apparatus for wireless communication. The apparatus includes a processing system configured to generate a message indicating a start time of a window during which one or more devices are permitted to communicate with the apparatus, the start time being based on an absolute time reference, and a transmitter configured to transmit the generated message. In some aspects, the absolute time reference is based on a target beacon transmit time (TBTT). In some aspects, the absolute time reference is based on a timing synchronization function (TSF). In some aspects, generating the message further comprises generating a restricted access window message to indicate a start time and duration of a restricted access window. In some aspects, the processing system is configured to generate the message as a target wake time information element (TWT IE). In some aspects, the message to generated to further comprise an indicator of a wireless communication flow direction during the window. In some aspects, the indicator of a wireless communication flow direction indicates whether the apparatus transmits or receives data during the window.

[0093] Another aspect disclosed is an apparatus for wireless communication. The apparatus includes means for generating a message indicating a start time of a window during which one or more devices are permitted to communicate with the apparatus, the start time being based on an absolute time reference, and means for transmitting the generated message. In some aspects, the absolute time reference is based on a target beacon transmit time (TBTT). In some aspects, the absolute time reference is based on a timing synchronization function (TSF). In some aspects, the means for generating is configured to generate the message as a restricted access window message, the restricted access window message comprising an indicator indicating a start time and duration of a restricted access window. In some aspects, the means for generating is configured to generate the message as a target wake time information element (TWT IE). In some aspects, the means for generating is configured to generate the message to further comprise an indicator of a wireless communication flow direction during the window. In some aspects, the indicator of a wireless communication flow direction indicates whether the apparatus transmits or receives data during the window.

[0094] Another aspect disclosed is a wireless node for wireless communication. The wireless node includes an antenna, a processing system configured to generate a message indicating a start time of a window during which one or more devices are permitted to communicate with the apparatus, the start time being based on an absolute

time reference; and a transmitter configured to transmit the generated message using the antenna.

[0095] Another aspect disclosed is a method for wireless communication. The method includes generating, by an apparatus, a message identifying at least one specific device, and generating the message to identify a time period during which the identified at least one specific device is permitted to communicate with the apparatus; and transmitting, by the apparatus, the generated message. In some aspects, generating the message further comprises generating a restricted access window message. In some aspects, the method includes generating the restricted access window message to indicate a start time and a duration of the time period. In some aspects, the method further includes generating the message to comprise a list of the at least one specific device permitted to communicate with the apparatus during the time period. In some aspects, the method further includes generating the message to comprise an indicator of each of the one or more specific devices permitted to communicate with the apparatus during the time period. In some aspects, the method further includes receiving a message from the specific device during the time period; and generating a response to the specific device's message if the specific device's message is received during the time period.

[0096] Another aspect disclosed is an apparatus for wireless communication. The apparatus includes a processing system configured to generate a message identifying at least one specific device and configured to generate the message to comprise an identifier of a time period during which the at least one identified specific device is permitted to communicate with the apparatus; and a transmitter configured to transmit the generated message. In some aspects, generating the message further comprises generating a restricted access window message. In some aspects, the processing system is further configured to generate the restricted access window message to indicate a start time and a duration of the time period. In some aspects, the processing system is further configured to generate the message to comprise a list of the one or more specific devices permitted to communicate with the apparatus during the time period. In some aspects, the processing system is further configured to generate the message to comprise an indicator of each of the one or more specific devices permitted to communicate with the apparatus during the time period. In some aspects, the processing system is further configured to receive a message from the specific device during the time period, and

wherein the processing system is further configured to generate a response to the specific device's if the specific device's message is received during the time period.

[0097] Another aspect disclosed is a method for wireless communication. The method includes decoding, by a first apparatus, a message received from a wireless communications network to identify a specific device, decoding the message to identify a time period during which the identified specific device is permitted to communicate with a second apparatus; and limiting, by the first apparatus, communication with the second apparatus during the time period. In some aspects, the method includes decoding the received message as a restricted access window message. In some aspects, the method includes determining a start time and a duration of a restricted access window based on the restricted access window message. In some aspects, the method includes decoding the restricted access window message to identify a listing of a group of devices permitted to communicate with the second apparatus during the time period. In some aspects, the method further includes decoding the message to identify an indicator of each of the one or more specific devices permitted to communicate with the second apparatus during the time period. In some aspects, limiting, by the first apparatus, communication with the second apparatus during the time period further comprises determining whether the first apparatus is identified by the received message based on the decoding, transmitting a message to the second apparatus during the time period if the first apparatus is identified, and not transmitting a message to the second apparatus during the time period if the first apparatus is not identified.

[0098] Another aspect disclosed is a first apparatus for wireless communication. The first apparatus includes a processing system configured to decode a message received from a wireless communication network to identify at least one specific device, decode the message to identify a time period during which the at least one specific device is permitted to communicate with a second apparatus, and limit communication with the second apparatus during the time period. In some aspects, the processing system is further configured to decode the received message as a restricted access window message. In some aspects, the processing system is further configured to determine a start time and a duration of a restricted access window based on the restricted access window message. In some aspects, the processing system is further configured to decode the restricted access window message to identify a list of the one or more specific devices permitted to communicate with the second apparatus during the

window. In some aspects, the processing system is further configured to decode the message to identify an indicator of each of the one or more specific devices permitted to communicate with the second apparatus during the time period. In some aspects, the processing system is configured to limit communication with the second apparatus during the time period by: determining whether the first apparatus is identified by the received message based on the decoding; wherein the first apparatus further comprises a transmitter configured to transmit a message to the second apparatus during the time period if the first apparatus is identified, and the transmitter is further configured to not transmit the message to the second apparatus during the time period if the first apparatus is not identified.

[0099] Another aspect disclosed is a method of wireless communication. The method includes generating, by an apparatus, a first message comprising a first indicator of a duration of a window during which one or more devices are permitted to communicate with the apparatus, wherein a limited duration is indicated based on the first indicator indicating a number of beacon intervals; and transmitting, by the apparatus, the first message. In some aspects, the duration is unlimited if the first indicator indicates a particular value. In some aspects, the first indicator in the first message indicates the window has an unlimited duration, the method further including generating a second message comprising a second indicator indicating an updated duration of the window, wherein the second indicator indicates the updated duration is limited by indicating a value that is different from the particular value; and transmitting, by the apparatus, the second message. In some aspects, the first message is generated as a restricted access window (RAW) message, wherein the window is a restricted access window. In some aspects, the restricted access window (RAW) message is generated to comprise a start time indicator indicating a start time of the restricted access window. IN some aspects, the message is generated to comprise a list of the one or more devices.

[00100] Another aspect disclosed is an apparatus for wireless communication. The apparatus includes a processing system configured to generate a first message comprising a first indicator indicating a duration of a window during which one or more devices are permitted to communicate with the apparatus, wherein a limited duration is indicated based on a number of beacon intervals; and a transmitter configured to transmit the generated message. In some aspects, the duration is unlimited if the first indicator indicates a particular value. In some aspects, the processing system is further

configured to generate the first message to indicate the window has an unlimited duration, and the processing system is further configured to generate a second message comprising a second indicator indicating an updated duration of the window, wherein the second indicator indicates the updated duration is limited by indicating a value that is different from the particular value, and the transmitter is further configured to transmit the second message. In some aspects, the first message is generated as a restricted access window (RAW) message, wherein the window is a restricted access window (RAW). In some aspects, the processing system is further configured to generate the restricted access window (RAW) message to comprise a start time indicator indicating a start time of the restricted access window. In some aspects, the processing system is further configured to generate the first message to comprise a list of the one or more devices.

[00101] Another aspect disclosed is a method of wireless communication. The method includes decoding, by a first apparatus, a first message comprising a first indicator of a duration of a window during which one or more devices are permitted to communicate with a second apparatus, wherein a limited duration is indicated by the first indicator based on a number of beacon intervals; and transmitting, by the first apparatus, a second message to the second apparatus during the window based on the indicated duration.

[00102] In some aspects, the method also includes comprising determining the window has an unlimited duration if the first indicator has a particular value. In some aspects, the method also includes determining that the window has an unlimited duration based on the first indicator indicating the particular value; and determining, based on a received third message comprising a second indicator, an updated duration of the window is limited based on the second indicator indicating a number of beacon intervals. In some aspects, the method also includes decoding the first message as a restricted access window message, wherein the window is a restricted access window. In some aspects, the method includes decoding the restricted access window (RAW) message to identify a start time indicator indicating a start time of the restricted access window. In some aspects, the method also includes decoding the first message to identify a list of the one or more devices permitted to communicate with the apparatus during the window.

[00103] Another aspect disclosed is a first apparatus for wireless communication. The method includes a processing system configured to: decode a first message comprising a first indicator of a duration of a window during which one or more devices are permitted to communicate with a second apparatus, wherein a limited duration is indicated by the first indicator based on a number of beacon intervals; and a transmitter configured to transmit a second message to the second apparatus during the window. In some aspects, the processing system is further configured to determine the window has an unlimited duration if the first indicator has a particular value. In some aspects, the processing system is further configured to determine the window has an unlimited duration based on the first indicator indicating the particular value, the processing system is further configured to determine an updated duration based on a received third message comprising a second indicator, and determine the updated duration is limited based on the second indicator indicating a value different than the particular value.

[00104] In some aspects, the processing system is further configured to decode the first received message as a restricted access window message, wherein the window is a restricted access window. In some aspects, the processing system is further configured to decode the restricted access window (RAW) message to determine a start time of the restricted access window based on a start time indicator included in the restricted access window (RAW) message. In some aspects, the processing system is further configured to decode the first message to identify a list of the one or more devices.

[00105] Another aspect disclosed is a method of wireless communication. The method includes generating, by an apparatus, a first message comprising a first indicator indicating a number of beacon intervals that each have a window during which one or more devices are permitted to communicate with the apparatus; and transmitting, by the apparatus, the first message. In some aspects, the number of beacon intervals is unlimited if the first indicator indicates a particular value. In some aspects, the first indicator in the first message indicates the number of beacon intervals is unlimited, the method further includes generating a second message comprising a second indicator indicating a limited number of beacon intervals that each have a window during which one or more devices are permitted to communicate with the apparatus by indicating a value that is different from the particular value; and transmitting, by the apparatus, the second message. In some aspects, the method further includes generating the first message comprises generating a raw parameter set (RPS) element. In some aspects, the

first message is generated to comprise a start time indicator indicating a start time of each of the windows within the beacon intervals. In some aspects, the first message further comprises a duration indicator indicating a duration of each of the windows within the beacon intervals. In some aspects, the message is generated to comprise a list of the one or more devices.

[00106] Another aspect disclosed is an apparatus for wireless communication. The apparatus includes a processing system configured to generate a first message comprising a first indicator indicating a number of beacon intervals that each have a window during which one or more devices are permitted to communicate with the apparatus; and a transmitter configured to transmit the generated message. In some aspects, the number of beacon intervals is unlimited if the first indicator indicates a particular value. In some aspects of the apparatus, the processing system is further configured to generate the first message to indicate the number of beacon intervals is unlimited, and the processing system is further configured to generate a second message comprising a second indicator indicating a limited number of beacon intervals that have a window during which one or more devices are permitted to communicate with the apparatus by indicating a value that is different from the particular value, and the transmitter is further configured to transmit the second message. In some aspects of the apparatus, generating the first message comprises generating a raw parameter set (RPS) element.

[00107] In some aspects of the apparatus, the processing system is further configured to generate the first message to comprise a start time indicator indicating a start time of each window within the beacon intervals. In some aspects, the processing system is further configured to generate the first message to comprise a duration indicator indicating a duration of each window within the beacon intervals. In some aspects, the processing system is further configured to generate the first message to comprise a list of the one or more devices.

[00108] Another aspect disclosed is a method of wireless communication. The method includes decoding, by a first apparatus, a first message comprising a first indicator indicating a number of beacon intervals that each have a window during which one or more devices are permitted to communicate with a second apparatus; and transmitting, by the first apparatus, a second message to the second apparatus during one of the windows based on the first indicator. In some aspects, the method further

includes determining the number of beacon intervals is unlimited if the first indicator has a particular value. In some aspects, the method also includes determining that the number of beacon intervals is unlimited based on the first indicator indicating the particular value; and determining, based on a received third message comprising a second indicator, a limited number of beacon intervals that each have a window during which one or more devices are permitted to communicate with the second apparatus based on the second indicator indicating a number of beacon intervals different than the particular value. In some aspects, the method further includes decoding the first message to identify a start time indicator indicating a start time of each window within the beacon intervals. In some aspects, the method also includes decoding the first message to identify a duration indicator indicating a duration of each window within the beacon intervals. In some aspects, the method further includes decoding the first message to identify a list of the one or more devices permitted to communicate with the apparatus during the window.

[00109] Another aspect disclosed is a first apparatus for wireless communication. The method includes a processing system configured to: decode a first message comprising a first indicator of a number of beacon intervals that each have a window during which one or more devices are permitted to communicate with a second apparatus; and a transmitter configured to transmit a second message to the second apparatus during one of the windows based on the first indicator. In some aspects, the processing system is further configured to determine the number of beacon intervals is unlimited if the first indicator has a particular value. In some aspects, the processing system is further configured to determine the number of beacon intervals is unlimited based on the first indicator indicating the particular value, and the processing system is further configured to determine an updated number of beacon intervals based on a received third message comprising a second indicator, and determine the updated number of beacon intervals that each have a window during which one or more devices are permitted to communicate with the second apparatus is limited based on the second indicator indicating a value different than the particular value.

[00110] In some aspects of the apparatus, the processing system is further configured to decode the first message to determine a start time of each window within the beacon intervals based on a start time indicator included in the first message. In some aspects of the apparatus, the processing system is further configured to decode the first message

to determine a duration of each window within the beacon intervals based on a duration indicator included in the first message. In some aspects of the apparatus, the processing system is further configured to decode the first message to identify a list of the one or more devices.

BRIEF DESCRIPTION OF THE DRAWINGS

[00111] FIG. 1 illustrates an example of a wireless communication system in which aspects of the present disclosure may be employed.

[00112] FIG. 2 illustrates an example of a wireless device that may be employed within the wireless communication system of FIG. 1.

[00113] FIG. 3 illustrates an example of components that may be included within the wireless device of FIG. 2 to transmit wireless communications.

[00114] FIG. 4 illustrates an example of components that may be included within the wireless device of FIG. 2 to transmit wireless communications.

[00115] FIG. 5 is a flowchart of a method of wireless communication in accordance with one implementation.

[00116] FIG. 6 is a flowchart of a method of wireless communication in accordance with one implementation.

[00117] FIG. 7 shows one implementation of the message identifying a wireless communication flow direction.

[00118] FIG. 8 is a flowchart of a method of wireless communication in accordance with one implementation.

[00119] FIG. 9 is a flowchart of a method of wireless communication in accordance with one implementation.

[00120] FIG. 10 shows one implementation of the message identifying a wireless communication flow direction.

[00121] FIG.11 is a flowchart of a method of wireless communication in accordance with one implementation.

[00122] FIG. 12 is a flowchart of a method of wireless communication in accordance with one implementation.

[00123] FIG. 13 shows one implementation of the message identifying a wireless communication flow direction.

[00124] FIG. 14 is a flowchart of a method of wireless communication in accordance with one implementation.

[00125] FIG. 15 is a flowchart of a method of wireless communication in accordance with one implementation.

[00126] FIG. 16 shows one implementation of the message identifying a wireless communication flow direction.

[00127] FIG.17 is a flowchart of a method of wireless communication in accordance with one implementation.

[00128] FIG. 18 is a flowchart of a method of wireless communication in accordance with one implementation.

[00129] FIG. 19 shows one implementation of the message identifying a wireless communication flow direction.

[00130] FIG. 20 is a flowchart of a method of wireless communication in accordance with one implementation.

[00131] FIG. 21 is a flowchart of a method of wireless communication in accordance with one implementation.

[00132] FIG.22 is a flowchart of a method of wireless communication in accordance with one implementation.

[00133] FIG. 23 is a flowchart of a method of wireless communication in accordance with one implementation.

DETAILED DESCRIPTION

[00134] Various aspects of the novel systems, apparatuses, and methods are described more fully hereinafter with reference to the accompanying drawings. The teachings disclosure may, however, be embodied in many different forms and should not be construed as limited to any specific structure or function presented throughout this disclosure. Rather, these aspects are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the disclosure to those skilled in the art. Based on the teachings herein one skilled in the art should appreciate that the scope of the disclosure is intended to cover any aspect of the novel systems, apparatuses, and methods disclosed herein, whether implemented independently of or combined with any other aspect of the invention. For example, an apparatus may be implemented or a method may be practiced using any number of the aspects set forth herein. In addition, the scope of the invention is intended to cover such an apparatus or

method which is practiced using other structure, functionality, or structure and functionality in addition to or other than the various aspects of the invention set forth herein. It should be understood that any aspect disclosed herein may be embodied by one or more elements of a claim.

[00135] Although particular aspects are described herein, many variations and permutations of these aspects fall within the scope of the disclosure. Although some benefits and advantages of the preferred aspects are mentioned, the scope of the disclosure is not intended to be limited to particular benefits, uses, or objectives. Rather, aspects of the disclosure are intended to be broadly applicable to different wireless technologies, system configurations, networks, and transmission protocols, some of which are illustrated by way of example in the figures and in the following description of the preferred aspects. The detailed description and drawings are merely illustrative of the disclosure rather than limiting, the scope of the disclosure being defined by the appended claims and equivalents thereof.

[00136] Wireless network technologies may include various types of wireless local area networks (WLANs). A WLAN may be used to interconnect nearby devices together, employing widely used networking protocols. The various aspects described herein may apply to any communication standard, such as WiFi or, more generally, any member of the IEEE 802.11 family of wireless protocols. For example, the various aspects described herein may be used as part of the IEEE 802.11ah protocol, which uses sub-1GHz bands.

[00137] In some aspects, wireless signals in a sub-gigahertz band may be transmitted according to the 802.11ah protocol using orthogonal frequency-division multiplexing (OFDM), direct–sequence spread spectrum (DSSS) communications, a combination of OFDM and DSSS communications, or other schemes. Implementations of the 802.11ah protocol may be used for sensors, metering, and smart grid networks. Advantageously, aspects of certain devices implementing the 802.11ah protocol may consume less power than devices implementing other wireless protocols, and/or may be used to transmit wireless signals across a relatively long range, for example about one kilometer or longer.

[00138] In some implementations, a WLAN includes various devices which are the components that access the wireless network. For example, there may be two types of devices: access points ("APs") and clients (also referred to as stations, or "STAs"). In

general, an AP serves as a hub or base station for the WLAN and a STA serves as a user of the WLAN. For example, an STA may be a laptop computer, a personal digital assistant (PDA), a mobile phone, etc. In an example, an STA connects to an AP via a WiFi (e.g., IEEE 802.11 protocol such as 802.11ah) compliant wireless link to obtain general connectivity to the Internet or to other wide area networks. In some implementations, an STA may also be used as an AP.

[00139] An access point ("AP") may also comprise, be implemented as, or known as a NodeB, Radio Network Controller ("RNC"), eNodeB, Base Station Controller ("BSC"), Base Transceiver Station ("BTS"), Base Station ("BS"), Transceiver Function ("TF"), Radio Router, Radio Transceiver, or some other terminology. The access point may be a main or relay base station. A relay base station relays data between wireless stations and another base station, being the main base station or another relay base station.

[00140] A station "STA" may also comprise, be implemented as, or known as an access terminal ("AT"), a subscriber station, a subscriber unit, a mobile station, a remote station, a remote terminal, a user terminal, a user agent, a user device, user equipment, or some other terminology. In some implementations, an access terminal may comprise a cellular telephone, a cordless telephone, a Session Initiation Protocol ("SIP") phone, a wireless local loop ("WLL") station, a personal digital assistant ("PDA"), a handheld device having wireless connection capability, or some other suitable processing device connected to a wireless modem. Accordingly, one or more aspects taught herein may be incorporated into a phone (e.g., a cellular phone or smartphone), a computer (e.g., a laptop), a portable communication device, a headset, a portable computing device (e.g., a personal data assistant), an entertainment device (e.g., a music or video device, or a satellite radio), a gaming device or system, a global positioning system device, or any other suitable device that is configured to communicate via a wireless medium.

[00141] As discussed above, certain of the devices described herein may implement the 802.11ah standard, for example. Such devices, whether used as an STA or AP or other device, may be used for smart metering or in a smart grid network. Such devices may provide sensor applications or be used in home automation. The devices may instead or in addition be used in a healthcare context, for example for personal healthcare. They may also be used for surveillance, to enable extended-range Internet

connectivity (e.g. for use with hotspots), or to implement machine-to-machine communications.

[00142] FIG. 1 illustrates an example of a wireless communication system 100 in which aspects of the present disclosure may be employed. The wireless communication system 100 may operate pursuant to a wireless standard, for example the 802.11ah standard. The wireless communication system 100 may include an AP 104, which communicates with STAs 106.

[00143] A variety of processes and methods may be used for transmissions in the wireless communication system 100 between the AP 104 and the STAs 106. For example, signals may be sent and received between the AP 104 and the STAs 106 in accordance with OFDM/OFDMA techniques. If this is the case, the wireless communication system 100 may be referred to as an OFDM/OFDMA system. Alternatively, signals may be sent and received between the AP 104 and the STAs 106 in accordance with CDMA techniques. If this is the case, the wireless communication system 100 may be referred to as a CDMA system.

[00144] A communication link that facilitates transmission from the AP 104 to one or more of the STAs 106 may be referred to as a downlink (DL) 108, and a communication link that facilitates transmission from one or more of the STAs 106 to the AP 104 may be referred to as an uplink (UL) 110. Alternatively, a downlink 108 may be referred to as a forward link or a forward channel, and an uplink 110 may be referred to as a reverse link or a reverse channel.

[00145] The AP 104 may act as a base station and provide wireless communication coverage in a basic service area (BSA) 102. The AP 104 along with the STAs 106 associated with the AP 104 that use the AP 104 for communication may be referred to as a basic service set (BSS). It should be noted that the wireless communication system 100 may not have a central AP 104, but rather may function as a peer-to-peer network between the STAs 106. Accordingly, the functions of the AP 104 described herein may alternatively be performed by one or more of the STAs 106.

[00146] The STAs 106 are not limited in type and may include a variety of different STAs. For example, as illustrated in FIG. 1, STAs 106 can include a cellular phone 106a, a television 106b, a laptop 106c, and a number of sensors 106d (e.g. a weather sensor or other sensor capable of communicating using a wireless protocol), to name a few.

[00147] FIG. 2 illustrates various components that may be utilized in a wireless device 202 that may be employed within the wireless communication system 100. The wireless device 202 is an example of a device that may be configured to implement the various methods described herein. For example, the wireless device 202 may comprise the AP 104 or one of the STAs 106.

[00148] The wireless device 202 may include a processor 204 which controls operation of the wireless device 202. The processor 204 may also be referred to as a central processing unit (CPU). Memory 206, which may include both read-only memory (ROM) and random access memory (RAM), provides instructions and data to the processor 204. A portion of the memory 206 may also include non-volatile random access memory (NVRAM). The processor 204 typically performs logical and arithmetic operations based on program instructions stored within the memory 206. The instructions in the memory 206 may be executable to implement the methods described herein.

[00149] When the wireless device 202 is implemented or used as a transmitting node, the processor 204 may be configured to select one of a plurality of medium access control (MAC) header types, and to generate a packet having that MAC header type. For example, the processor 204 may be configured to generate a packet comprising a MAC header and a payload and to determine what type of MAC header to use, as discussed in further detail below.

[00150] When the wireless device 202 is implemented or used as a receiving node, the processor 204 may be configured to process packets of a plurality of different MAC header types. For example, the processor 204 may be configured to determine the type of MAC header used in a packet and process the packet and/or fields of the MAC header accordingly as further discussed below.

[00151] The processor 204 may comprise or be a component of a processing system implemented with one or more hardware processors. The one or more processors may be implemented with any combination of general-purpose microprocessors, microcontrollers, digital signal processors (DSPs), field programmable gate array (FPGAs), programmable logic devices (PLDs), controllers, state machines, gated logic, discrete hardware components, dedicated hardware finite state machines, or any other suitable entities that can perform calculations or other manipulations of information.

[00152] The processing system may also include machine-readable media for storing software. Software shall be construed broadly to mean any type of instructions, whether referred to as software, firmware, middleware, microcode, hardware description language, or otherwise. Instructions may include code (e.g., in source code format, binary code format, executable code format, or any other suitable format of code). The instructions, when executed by the one or more processors, cause the processing system to perform the various functions described herein.

[00153] The wireless device 202 may also include a transmitter 210 and a receiver 212 to allow transmission and reception of data between the wireless device 202 and a remote location. Further, the transmitters 210 and the receiver 212 may be configured to allow transmission and reception of setup and/or configuration packets or frames between the wireless device 202 and a remote location including, for example, an AP. The transmitter 210 and receiver 212 may be combined into a transceiver 214. An antenna 216 may be attached to the housing 208 and electrically coupled to the transceiver 214. Alternatively, or additionally, the wireless device 202 may include an antenna 216 formed as part of the housing 208 or may be an internal antenna. The wireless device 202 may also include (not shown) multiple transmitters, multiple receivers, multiple transceivers, and/or multiple antennas.

[00154] The wireless device 202 may also include a signal detector 218 that may be used in an effort to detect and quantify the level of signals received by the transceiver 214. The signal detector 218 may detect such signals as total energy, energy per subcarrier per symbol, power spectral density and other signals. The wireless device 202 may also include a digital signal processor (DSP) 220 for use in processing signals. The DSP 220 may be configured to generate a data unit for transmission. In some aspects, the data unit may comprise a physical layer data unit (PPDU). In some aspects, the PPDU is referred to as a packet or a frame.

[00155] The wireless device 202 may further comprise a user interface 222 in some aspects. The user interface 222 may comprise a keypad, a microphone, a speaker, and/or a display. The user interface 222 may include any element or component that conveys information to a user of the wireless device 202 and/or receives input from the user.

[00156] The various components of the wireless device 202 may be housed within a housing 208. Further, the various components of the wireless device 202 may be

coupled together by a bus system 226. The bus system 226 may include a data bus, for example, as well as a power bus, a control signal bus, and a status signal bus in addition to the data bus. Those of skill in the art will appreciate the components of the wireless device 202 may be coupled together, or may accept or provide inputs to each other using some other mechanism.

[00157] Although a number of separate components are illustrated in FIG. 2, those of skill in the art will recognize that one or more of the components may be combined or commonly implemented. For example, the processor 204 may be used to implement not only the functionality described above with respect to the processor 204, but also to implement the functionality described above with respect to the signal detector 218 and/or the DSP 220. Further, each of the components illustrated in FIG. 2 may be implemented using a plurality of separate elements.

[00158] As discussed above, the wireless device 202 may comprise an AP 104 or a STA 106, and may be used to transmit and/or receive communications. FIG. 3 illustrates various components that may be utilized in the wireless device 202 to transmit wireless communications. The components illustrated in FIG. 3 may be used, for example, to transmit OFDM communications. In some aspects, the components illustrated in FIG. 3 are used to transmit data units with training fields with peak-to-power average ratio is as low as possible, as will be discussed in additional detail below. For ease of reference, the wireless device 202 configured with the components illustrated in FIG. 3 is hereinafter referred to as a wireless device 202a.

[00159] The wireless device 202a may comprise a modulator 302 configured to modulate bits for transmission. For example, the modulator 302 may determine a plurality of symbols from bits received from the processor 204 or the user interface 222, for example by mapping bits to a plurality of symbols according to a constellation. The bits may correspond to user data or to control information. In some aspects, the bits are received in codewords. In one aspect, the modulator 302 comprises a QAM (quadrature amplitude modulation) modulator, for example a 16-QAM modulator or a 64-QAM modulator. In other aspects, the modulator 302 comprises a binary phase-shift keying (BPSK) modulator or a quadrature phase-shift keying (QPSK) modulator.

[00160] The wireless device 202a may further comprise a transform module 304 configured to convert symbols or otherwise modulated bits from the modulator 302 into a time domain. In FIG. 3, the transform module 304 is illustrated as being implemented

by an inverse fast Fourier transform (IFFT) module. In some implementations, there may be multiple transform modules (not shown) that transform units of data of different sizes.

[00161] In FIG. 3, the modulator 302 and the transform module 304 are illustrated as being implemented in the DSP 220. In some aspects, however, one or both of the modulator 302 and the transform module 304 are implemented in the processor 204 or in another element of the wireless device 202.

[00162] As discussed above, the DSP 220 may be configured to generate a data unit for transmission. In some aspects, the modulator 302 and the transform module 304 may be configured to generate a data unit comprising a plurality of fields including control information and a plurality of data symbols. The fields including the control information may comprise one or more training fields, for example, and one or more signal (SIG) fields. Each of the training fields may include a known sequence of bits or symbols. Each of the SIG fields may include information about the data unit, for example a description of a length or data rate of the data unit.

[00163] Returning to the description of FIG. 3, the wireless device 202a may further comprise a digital to analog converter 306 configured to convert the output of the transform module into an analog signal. For example, the time-domain output of the transform module 306 may be converted to a baseband OFDM signal by the digital to analog converter 306. The digital to analog converter 306 may be implemented in the processor 204 or in another element of the wireless device 202. In some aspects, the digital to analog converter 306 is implemented in the transceiver 214 or in a data transmission processor.

[00164] The analog signal may be wirelessly transmitted by the transmitter 210. The analog signal may be further processed before being transmitted by the transmitter 210, for example by being filtered or by being upconverted to an intermediate or carrier frequency. In the implementation illustrated in FIG. 3, the transmitter 210 includes a transmit amplifier 308. Prior to being transmitted, the analog signal may be amplified by the transmit amplifier 308. In some aspects, the amplifier 308 comprises a low noise amplifier (LNA).

[00165] The transmitter 210 is configured to transmit one or more packets, frames, or data units in a wireless signal based on the analog signal. The data units may be

generated using the processor 204 and/or the DSP 220, for example using the modulator 302 and the transform module 304 as discussed above.

[00166] FIG. 4 illustrates various components that may be utilized in the wireless device 202 to receive wireless communications. The components illustrated in FIG. 4 may be used, for example, to receive OFDM communications. In some implementations, the components illustrated in FIG. 4 are used to receive packets, frames, or data units that include one or more training fields, as will be discussed in additional detail below. For example, the components illustrated in FIG. 4 may be used to receive data units transmitted by the components discussed above with respect to FIG. 3. For ease of reference, the wireless device 202 configured with the components illustrated in FIG. 4 is hereinafter referred to as a wireless device 202b.

[00167] The receiver 212 is configured to receive one or more packets, frames, or data units in a wireless signal.

[00168] In the implementation illustrated in FIG. 4, the receiver 212 includes a receive amplifier 401. The receive amplifier 401 may be configured to amplify the wireless signal received by the receiver 212. In some aspects, the receiver 212 is configured to adjust the gain of the receive amplifier 401 using an automatic gain control (AGC) procedure. In some aspects, the automatic gain control uses information in one or more received training fields, such as a received short training field (STF) for example, to adjust the gain. Those having ordinary skill in the art will understand methods for performing AGC. In some aspects, the amplifier 401 comprises an LNA.

[00169] The wireless device 202b may comprise an analog to digital converter 402 configured to convert the amplified wireless signal from the receiver 212 into a digital representation thereof. Further to being amplified, the wireless signal may be processed before being converted by the digital to analog converter 402, for example by being filtered or by being downconverted to an intermediate or baseband frequency. The analog to digital converter 402 may be implemented in the processor 204 or in another element of the wireless device 202. In some aspects, the analog to digital converter 402 is implemented in the transceiver 214 or in a data receive processor.

[00170] The wireless device 202b may further comprise a transform module 404 configured to convert the representation the wireless signal into a frequency spectrum. In FIG. 4, the transform module 404 is illustrated as being implemented by a fast

Fourier transform (FFT) module. In some aspects, the transform module may identify a symbol for each point that it uses.

[00171] The wireless device 202b may further comprise a channel estimator and equalizer 405 configured to form an estimate of the channel over which the data unit is received, and to remove certain effects of the channel based on the channel estimate. For example, the channel estimator may be configured to approximate a function of the channel, and the channel equalizer may be configured to apply an inverse of that function to the data in the frequency spectrum.

[00172] In some aspects, the channel estimator and equalizer 405 uses information in one or more received training fields, such as a long training field (LTF) for example, to estimate the channel. The channel estimate may be formed based on one or more LTFs received at the beginning of the data unit. This channel estimate may thereafter be used to equalize data symbols that follow the one or more LTFs. After a certain period of time or after a certain number of data symbols, one or more additional LTFs may be received in the data unit. The channel estimate may be updated or a new estimate formed using the additional LTFs. This new or update channel estimate may be used to equalize data symbols that follow the additional LTFs. In some aspects, the new or updated channel estimate is used to re-equalize data symbols preceding the additional LTFs. Those having ordinary skill in the art will understand methods for forming a channel estimate.

[00173] The wireless device 202b may further comprise a demodulator 406 configured to demodulate the equalized data. For example, the demodulator 406 may determine a plurality of bits from symbols output by the transform module 404 and the channel estimator and equalizer 405, for example by reversing a mapping of bits to a symbol in a constellation. The bits may be processed or evaluated by the processor 204, or used to display or otherwise output information to the user interface 222. In this way, data and/or information may be decoded. In some aspects, the bits correspond to codewords. In one aspect, the demodulator 406 comprises a QAM (quadrature amplitude modulation) demodulator, for example a 16-QAM demodulator or a 64-QAM demodulator. In other aspects, the demodulator 406 comprises a binary phase-shift keying (BPSK) demodulator or a quadrature phase-shift keying (QPSK) demodulator.

[00174] In FIG. 4, the transform module 404, the channel estimator and equalizer 405, and the demodulator 406 are illustrated as being implemented in the DSP 220. In

some aspects, however, one or more of the transform module 404, the channel estimator and equalizer 405, and the demodulator 406 are implemented in the processor 204 or in another element of the wireless device 202.

[00175] As discussed above, the wireless signal received at the receiver 212 comprises one or more data units. Using the functions or components described above, the data units or data symbols therein may be decoded evaluated or otherwise evaluated or processed. For example, the processor 204 and/or the DSP 220 may be used to decode data symbols in the data units using the transform module 404, the channel estimator and equalizer 405, and the demodulator 406.

[00176] Data units exchanged by the AP 104 and the STA 106 may include control information or data, as discussed above. At the physical (PHY) layer, these data units may be referred to as physical layer protocol data units (PPDUs). In some aspects, a PPDU may be referred to as a packet, frame, or physical layer packet. Each PPDU may comprise a preamble and a payload. The preamble may include training fields and a SIG field. The payload may comprise a Media Access Control (MAC) header or data for other layers, and/or user data, for example. The payload may be transmitted using one or more data symbols. The systems, methods, and devices herein may utilize data units with training fields whose peak-to-power ratio has been minimized.

[00177] In wireless communications such as those specified in the IEEE 802.11 family of wireless protocols, multiple stations share a transmission medium using a media access control protocol. A beacon frame, which is one of management and control frames that support data transfer, may be used to establish and maintain the communications in an orderly fashion. In some applications such as those specified in the 802.11ah protocol, a restricted access window may be used to define a period of time that an access point declares as reserved for a selected group of wireless stations. However, stations that are not associated with the access point cannot contend for the medium when a restricted access window is open. Additionally, the restricted access window cannot currently be specifically defined to be for uplink or downlink transmissions only. Thus, it is beneficial to have a message defining a time period in which the access point will accept messages from non-associated stations. It is additionally beneficial to provide for an ability to specify the type of communication permitted during a restricted access window.

[00178] In implementations as will be described below, an access point (AP) generates a message a period of time that an access point declares as reserved for a selected group of wireless stations, and sends the message to the associated wireless stations. Upon receipt of the message, the wireless stations may transmit a packet to the access point during the identified time period. In one implementation, the message indicates an indication as to whether non-associated stations are permitted to transmit a request to the access point during the period of time. In another implementation, the message indicates the nature of communication between stations and the access point during the time period. For example, the message may indicate whether communication during the time period includes uplink data, downlink data, or both. In one implementation, the message is sent to all the wireless stations associated with the access point. These implementations may be applied in processes and standards associated with IEEE 802.11 and/or 802.11ah among others.

[00179] FIG. 5 is a flowchart of a method of wireless communication in accordance with one implementation. The method 500 may be performed by an apparatus for wireless communication, such as the access point (AP) 104 (shown in FIG. 1) or the wireless device 202 shown in FIG. 2. Method 500 may enable improved management of data transfer between an access point and one or more stations during time periods reserved for such data transfer. Because such time periods are of a finite duration, specifying a type of traffic that may be transferred during the time period can result in more efficient operation of a wireless communication network.

[00180] At block 502, the method includes generating a message identifying a time period in which an apparatus is to communicate a message with one or more wireless devices. The message further indicates a wireless communication flow direction. In an aspect, the wireless communication flow direction indicator in the message indicates whether the communication of a message during the time period is uplink or downlink data. For example, the message may be generated to indicate whether the apparatus performing process 500 will transmit a message or receive a message during the time period. In an aspect, the message is generated to indicate a priority of downlink data and uplink data. For example, the message may be generated to indicate that downlink data is higher priority than uplink data. In an aspect, the message may be generated to further indicate that bidirectional data may be communicated during the time period. A field in the message may provide the indication. In an aspect, the field may be one bit

in length. In another aspect, the field may be more than one bit in length, for example, the field may be two bits in length. In some aspects, the message may be generated as a restricted access window (RAW) message, such as the RAW message of the 802.11 or 802.11ah protocol.

[00181] Some aspects of block 502 may perform one or more of the functions discussed with respect to blocks 802, 1102, 1402, 1702, and/or 2202.

[00182] In an aspect, the processor 204 may be configured to perform one or more of the functions discussed with respect to block 502. In an aspect, means for generating may be the processor 204.

[00183] In block 504, the generated message is transmitted. In one aspect, the transmitter 210 may be configured to perform one or more of the functions discussed with respect to block 504. In an aspect, means for transmitting the generated message may include the transmitter 210 of Figure 2. In another aspect, the processor 204 may be configured to perform one or more of the functions discussed above with respect to block 504. In an aspect, means for transmitting the generated message may include the processor 204.

[00184] FIG. 6 is a flowchart of a method of wireless communication in accordance with one implementation. The method 600 may be performed by an apparatus for wireless communication, such as the station 106 (shown in FIG. 1), or the wireless device 202 shown in FIG. 2. The method 600 may enable a station to interoperate with an access point performing process 500 above. At block 602, the method includes receiving a message identifying a time period in which a first device communicates a message with one or more second wireless devices, the message further comprising an indicator indicating a wireless communication flow direction during the time period. In an aspect, the wireless communication flow direction indicator in the message indicates whether the communication of a message during the time period is uplink or downlink data. For example, the message indicates whether the apparatus performing process 600 will transmit a message or receive a message during the time period. In an aspect, the message may further indicate that bidirectional data may be communicated during the time period. A field in the message may provide the indication. In an aspect, the field may be one bit in length. In another aspect, the field may be more than one bit in length, for example, the field may be two bits in length.

[00185] Some aspects of block 602 include decoding the received message as a restricted access window (RAW) message. In some aspects, the received message is decoded to determine whether the communication of data during the time period is uplink data or downlink data. In some aspects, the received message is decoded to determine whether the communication of data during the time period is uplink, downlink, or bidirectional data. In some aspects, of block 602, the indicator of wireless communication flow direction in the received message is decoded as either one or two bytes in length. In some aspects, means for decoding may include the hardware processor 204.

[00186] Some aspects of block 602 may perform one or more of the functions discussed with respect to blocks 902, 1202, 1502, 1802, and/or 2302.

[00187] In an aspect, the receiver 212 is configured to perform one or more of the functions discussed with respect to block 602. In an aspect, means for receiving may be the receiver 212 of Figure 2. In another aspect, the processor 204 may be configured to perform one or more of the functions discussed above with respect to block 602. In an aspect, means for receiving may include the processor 204. In block 604, a message is communicated with the access point based on the wireless communication flow direction indication. For example, if the indicated flow direction is for uplink traffic, block 604 may include transmitting a message to the first device. If the indicated flow direction is for downlink traffic, block 604 may include receiving a message from the first device.

[00188] In an aspect, the processor 204 is configured to perform one or more of the functions discussed with respect to block 604. In an aspect, means for communicating a message with the first device may include the processor 204. In some aspects, the first device is an access point.

[00189] The message indicating a wireless communication flow direction, for example, the message generated in block 502 or the message received in block 602, may be composed in various ways. FIG. 7 shows one implementation of the message comprising an indicator identifying a wireless communication flow direction. The message 700, or a substantially similar message, may be transmitted from an AP to associated wireless stations as described above with regard to FIG. 5. The message 700, or a substantially similar message, may also be received in block 602 of process 600.

The message 700 may be transmitted using any process and method suitable for transmissions from the AP to the station.

[00190] In the illustrative implementation, the message defines a restricted access window, a period of time that an access point declares as reserved for a selected group of wireless stations, such as one specified in the 802.11ah protocol. The message includes a RAW Start Time 702 indicating the start time of the restricted access window. The message also includes a RAW Duration 704 indicating the duration of the restricted access window. The message also includes a Group ID 706 listing the selected group of wireless stations allowed to send a packet to the access point during the restricted access window.

[00191] In addition, the message includes a field 708 for indicating a wireless communication flow direction. In an aspect, the field 708 may include one bit which can be set to a logic value of 0 or 1, wherein a logic value of 1 indicates that the wireless communication flow during the restricted access window is in an uplink direction, and a logic value of 0 indicates that wireless communication flow during the restricted access window is in a downlink direction. In another aspect, the logic values may be reversed. In another aspect, the field 708 may include more than one bit. In these aspects, the field 708 may indicate that the wireless communication flow during the restricted access window is in an uplink direction, a downlink direction, or is bidirectional. In an aspect, the field 708 may prioritize downlink data and uplink data. For example, the field 708 may indicate that downlink data is higher priority than uplink data. Alternatively, field 708 may indicate that uplink data is higher priority than downlink data.

[00192] FIG. 8 is a flowchart of a method of wireless communication in accordance with one implementation. The method 800 may be performed by an apparatus for wireless communication, such as the access point (AP) 104 (shown in FIG. 1) or the wireless device 202 shown in FIG. 2. Method 800 may improve the ability of an access point to manage the type of communication it receives during certain time periods. For example, some access points may determine that unassociated stations should not communicate with it during a restricted access window. Other access points may determine that they will allow unassociated stations to communicate with them during certain time periods, for example, during certain restricted access windows. This improved ability for an access point to manage the traffic it receives during one or more

time periods, such as one or more restricted access windows, may provide for more efficient operation of a wireless communication network.

[00193] At block 802, the method includes generating a message indicating whether one or more devices that are not associated with an apparatus are permitted to communicate with the apparatus during a time period defined by the message. In an aspect the message further indicates the period of time is declared as reserved for communication by an access point for a selected group of wireless stations, such as a group of stations specified in the 802.11ah protocol. For example, a BSSID may be included in the generated message to identify the group of stations in some aspects.

[00194] In an aspect, the message may indicate that the time period is to be used for association of stations only. In this aspects, only non-associated stations may communicate with the apparatus during the time period defined by the message. Alternatively, the message may indicate the time period can be used by both a group of associated stations as well as non-associated stations. In some aspects, the message includes at least two distinct indicators, a first indicator indicating whether non-associated stations may utilize the time period, and a second indicator indicating whether or which associated stations may utilize the time period.

[00195] In an aspect the message is generated as a restricted access window (RAW) message. In some aspects, the message is generated to indicate whether associated devices (such as specific devices) may also use the time period for communication with the apparatus. In these aspects, the specific devices may be identified in the message by, for example, unique device identifiers or network addresses. In some aspects, the message is generated to indicate whether a group of associated stations may also use the time period for communication with the apparatus. Some aspects of block 802 may perform one or more of the functions discussed with respect to blocks 502, 1102, 1402, 1702, and/or 2202.

[00196] In some aspects, the message may indicate devices not associated with the apparatus are permitted to communicate with the apparatus via a raw parameter set (RPS) element in a short beacon frame. The RPS element may indicate a RAW during which all STAs are allowed to access the medium or communicate with an access point. This may be indicated in some aspects via a RAW Group field in the RPS element that is all zeros. Such a RAW may be used for association of new STAs.

[00197] In an aspect, the processor 204 may be configured to perform one or more of the functions discussed with respect to block 802. In an aspect, means for generating may include the processor 204.

[00198] At block 804, the generated message is transmitted. In an aspect, the transmitter 210 may be configured to perform one or more of the functions discussed with respect to block 804. In an aspect, the message is transmitted to a station. In an aspect, means for transmitting may include the transmitter 210. In another aspect, the processor 204 may be configured to perform one or more of the functions discussed above with respect to block 804. In an aspect, means for transmitting the generated message may include the processor 204.

[00199] Some aspects of process 800 further include receiving a message from a non-associated device, such as a station, during the indicated time period, and transmitting a response to the message based on the message being received within the time period. The process may also include receiving a message from a non-associated device, such as a station, outside the time period. In response, a message may be transmitted essentially "nak-ing" or otherwise providing a negative indication to the transmitter of the message that the apparatus will not process the message because it was received outside the time period. In other aspects a message received outside the time period may simply be dropped or ignored by the device receiving the message. Receiving of the messages outside the time period may be performed by the receiver 212 or processor 204. Means for receiving may include the processor 204 and/or receiver 212. Means for dropping or ignoring may include the processor 204. Means for transmitting a response may include the processor 204 and/or the transmitter 210.

[00200] Some aspects of process 800 include sleeping during the time period if the generated message indicates that devices are not permitted to communicate with the apparatus during the time period. Means for sleeping during the time period may include the processor 204.

[00201] FIG. 9 is a flowchart of a method of wireless communication in accordance with one implementation. The method 900 may be performed by an apparatus for wireless communication, such as the station 106 (shown in FIG. 1) or the wireless device 202 shown in FIG. 2. In some aspects, method 900 may enable a station to interoperate on a wireless communication network with an access point performing process 800.

[00202] At block 902, the method includes receiving a message indicating whether one or more devices that are not associated with an apparatus are permitted to communicate with the apparatus during a time period defined by the message. In an aspect the message further indicates that the time period is reserved for a selected group of wireless stations to communicate. For example, the message may be a restricted access window (RAW) message, similar to the RAW message specified in the 802.11ah protocol Some aspects of block 902 may perform one or more of the functions discussed with respect to blocks 602, 1202, 1502, 1802, and/or 2302.

[00203] In an aspect, the receiver 212 is configured to perform one or more of the functions discussed with respect to block 902. In an aspect, means for receiving may include the receiver 212. In another aspect, the processor 204 may be configured to perform one or more of the functions discussed above with respect to block 902. In an aspect, means for receiving may include the processor 204.

[00204] Block 902 may further include decoding the received message to determine whether one or more devices that are not associated with the apparatus are permitted to communicate with the apparatus during the time period defined by the message. Block 902 may also include decoding the received message to determine the period of time that the access point declares as reserved for the selected group of wireless stations. Block 902 may also include decoding the received message as a restricted access window message. In some aspects, means for decoding includes the processor 204.

[00205] In block 904, a message is selectively transmitted to the apparatus based on the indication. In an aspect, an association message is transmitted to the apparatus if the indication indicates a first value and an association message is not transmitted to the apparatus if the indication indicates a second value. In an aspect, the transmitter 210 is configured to perform one or more of the functions discussed with respect to block 904. In an aspect, means for transmitting may include the transmitter 210. In another aspect, the processor 204 may be configured to perform one or more of the functions discussed above with respect to block 904. In an aspect, means for transmitting the generated message may include the processor 204.

[00206] A message indicating whether one or more devices that are not associated with the apparatus are permitted to communicate with the apparatus during a time period, such as the message generated in block 802 above, or the message received in block 902 above, may be composed in various ways. FIG. 10 shows one

implementation of the message indicating whether one or more devices that are not associated with the apparatus are permitted to communicate with the apparatus during a time period. The message 1000 may be transmitted from an AP to wireless stations as described above with regard to FIG. 8. The message 1000 may be transmitted using any process and method suitable for transmissions from the AP to the station.

[00207] In the illustrative implementation, the message defines a restricted access window, a period of time that an access point declares as reserved for a selected group of wireless stations, such as one specified in the 802.11ah protocol. The message includes a RAW Start Time 702 indicating the start time of the restricted access window. The message also includes a RAW Duration 704 indicating the duration of the restricted access window. The message also includes a Group ID 706 listing the selected group of wireless stations allowed to send a packet to the access point during the restricted access window.

[00208] In addition, the message includes a field 1008 for indicating whether one or more devices that are not associated with the apparatus are permitted to communicate with the apparatus during a time period defined by the RAW Start Time 702 and RAW Duration 704. The message also includes a Group ID 706 listing the selected group of wireless stations allowed to send a packet to the access point during the restricted access window. In an aspect, the field 1008 may include one bit which can be set to a logic value of 0 or 1, wherein a logic value of 1 indicates that one or more devices that are not associated with the apparatus are permitted to communicate with the apparatus during the time period, and a logic value of 0 indicates that such communication is not permitted during the time period. In an aspect, the logic values may be reversed. In another aspect, the field 1008 may include more than one bit. In these aspects, the field 1008 may indicate that the time period is allocated for association of non-associated stations only. Alternatively, such a field may indicate that the time period is allocated for a group of stations, but that non-associated stations may also communicate with the apparatus during the time period. In yet another alternative, the field may indicate that the time period is allocated for associated stations only.

[00209] FIG.11 is a flowchart of a method of wireless communication in accordance with one implementation. The method 1100 may be performed by an apparatus for wireless communication, such as the access point (AP) 104 (shown in FIG. 1) or the wireless device 202 shown in FIG. 2. Method 1100 may provide for improved

determination of an expiration time of a time period or window. In some current methods, the expiration time of a time period may be determined based parameters which may not be known to an access point. For example, some expiration times are based on the end of a beacon transmission. Since the end of a beacon signal may be difficult or impossible for some wireless nodes to predict, these nodes may be unable to determine the expiration time of a time period or a window. This may inhibit the nodes from entering a sleep state for a period of time equivalent to the uncertainty in the expiration of the time period or window. Method 1100 provides that an expiration of a time period is based on a number of beacon intervals. Since the length of a beacon interval is known, stations or access points on a wireless network utilizing process 1100 and 1200 below may improve their predictions of the end of a time period or window.

[00210] At block 1102, the method includes generating a message indicating an expiration time of a window during which one or more identified devices are permitted to communicate with the apparatus, wherein the expiration time is indicated based on a number of beacon intervals. In an aspect the message is generated as a restricted access window message, such as one specified in the 802.11ah protocol. In some aspects, the message is generated to indicate a group of associated stations may also use the time period for communication with the apparatus.

[00211] In some aspects, a particular value may be reserved to indicate the window does not expire. For example, in some aspects, the particular value reserved for this purpose is zero (0). In these aspects, if the number of beacon intervals is set to zero the message indicates the window does not expire. In some aspects, the message may be generated to substantially conform with the format of message 1300, discussed below with respect to FIG. 13.

[00212] In some aspects, the generated message may include a periodic operation parameters subfield. The periodic operation parameters subfield may be three octets in length in some aspects. In some aspects, the periodic operation parameters subfield comprises a periodic restricted access window (PRAW) periodicity, PRAW Validity, and PRAW Start Offset sub-subfields. The PRAW periodicity subfield indicates the period of current PRAW occurrence in a unit of short beacon interval, and is eight bits in some aspects. The PRAW Validity subfield indicates the number of periods that the PRAW repeats, and is of length 8 bits in some aspects. For example, the PRAW Validity subfield may indicate a duration of a PRAW based on a number of beacon

intervals as discussed above. The PRAW Start Offset subfield indicates the offset value in time units (TU) from the end of a (Short) beacon frame that the first window of the PRAW appears from, and is of length 8 bits.

[00213] Some aspects of block 1102 may perform one or more of the functions discussed with respect to blocks 502, 1802, 1402, 1702, and/or 2202.

[00214] In an aspect, the processor 204 is configured to perform one or more of the functions discussed with respect to block 1102. In an aspect, means for generating the message may include the processor 204.

[00215] In block 1104, the generated message is transmitted. In an aspect, the message may include a number of beacon intervals field. In some of these aspects, a particular value of the number of beacon intervals field may be reserved to indicate that the window does not expire. In these aspects, transmitting a message with the number of beacon intervals field set to the reserved value indicates the window does not expire. In these aspects, a second message may be transmitted with the number of beacon intervals field set to a value other than the reserved value to indicate a window that will expire after the indicated number of beacon intervals.

[00216] In one aspect, the transmitter 210 is configured to perform one or more of the functions discussed with respect to block 1104. In another aspect, the processor 204 may be configured to perform one or more of the functions discussed above with respect to block 1104. In an aspect, means for transmitting the generated message may include the transmitter 210 and/or the processor 204.

[00217] The method 1100 may further include receiving a second message from one or more of the identified devices, and processing the message based on whether the message was received during the window and/or before expiration of the window. Means for receiving the second message may be performed by one or more of the processor 204 and/or receiver 212.

[00218] Some aspects of process 1100 further include generation and transmission of a subsequent message, also including an expiration time of the window. This subsequent message effectively redefines the expiration time of the window defined by any previously generated and transmitted messages. For example, in these aspects, if a previously transmitted message indicated the window did not expire, a subsequently generated and transmitted message may indicate the window does expire after a particular number of beacon intervals. The generation and transmission may be

performed by one or more of the processor 204 and/or transmitter 210. Means for generating and means for transmitting may include one or more of the processor 204 and/or transmitter 210.

[00219] FIG. 12 is a flowchart of a method of wireless communication in accordance with one implementation. The method 1200 may be performed by an apparatus for wireless communication, such as the station 106 (shown in FIG. 1) or the wireless device 202 shown in FIG. 2. In one aspect, method 1200 may enable a station to interoperate with an access point performing process 1100.

[00220] At block 1202, the method includes receiving a message indicating an expiration time of a window during which one or more identified devices are permitted to communicate with an access point, the expiration time being based on a number of beacon intervals. Some aspects of block 1202 may perform one or more of the functions discussed with respect to blocks 602, 902, 1502, 1802, and/or 2302.

[00221] In an aspect, the receiver 212 is configured to perform one or more of the functions discussed with respect to block 1202. In an aspect, means for receiving the message indicating an expiration time may include the receiver 212. In another aspect, the processor 204 may be configured to perform one or more of the functions discussed above with respect to block 1202. In an aspect, means for receiving may include the processor 204.

[00222] In some aspects, block 1202 includes decoding the received message to determine the expiration time of the window. In some aspects, the decoding may be performed by the processor 204. In some aspects, means for decoding may include the processor 204.

[00223] In an aspect the received message further indicates a period of time that an access point declares as reserved for a selected group of wireless stations, such as one specified in the 802.11ah protocol. In an aspect, the received message is a restricted access window message. In some aspects, the received message may substantially conform to the format of the message 1300, discussed below. Some aspects include decoding the received message to determine the period of time that an access point declares as reserved for a selected group of wireless stations. In some aspects, means for decoding may include the processor 204. Some aspects of process 1200 include decoding the received message as a restricted access window message. Means for decoding may include the hardware processor 204.

[00224] In block 1204, a messaged is transmitted during the window. In some aspects, the transmission of the message during the window is based on the message received in block 1202. In an aspect, the transmitter 210 is configured to perform one or more of the functions discussed with respect to block 1204. In an aspect, means for transmitting a message during the window may include the transmitter 210. In another aspect, the processor 204 may be configured to perform one or more of the functions discussed above with respect to block 1204. In an aspect, means for transmitting a message during the window may include the processor 204.

[00225] In an aspect, the transmitted message may include a number of beacon intervals field. In some of these aspects, a particular value of the number of beacon intervals field may indicate that the window does not expire. In these aspects, receiving a message with the number of beacon intervals field set to the particular value indicates the window does not expire. In these aspects, a second message may be received with the number of beacon intervals field set to a value other than the particular value to indicate the window will expire after the indicated number of beacon intervals.

[00226] A message indicating an expiration time of a window, as discussed above with respect to FIGs. 11 and 12, may be composed in various ways. FIG. 13 shows one implementation of the message indicating an expiration time of a window. The message 1300 may be transmitted from an AP to associated wireless stations as described above with regard to FIG. 11. The message 1300 may be transmitted using any process and method suitable for transmissions from the AP to the station.

[00227] In the illustrative implementation, the message defines a restricted access window, a period of time that an access point declares as reserved for a selected group of wireless stations, such as one specified in the 802.11ah protocol. The message includes a RAW Start Time 702 indicating the start time of the restricted access window. The message also includes a RAW Duration 704 indicating the duration of the restricted access window. The message also includes a Group ID 706 listing the selected group of wireless stations allowed to send a packet to the access point during the restricted access window.

[00228] In addition, the message includes a field 1308 for indicating an expiration time of the restricted access window. In the illustrated aspect, the expiration time is indicated based on a number of beacons. As discussed above, a particular value of field 1308 may be reserved to indicate that the window does not expire. In these aspects, a

first version of message 1300 may be sent with field 1308 set to the particular value, thus indicating that the window does not expire. Later, a second version of message 1300 may be transmitted with field 1308 set to a value other than the particular value. The second message indicates an expiration time of the window after the number of beacon intervals specified in field 1308.

[00229] FIG.14 is a flowchart of a method of wireless communication in accordance with one implementation. The method 1400 may be performed by an apparatus for wireless communication, such as the access point (AP) 104 (shown in FIG. 1) or the wireless device 202 shown in FIG. 2. In some current methods, the start time of a time period may be determined based on parameters which may not be known to one or more devices on the wireless network. For example, some start times are based on the end of a beacon transmission. Since the end of a beacon signal may be difficult or impossible for some wireless nodes to predict, these nodes may be unable to determine the start time of a time period or a window. This may inhibit the nodes from entering a sleep state for a period of time equivalent to the uncertainty in the start of the time period or window. Method 1400 provides that the start of a time period is based on a time reference maintained by an apparatus. Since the apparatus maintains the time reference, and may communicate synchronization signals to other devices on a wireless network that are based on the time reference, the start of the time period can be easily determined. Because of this, stations or access points on a wireless network utilizing process 1400 and 1500 below may improve their predictions for the start of a time period or window.

[00230] At block 1402, the method includes generating a message indicating a start time of a window during which one or more identified devices are permitted to communicate with the apparatus, the start time being based on an absolute time reference maintained by the apparatus. In an aspect, the time reference is a target beacon transmit time (TBTT). In another aspect, the time reference is a timing synchronization function (TSF). In some aspects, the message is generated as a restricted access window (RAW) message. A restricted access window message indicates a start time and duration of the restricted access window.

[00231] In some aspects, block 1402 may perform one or more of the functions discussed with respect to blocks 502, 802, 1102, 1702 (discussed below), and/or 2202 (also discussed below).

[00232] In an aspect, the processor 204 may be configured to perform one or more of the functions discussed with respect to block 1402. In an aspect, means for generating the message indicating a start time of a window may include a processor 204.

[00233] In block 1404, the generated message is transmitted. In an aspect, the message is a target wake time information element (TWT IE). In an aspect, the transmitter 210 is configured to perform one or more of the functions discussed with respect to block 1404. In an aspect, means for transmitting the generated message may include the transmitter 210. In another aspect, the processor 204 may be configured to perform one or more of the functions discussed above with respect to block 1404. In an aspect, means for transmitting the generated message may include the processor 204.

[00234] FIG. 15 is a flowchart of a method of wireless communication in accordance with one implementation. The method 1500 may be performed by an apparatus for wireless communication, such as the station 106 (shown in FIG. 1) or the wireless device 202 shown in FIG. 2. In an aspect, method 1500 may enable a station to interoperate with an access point performing method 1400 above.

[00235] At block 1502, the method includes receiving a message indicating a start time of a window during which one or more identified devices are permitted to communicate with an access point, the start time being based on an absolute time reference maintained by the access point. In an aspect, the message is a target wake time information element (TWT IE). In an aspect, the time reference is a target beacon transmit time (TBTT). In an aspect, the time reference is a timing synchronization function (TSF).

[00236] In an aspect, the receiver 212 is configured to perform one or more of the functions discussed with respect to block 1502. In an aspect, means for receiving a message indicating a start time of a window may include the receiver 212. In another aspect, the processor 204 may be configured to perform one or more of the functions discussed above with respect to block 1502. In an aspect, means for receiving may include the processor 204.

[00237] Some aspects of block 1502 include decoding the received message to determine the start time of the window. In some aspects, the processor 204 may perform the decoding. In some aspects, means for decoding the received message includes the processor 204. In some aspects, the means for decoding is configured to decode the time reference as a target beacon transmit time (TBTT) or as a timing

synchronization function (TSF). In some aspects, the means for decoding is configured to decode the received message as a restricted access window message.

[00238] Some aspects of block 1502 may perform one or more of the functions discussed with respect to blocks 602, 902, 1202, 1802 (discussed below), and/or 2302 (also discussed below).

[00239] In block 1504, communications on the wireless communication network are limited based on the message. In some aspects, a second message is received by process 1500. The second message is processed based on whether the second message is received during the window. The window may be at least partially defined by the start time indicated in the message received in block 1502. Some aspects of process 1500 include transmitting a beacon message indicating a second time reference derived from the time reference maintained by the apparatus.

[00240] In an aspect, the processor 204 is configured to perform one or more of the functions discussed with respect to block 1504. In an aspect, means for limiting communication on the wireless communication network may include the processor 204. In some aspects, the means for limiting may include a means for transmitting a beacon message indicating a second time reference derived from the time reference maintained by the apparatus. In some aspects, the means for transmitting may include the transmitter 210 and/or the processor 204. In some aspects, means for receiving a second message may include one or more of the receiver 212 or the hardware processor 204. In some aspects, mean for processing the second message based on whether the second message was received during the window may include the hardware processor 204.

[00241] The message indicating the start time of a window may be composed in various ways. FIG. 16 shows one implementation of the indicating the start time of a window. The message 1600, or a message with substantially similar fields to the message 1600, may be transmitted from an AP to associated wireless stations as described above with regard to FIG. 14. The message 1600, or a message including substantially similar fields to the message 1600, may be received in block 1502 of process 1500, discussed above. The message 1600 may be transmitted using any process and method suitable for transmissions from the AP to the station.

[00242] In the illustrative implementation, the message defines a restricted access window, a period of time that an access point declares as reserved for a selected group of wireless stations, such as one specified in the 802.11ah protocol. The message

includes a RAW Start Time 702 indicating the start time of the restricted access window. In some aspects, the RAW Start Time 702 may be eight (8) bits in length and indicate a duration, in time units (TU) from the end of a (short) beacon or (short) probe Response frame transmission that includes an EPS element to the start time of the restricted access window (RAW). The time unit for the RAW Start Time subfield 802 is two time units (TU).

[00243] In some aspects, the message also includes a RAW Duration 704 indicating the duration of the restricted access window. The message also includes a Group ID 706 listing the selected group of wireless stations allowed to send a packet to the access point during the restricted access window.

[00244] In one aspect of the method described above, the RAW Start Time 702 may be based on a time reference maintained by an apparatus, for example, an apparatus transmitting message 1600. As discussed above with respect to processes 1400 and 1500, in some aspects, the RAW start Time 702 may be based on a target beacon transmit time (TBTT). In another aspect, the RAW start Time 702 may be based on a timing synchronization function (TSF).

[00245] FIG.17 is a flowchart of a method of wireless communication in accordance with one implementation. The method 1700 may be performed by an apparatus for wireless communication, such as the access point (AP) 104 (shown in FIG. 1) or wireless device 202 of FIG. 2. The method 1700 may provide for improved association of one or more stations with a time period for transmission on the wireless network. For example, some current methods may not allow individual stations to be associated with a time period for transmission. Instead, these methods may provide for the association of a group of stations with a time period for transmission. By enabling a time period or window to be associated with one or more stations, improved control of communications on a wireless network may result, leading to improved efficiency and performance of the wireless network.

[00246] At block 1702, the method includes generating a message identifying a specific device or an unrestricted group of devices, and identifying a time period during which the identified specific device or unrestricted group of devices are permitted to communicate with an apparatus. In an aspect, the message identifies each member of the unrestricted group of devices. For example, the message may include a field or other indication that provides a device identifier for each device in the unrestricted

group of devices. In an aspect, the message identifies two or more specific devices, and the time period identifies a time during which the two or more specific devices are permitted to communicate with the apparatus. For example, the message may identify greater than 64 different devices.

[00247] In an aspect, the message is a restricted access window message. The restricted access window message may include a group subfield that indicates AID's of stations allowed restricted access during the restricted access window period. In some aspects, the group subfield may include a page index, a starting AID for station's allowed access during the restricted access window period, and an ending AID for stations allowed access during the restricted access window period. In these aspects, any station with an AID between or including the starting AID and the ending AID, in accordance with the hierarchical addressing method of AID's, is allowed access during the restricted access window period. In this way, the number of stations that can be allowed access during the restricted access window period is unrestricted.

[00248] Some aspects of block 1702 may perform one or more of the functions discussed with respect to blocks 502, 802, 1102, 1402, and/or 2202 (discussed below).

[00249] In an aspect, the processor 204 may be configured to perform one or more of the functions discussed with respect to block 1702. In an aspect, means for generating a message identifying a specific device or an unrestricted group of devices may include the processor 204.

[00250] In block 1704, the generated message is transmitted. In some aspects, process 1700 further includes receiving a message from a source device during the time period identified by the generated and transmitted message. The received message is processed based on the message being from the source device and based on the received message being received within the time period identified by the generated and transmitted message. For example, because the message was received from the source device during the time period, the message may be processed fully if the generated message identified the source device. If the message requests resources of some kind from the receiving device, the resources may be allocated and a response sent to the source device if the source device was identified by the message generated in block 1702. If the generated message did not identify the source device of the received message, either directly via a device identifier, or indirectly by identifying a group of which the source device belongs, then a message received from the source device during

the time period may not be processed in a regular fashion. For example, the message may be dropped or ignored without responding to the source device. In some aspects, a response may be generated and transmitted to the source device, but the response may indicate a negative acknowledgment, or otherwise communicate an error status because the message was received from the source device during the time period, but the source device was not granted permission to transmit a message to the device performing process 1700 during the time period.

[00251] In an aspect, one or more of the processor 204 and/or the transmitter 210 may be configured to perform one or more of the functions discussed with respect to block 1704. In an aspect, means for transmitting the message may include the transmitter 210 and/or the processor 204.

[00252] FIG. 18 is a flowchart of a method of wireless communication in accordance with one implementation. The method 1800 may be performed by an apparatus for wireless communication, such as the station 106 (shown in FIG. 1) or the wireless device 202 of FIG. 2. In an aspect, method 1800 may enable a station to interact with an access point performing process 1700.

[00253] At block 1802, the method includes receiving a message indicating a start time of a window during which one or more identified devices are permitted to communicate with an access point. In an aspect, the message may be decoded to identify two or more specific devices, and to identify a time period during which the two or more specific devices are permitted to communicate with the apparatus. For example, in one aspect the message may be decoded to identify more than sixty four devices that are permitted to communicate with the apparatus. In an aspect, the message is decoded as a restricted access window message.

[00254] Some aspects of block 1802 may include one or more of the functions discussed with respect to blocks 602, 902, 1202, 1502, and/or 2302 (discussed below).

[00255] In an aspect, one or more of the processor 204 and/or the receiver 212 may be configured to perform one or more of the functions discussed with respect to block 1802. In an aspect, means for receiving the message indicating a start time of a window may include the receiver 212. In another aspect, the processor 204 may be configured to perform one or more of the functions discussed above with respect to block 1802. In an aspect, means for receiving may include the processor 204. In an aspect, means for decoding the received message to identify the start time of a window may include the

processor 204. Means for decoding the received message to identify a time period may also include the processor 204. In some aspects, the means for decoding the received message is configured to decode the message to identify two or more specific devices and discussed above. The means for decoding may also be configured to decode the time period to identify a time during which the two or more specific devices are permitted to communicate with the access point. In some aspects, the means for decoding is configured to decode the received message as a restricted access window message.

[00256] In block 1804, communications on the wireless communication network are limited based on the message. For example, in some aspects, if the received message is decoded to identify a device identifier of a device receiving the message, the receiving device may communicate with the apparatus during the time period identified by the message. For example, the device may transmit a message to the access point during the time period. Alternatively, if a receiving device is not identified by the message, that device may determine not to communicate with the access point during the identified time period.

[00257] Similarly, if the received message identifies an unrestricted group of devices of which the receiving device is not included, then the receiving device may not communicate with an apparatus that transmitted the message during the identified time period. Alternatively, if the receiving device was identified in the message, either specifically via a device identifier, or indirectly via identification of a group of devices of which the receiving device is a part, then the receiving device may communicate with an apparatus transmitting the received message during the identified time period.

[00258] In an aspect, the processor 204 may be configured to perform one or more of the functions discussed above with respect to block 1804. In an aspect, means for limiting communications on the wireless communication network may include the processor 204. In one aspect, the means for limiting is further configured to determine whether the apparatus is identified by the received message, and transmit a message to the access point during the time period if the apparatus is identified. In some aspects, the means for limiting is further configured to not transmit a message to the access point during the time period if the apparatus is not identified.

[00259] The message generating and transmitted in process 1700, and the message received and decoded in process 1800, may be composed in various ways. FIG. 19

shows one implementation of the message identifying a specific device or an unrestricted group of devices. The message 1900 may be transmitted from an AP to associated wireless stations as described above with regard to FIG. 17. For example, the message 1900, or a message substantially similar to the message 1900, may be generated in block 1702 and transmitted in block 1704. Similarly, the message 1900, or a message substantially similar to the message 1900, may be received and/or decoded in block 1802. The message 1900 may be transmitted using any process and method suitable for transmissions from the AP to the station.

[00260] In the illustrative implementation, the message defines a restricted access window, a period of time that an access point declares as reserved for a selected group of wireless stations, such as one specified in the 802.11ah protocol. The message includes a RAW Start Time 702 indicating the start time of the restricted access window. The message also includes a RAW Duration 704 indicating the duration of the restricted access window. The message also includes a Group ID 706 listing the selected group of wireless stations allowed to send a packet to the access point during the restricted access window.

[00261] In addition, the message includes a field 1908 for indicating a specific station. In the illustrated aspect, the specific station identified by field 1908 is permitted to communicate with an access point during a time period identified by the restricted access window.

[00262] In some aspects of message 1900, the message may include a group subfield that indicates AID's of stations allowed restricted access during the restricted access window period. In some aspects, the group subfield may include a page index, a starting AID for station's allowed access during the restricted access window period, and an ending AID for stations allowed access during the restricted access window period. In these aspects, any station with an AID between or including the starting AID and the ending AID, in accordance with the hierarchical addressing method of AID's, is allowed access during the restricted access window period. In this way, the number of stations that can be allowed access during the restricted access window period is unrestricted.

[00263] FIG. 20 is a flowchart of a method of wireless communication in accordance with one implementation. The method 2000 may be performed by an apparatus for wireless communication, such as the access point (AP) 104 (shown in FIG. 1). Method

2000 may provide for an improved ability for stations associated with multiple groups on a wireless network to enter a sleep state. For example, with previous methods, a station associated with multiple groups on a wireless network may remain awake and listening to network traffic during target wake times associated with each of the groups with which the station is associated.

[00264] At block 2002, the method includes transmitting a message including a target wake time and an identifier for the target wake time. In an aspect, the message is (or includes) a target wake time information element (TWT IE).

[00265] In an aspect, the transmitter 210 may be configured to perform one or more of the functions discussed with respect to block 2002. In an aspect, means for transmitting a message including a target wake time and an identifier for the target wake time is a transmitter 210. In another aspect, the processor 204 may be configured to perform one or more of the functions discussed above with respect to block 2002. In an aspect, means for transmitting a message including a target wake time and an identifier for the target wake time may include the processor 204.

[00266] In block 2004, a paging message is transmitted including the identifier for the target wake up time. In an aspect, the transmitter 210 may be configured to perform one or more of the functions discussed with respect to block 2004. In an aspect, means for transmitting a message including a target wake time and an identifier for the target wake time may include the transmitter 210. In an aspect, means for transmitting a paging message may include the transmitter 210. In another aspect, the processor 204 may be configured to perform one or more of the functions discussed above with respect to block 2004. In an aspect, means for transmitting the paging message may include the processor 204.

[00267] FIG. 21 is a flowchart of a method of wireless communication in accordance with one implementation. The method 2100 may be performed by an apparatus for wireless communication, such as the station 106 (shown in FIG. 1) or the wireless device 202 shown in FIG. 2. In an aspect, method 2100 may enable a station to interoperate with an access point performing method 2000 discussed above. At block 2102, the method includes receiving a message indicating a target wake time and an identifier for the target wake time. In an aspect, the message is (or includes) a target wake time information element (TWT IE). In an aspect, the receiver 212 may be configured to perform one or more of the functions discussed with respect to block

2102. In an aspect, means for receiving a message indicating a target wake time and an identifier for the target wake time may include the receiver 212. In another aspect, the processor 204 may be configured to perform one or more of the functions discussed above with respect to block 2102. In an aspect, means for receiving may include the processor 204.

[00268] In block 2104, a paging message is received indicating the identifier for the target wake time. In some aspects, block 2104 may include decoding the paging message to determine the identifier. In an aspect, the receiver 212 may be configured to perform one or more functions discussed with respect to block 2104. In an aspect, means for receiving a paging message indicating the identifier for the target wake time may include the receiver 212. In another aspect, the processor 204 may be configured to perform one or more of the functions discussed above with respect to block 2104. In an aspect, means for means for receiving a paging message indicating the identifier for the target wake time may include the processor 204.

[00269] FIG.22 is a flowchart of a method of wireless communication in accordance with one implementation. The method 2200 may be performed by an apparatus for wireless communication, such as the access point (AP) 104 (shown in FIG. 1) or the wireless device 202 of FIG. 2. Method 2200 may provide an improved ability to manage uplink traffic transmitted by a first device to a second device. In an aspect, the first device is a station and the second device is an access point. In current methods, a target wake time message may be identified as providing an opportunity to transmit either uplink traffic or downlink traffic. If uplink traffic will be sent, the transmitter of the uplink traffic (the first device) will precede data transmission during a transmission interval identified by the target wake time with a request-to-send message. In response, a clear to send message may be transmitted by the second device to the first device. After receiving the clear-to-send message, the transmitter of the uplink traffic will initiate the data transfer. In some network environments, the second device may determine that a request-to-send / clear-to-send message communication exchange is unnecessary. In these network environments, the method 2200 provides an ability for the second device to indicate to the first device that no request-to-send message is needed before transmission of data is initiated. This may result in improved efficiency of operation of the wireless communication network.

[00270] At block 2202, the method includes generating a message indicating a target wake time and an uplink direction indicator, the message further indicating whether a request-to-send message should be transmitted before transmitting uplink data. Some aspects of block 2202 may perform one or more of the functions discussed with respect to blocks 502, 802, 1102, 1402, and/or 1702.

[00271] In an aspect, the processor 204 may be configured to perform one or more functions discussed with respect to block 2202. In an aspect, means for generating the message indicating a target wake time and an uplink direction indicator may include the processor 204. In block 2204, the generated message is transmitted. In an aspect, the transmitter 210 is configured to perform one or more of the functions discussed above with respect to block 2204. In an aspect, means for transmitting the generated message may include the transmitter 210. In another aspect, the processor 204 may be configured to perform one or more of the functions discussed above with respect to block 2204. In an aspect, means for transmitting the generated message may include the processor 204.

[00272] FIG. 23 is a flowchart of a method of wireless communication in accordance with one implementation. The method 2300 may be performed by an apparatus for wireless communication, such as the station 106 (shown in FIG. 1). In an aspect, method 2300 may enable a station to interoperate with an access point performing method 2200 discussed above. At block 2302, the method includes receiving a message indicating a target wake time and an uplink direction indicator, the message further indicating whether a request to send message should be transmitted before transmitting uplink data. Some aspects of block 2302 may perform one or more of the functions discussed with respect to blocks 602, 902, 1202, 1502, and/or 1802.

[00273] In an aspect, the receiver 212 may be configured to perform one or more of the functions discussed with respect to block 2302. In an aspect, means for receiving a message indicating a target wake time and an uplink direction indicator includes a receiver 212. In another aspect, the processor 204 may be configured to perform one or more of the functions discussed above with respect to block 2302. In an aspect, means for receiving may include the processor 204.

[00274] In block 2304, a request to send message is transmitted based on whether the message indicates a request-to-send message should be transmitted before transmitting uplink data. In an aspect, the transmitter 210 may be configured to perform one or more

of the functions discussed above with respect to block 2304. In an aspect, means for transmitting a request to send message may include the transmitter 210. In another aspect, the processor 204 may be configured to perform one or more of the functions discussed above with respect to block 2304. In an aspect, means for transmitting the request to send message may include the processor 204.

[00275] In some of the foregoing implementations, a message from an access point specifies a restricted access window, a period of time that the access point declares as reserved for a selected group of wireless stations, such as one specified in the 802.11ah protocol. Alternatively, the message may specify an access window during which access to the medium is granted to all wireless stations. In other words, the access point will accept a packet from all wireless stations during the access window. In one implementation, the message may further include a flag for indicating no access outside the access window, such as the flag 708 (see FIG. 7). This allows an access point to define active and inactive periods of time for the access point.

[00276] As used herein, the term "determining" encompasses a wide variety of actions. For example, "determining" may include calculating, computing, processing, deriving, investigating, looking up (e.g., looking up in a table, a database or another data structure), ascertaining and the like. Also, "determining" may include receiving (e.g., receiving information), accessing (e.g., accessing data in a memory) and the like. Also, "determining" may include resolving, selecting, choosing, establishing and the like. Further, a "channel width" as used herein may encompass or may also be referred to as a bandwidth in certain aspects.

[00277] As used herein, a phrase referring to "at least one of" a list of items refers to any combination of those items, including single members. As an example, "at least one of: a, b, or c" is intended to cover: a, b, c, a-b, a-c, b-c, and a-b-c.

[00278] The various operations of methods described above may be performed by any suitable means capable of performing the operations, such as various hardware and/or software component(s), circuits, and/or module(s). Generally, any operations illustrated in the Figures may be performed by corresponding functional means capable of performing the operations.

[00279] The various illustrative logical blocks, modules and circuits described in connection with the present disclosure may be implemented or performed with a general purpose processor, a digital signal processor (DSP), an application specific integrated

circuit (ASIC), a field programmable gate array signal (FPGA) or other programmable logic device (PLD), discrete gate or transistor logic, discrete hardware components or any combination thereof designed to perform the functions described herein. A general purpose processor may be a microprocessor, but in the alternative, the processor may be any commercially available processor, controller, microcontroller or state machine. A processor may also be implemented as a combination of computing devices, e.g., a combination of a DSP and a microprocessor, a plurality of microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration.

[00280] In one or more aspects, the functions described may be implemented in hardware, software, firmware, or any combination thereof. If implemented in software, the functions may be stored on or transmitted over as one or more instructions or code on a computer-readable medium. Computer-readable media includes both computer storage media and communication media including any medium that facilitates transfer of a computer program from one place to another. A storage media may be any available media that can be accessed by a computer. By way of example, and not limitation, such computer-readable media can comprise RAM, ROM, EEPROM, CD-ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other medium that can be used to carry or store desired program code in the form of instructions or data structures and that can be accessed by a computer. Also, any connection is properly termed a computer-readable medium. For example, if the software is transmitted from a website, server, or other remote source using a coaxial cable, fiber optic cable, twisted pair, digital subscriber line (DSL), or wireless technologies such as infrared, radio, and microwave, then the coaxial cable, fiber optic cable, twisted pair, DSL, or wireless technologies such as infrared, radio, and microwave are included in the definition of medium. Disk and disc, as used herein, includes compact disc (CD), laser disc, optical disc, digital versatile disc (DVD), floppy disk and blu-ray disc where disks usually reproduce data magnetically, while discs reproduce data optically with lasers. Thus, in some aspects computer readable medium may comprise non-transitory computer readable medium (e.g., tangible media). In addition, in some aspects computer readable medium may comprise transitory computer readable medium (e.g., a signal). Combinations of the above should also be included within the scope of computer-readable media.

[00281] The methods disclosed herein comprise one or more steps or actions for achieving the described method. The method steps and/or actions may be interchanged with one another without departing from the scope of the claims. In other words, unless a specific order of steps or actions is specified, the order and/or use of specific steps and/or actions may be modified without departing from the scope of the claims.

[00282] The functions described may be implemented in hardware, software, firmware or any combination thereof. If implemented in software, the functions may be stored as one or more instructions on a computer-readable medium. A storage media may be any available media that can be accessed by a computer. By way of example, and not limitation, such computer-readable media can comprise RAM, ROM, EEPROM, CD-ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other medium that can be used to carry or store desired program code in the form of instructions or data structures and that can be accessed by a computer. Disk and disc, as used herein, include compact disc (CD), laser disc, optical disc, digital versatile disc (DVD), floppy disk, and Blu-ray® disc where disks usually reproduce data magnetically, while discs reproduce data optically with lasers.

[00283] Thus, certain aspects may comprise a computer program product for performing the operations presented herein. For example, such a computer program product may comprise a computer readable medium having instructions stored (and/or encoded) thereon, the instructions being executable by one or more processors to perform the operations described herein. For certain aspects, the computer program product may include packaging material.

[00284] Software or instructions may also be transmitted over a transmission medium. For example, if the software is transmitted from a website, server, or other remote source using a coaxial cable, fiber optic cable, twisted pair, digital subscriber line (DSL), or wireless technologies such as infrared, radio, and microwave, then the coaxial cable, fiber optic cable, twisted pair, DSL, or wireless technologies such as infrared, radio, and microwave are included in the definition of transmission medium.

[00285] Further, it should be appreciated that modules and/or other appropriate means for performing the methods and techniques described herein can be downloaded and/or otherwise obtained by a user terminal and/or base station as applicable. For example, such a device can be coupled to a server to facilitate the transfer of means for performing the methods described herein. Alternatively, various methods described

herein can be provided via storage means (e.g., RAM, ROM, a physical storage medium such as a compact disc (CD) or floppy disk, etc.), such that a user terminal and/or base station can obtain the various methods upon coupling or providing the storage means to the device. Moreover, any other suitable technique for providing the methods and techniques described herein to a device can be utilized.

[00286] It is to be understood that the claims are not limited to the precise configuration and components illustrated above. Various modifications, changes and variations may be made in the arrangement, operation and details of the methods and apparatus described above without departing from the scope of the claims.

[00287] While the foregoing is directed to aspects of the present disclosure, other and further aspects of the disclosure may be devised without departing from the basic scope thereof, and the scope thereof is determined by the claims that follow.

WHAT IS CLAIMED IS:

1. A method for wireless communication, comprising:

generating, by an apparatus, a restricted access window (RAW) message identifying a time period during which the apparatus is to communicate data with one or more wireless devices, the message further comprising an indicator indicating a wireless communication flow direction during the time period; and

transmitting, by the apparatus, the generated message.

2. The method of claim 1, wherein the indicator indicates whether the data communicated during the time period is uplink or downlink data.

3. The method of claim 1, wherein the indicator indicates whether the data communicated during the time period is uplink, downlink, or bidirectional data.

4. The method of claim 1, further comprising generating the restricted access window message to comprise a priority indicator indicating a priority between uplink data and downlink data communicated during the time period.

5. The method of claim 1, wherein the wireless communication flow direction indicator has a bit length of one or two bits.

6. The method of claim 1, wherein the time period identifies a target wake time (TWT).

7. The method of claim 1, further comprising generating the restricted access window (RAW) message to comprise a start time indicator and a duration indicator, wherein the start time indicator indicates a start time of the RAW and the duration indicator indicates a duration of the RAW.

8. An apparatus for wireless communication, comprising:

a processing system configured to generate a restricted access window (RAW) message identifying a time period during which the apparatus is to communicate data with one or more wireless devices, the message further generated to comprise an indicator indicating a wireless communication flow direction during the time period; and

a transmitter configured to transmit the generated message.

9. The apparatus of claim 8, wherein the indicator indicates whether the data communicated during the time period is uplink or downlink data.

10. The apparatus of claim 8, wherein the indicator indicates whether the data communicated during the time period is uplink, downlink, or bidirectional data.

11. The apparatus of claim 8, wherein the processing system is further configured to generate the restricted access window message to comprise a priority indicator indicating a priority of uplink data and downlink data communicated during the time period.

12. The apparatus of claim 8, wherein the wireless communication flow direction indicator has a bit length of either one or two bits.

13. The apparatus of claim 8, wherein the time period identifies a target wake time (TWT).

14. The apparatus of claim 8, wherein the processing system is further configured to generate the restricted access window (RAW) message to comprise a start time indicator and a duration indicator, wherein the start time indicator indicates a start time of the RAW and the duration indicator indicates a duration of the RAW.

15. A method of wireless communication, comprising:

receiving, by an apparatus, a restricted access window (RAW) message identifying a time period during which a first device communicates data with one or more second devices, the message further comprising an indicator indicating a wireless communication flow direction; and

communicating data, by the apparatus, with the first device based on the wireless communication flow direction indicator.

16. The method of claim 15, further comprising decoding the restricted access window (RAW) message to determine whether the data communicated is uplink or downlink data.

17. The method of claim 15, further comprising decoding the restricted access window (RAW) message to determine whether the data communicated is uplink, downlink, or bidirectional data.

18. The method of claim 15, further comprising decoding the restricted access window (RAW) message to determine a priority of uplink data and downlink data communicated during the time period.

19. The method of claim 15, further comprising decoding the wireless communication flow direction indicator based on either one or two bits of the received RAW message.

20. The method of claim 15, wherein the time period identifies a target wake time (TWT).

21. The method of claim 15, further comprising decoding a start time of the RAW and a duration of the RAW based on the restricted access window message.

22. An apparatus for wireless communication, comprising:

a processing system configured to receive a restricted access window (RAW) message identifying a time period during which a first device communicates data with one or more second devices, the message further comprising an indicator indicating a wireless communication flow direction during the time period, and

wherein the processing system is further configured to communicate data with the first device based on the wireless communication flow direction indicator.

23. The apparatus of claim 22, wherein the processing system is further configured to decode the restricted access window message to determine whether the data communicated is uplink or downlink data.

24. The apparatus of claim 22, wherein the processing system is further configured to decode the restricted access window message to determine whether the data communicated is uplink, downlink, or bidirectional data.

25. The apparatus of claim 22, wherein the processing system is further configured to decode the restricted access window message to determine a priority of uplink data and downlink data communicated during the time period.

26. The apparatus of claim 22, wherein the processing system is further configured to decode the wireless communication flow direction indicator based on either one or two bits of the received message.

27. The apparatus of claim 22, wherein the time period identifies a target wake time (TWT).

28. The apparatus of claim 22, wherein the processing system is further configured to decode a start time of the RAW and a duration of the RAW based on the restricted access window message.

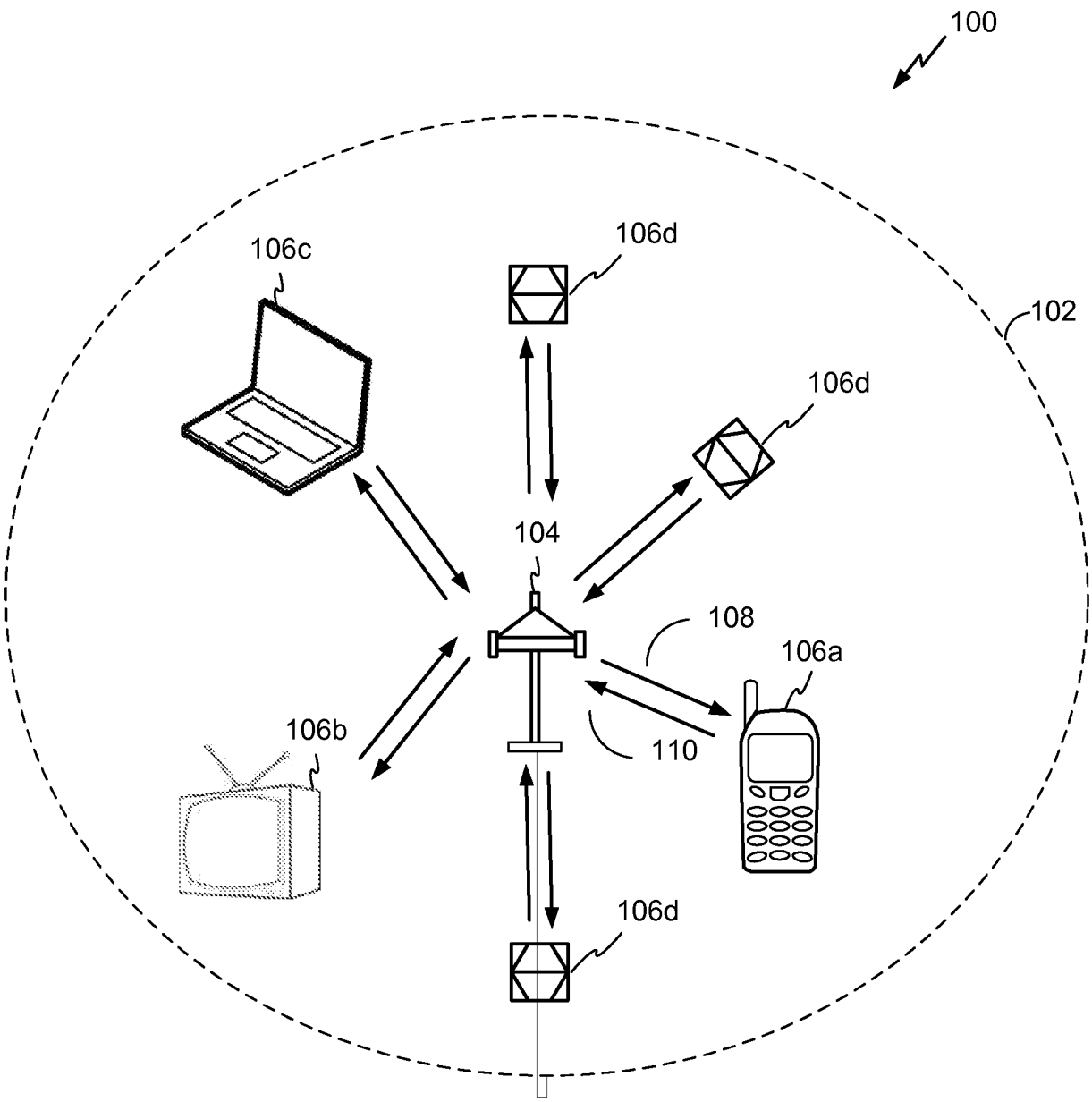

FIG. 1

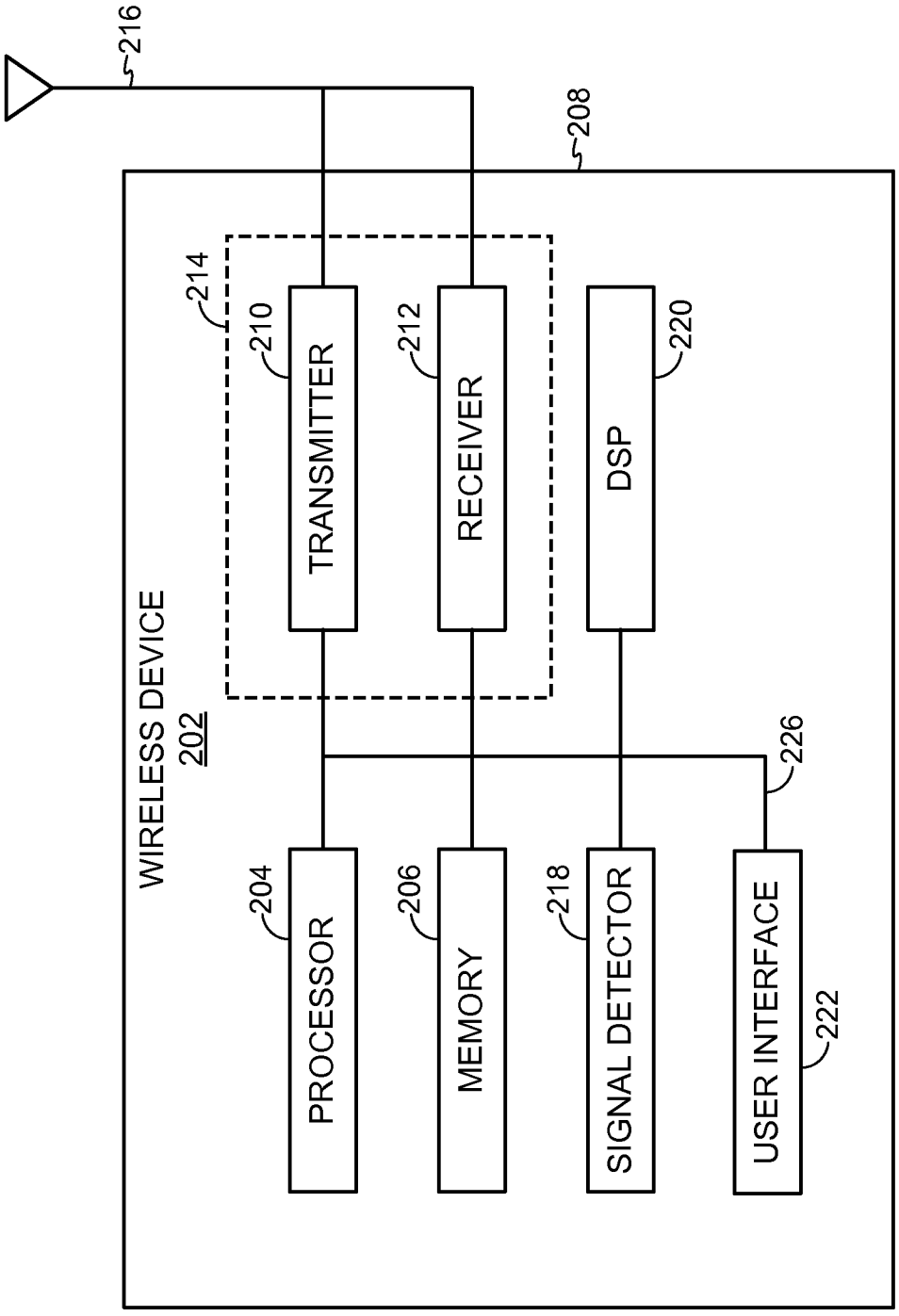
216
208
214
210
TRANSMITTER
212
RECEIVER
220
DSP
WIRELESS DEVICE
202
226
204
PROCESSOR
206
MEMORY
218
SIGNAL DETECTOR
USER INTERFACE
222

FIG. 2

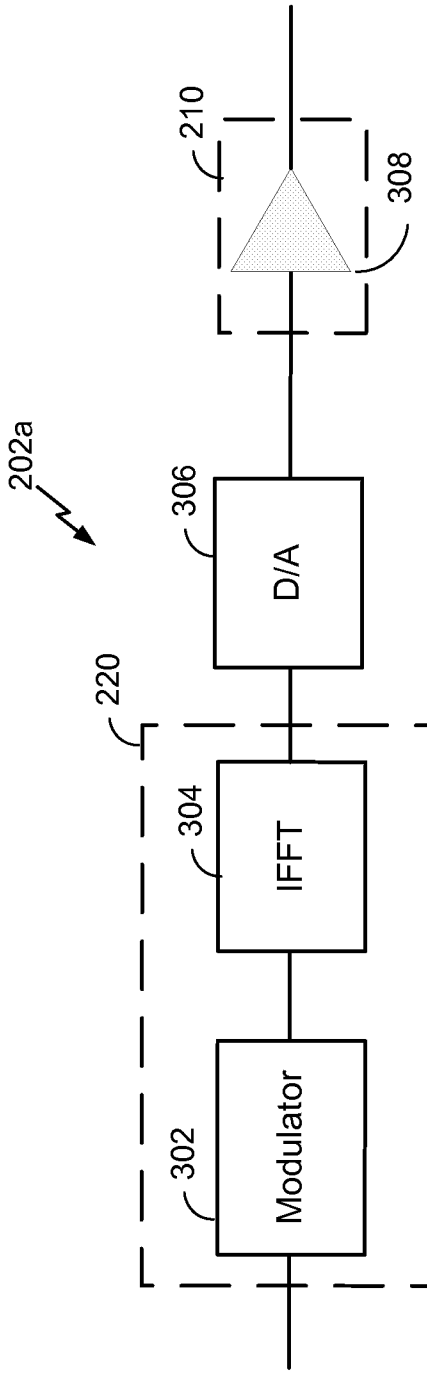
202a
210
308
306
D/A
220
304
IFFT
302
Modulator

FIG. 3

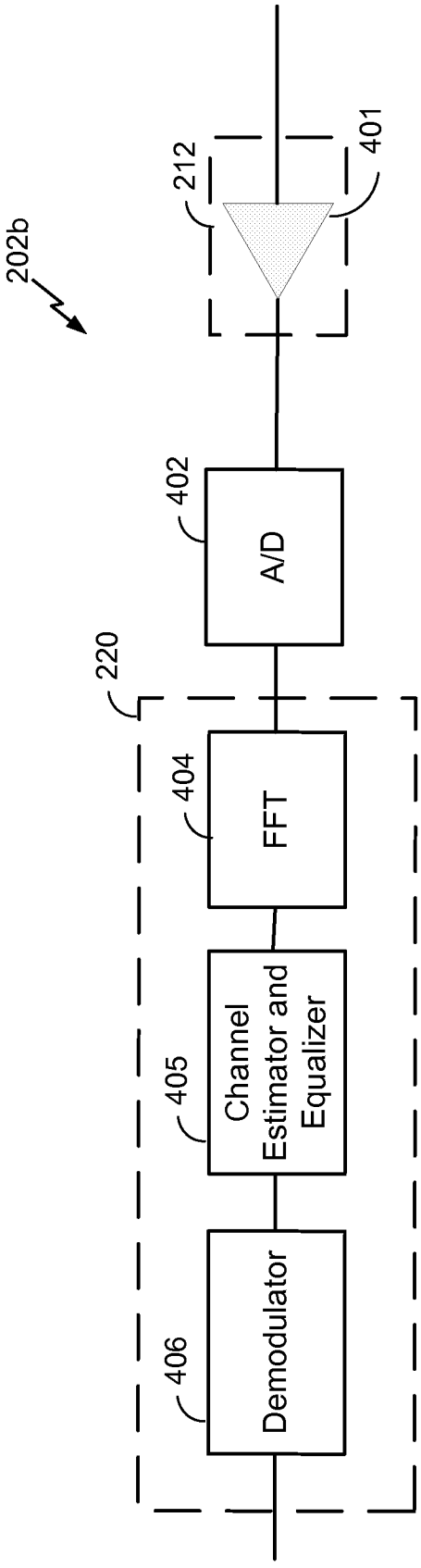
202b
212
401
402
A/D
220
404
FFT
405
Channel Estimator and Equalizer
406
Demodulator

FIG. 4

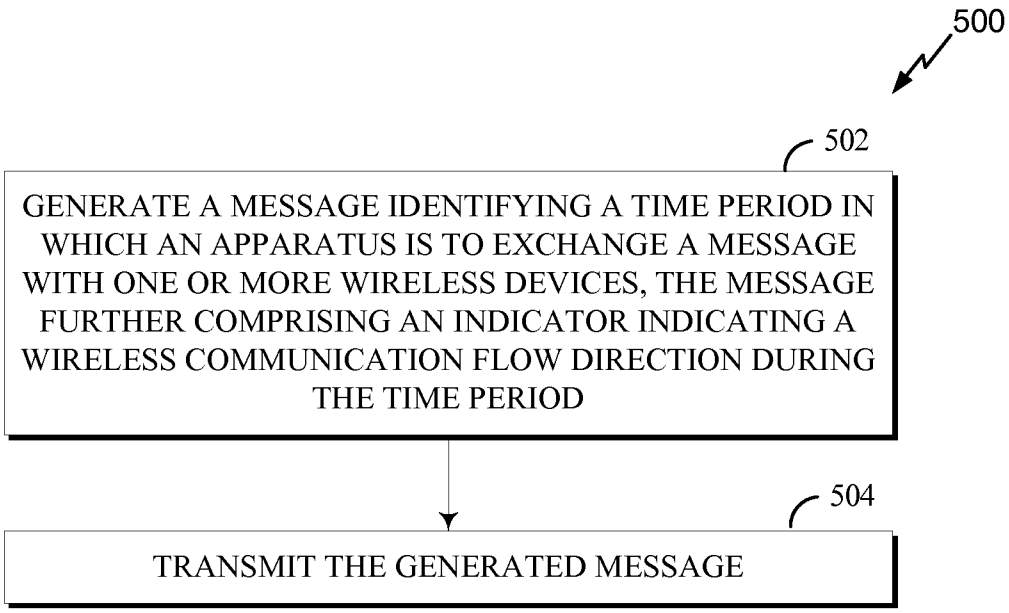
500
502
GENERATE A MESSAGE IDENTIFYING A TIME PERIOD IN WHICH AN APPARATUS IS TO EXCHANGE A MESSAGE WITH ONE OR MORE WIRELESS DEVICES, THE MESSAGE FURTHER COMPRISING AN INDICATOR INDICATING A WIRELESS COMMUNICATION FLOW DIRECTION DURING THE TIME PERIOD
504
TRANSMIT THE GENERATED MESSAGE

FIG. 5

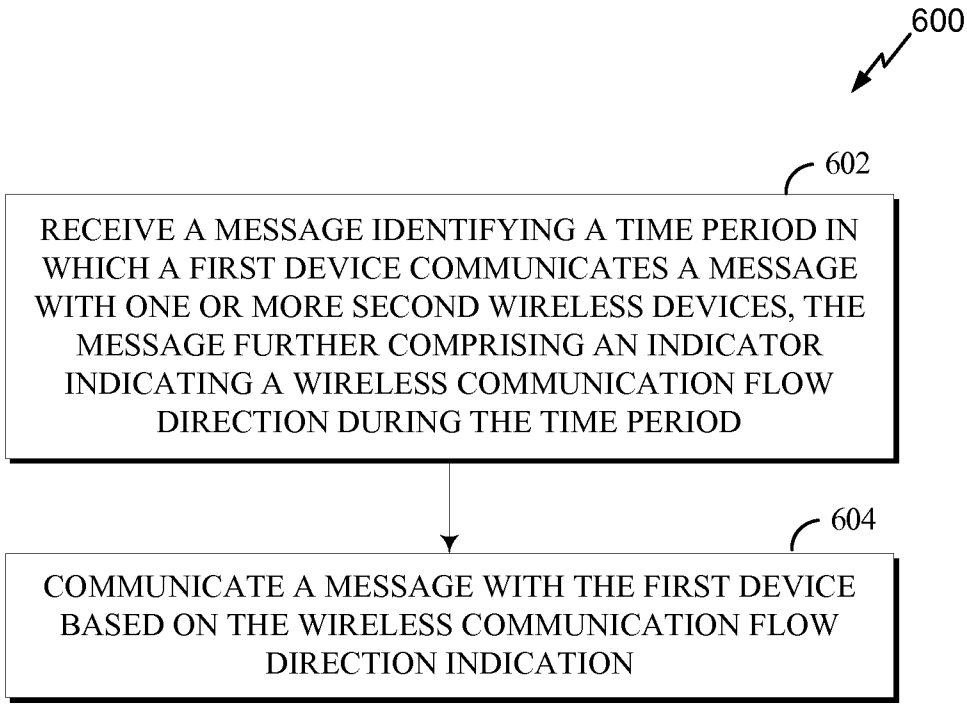
600
602
RECEIVE A MESSAGE IDENTIFYING A TIME PERIOD IN WHICH A FIRST DEVICE COMMUNICATES A MESSAGE WITH ONE OR MORE SECOND WIRELESS DEVICES, THE MESSAGE FURTHER COMPRISING AN INDICATOR INDICATING A WIRELESS COMMUNICATION FLOW DIRECTION DURING THE TIME PERIOD
604
COMMUNICATE A MESSAGE WITH THE FIRST DEVICE BASED ON THE WIRELESS COMMUNICATION FLOW DIRECTION INDICATION

FIG. 6

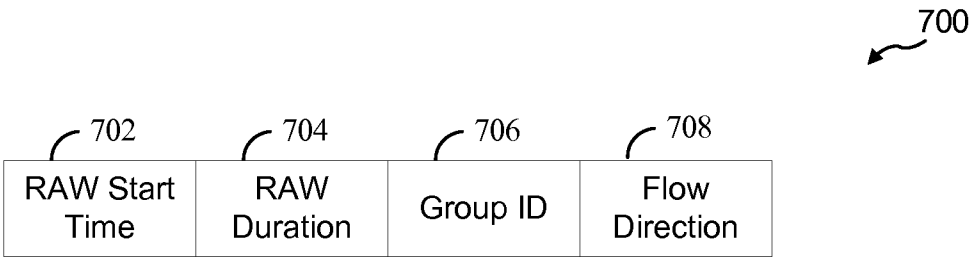
700
702
704
706
708
RAW Start Time
RAW Duration
Group ID
Flow Direction

FIG. 7

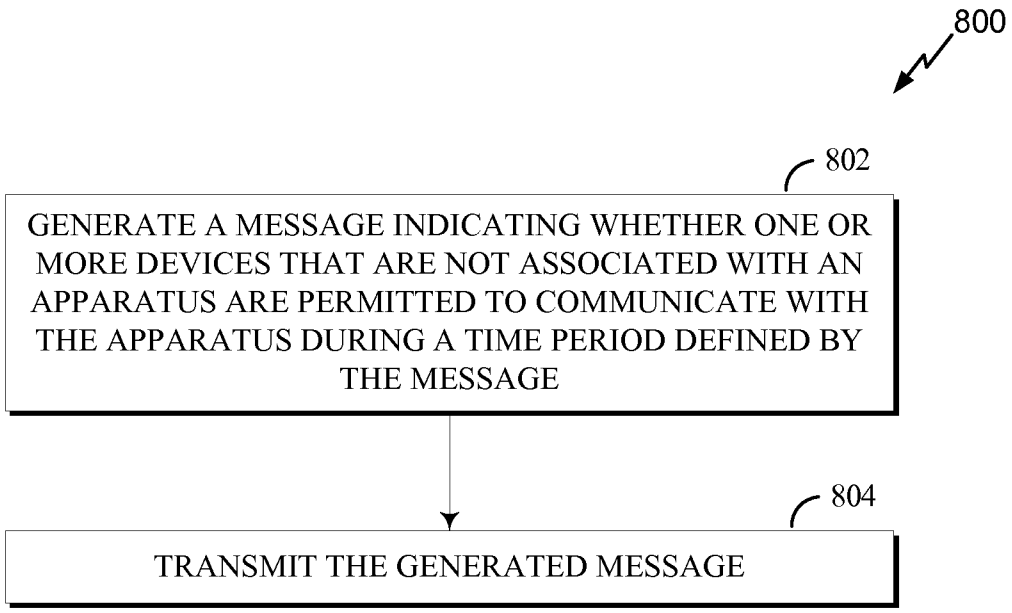
800
802
GENERATE A MESSAGE INDICATING WHETHER ONE OR MORE DEVICES THAT ARE NOT ASSOCIATED WITH AN APPARATUS ARE PERMITTED TO COMMUNICATE WITH THE APPARATUS DURING A TIME PERIOD DEFINED BY THE MESSAGE
804
TRANSMIT THE GENERATED MESSAGE

FIG. 8

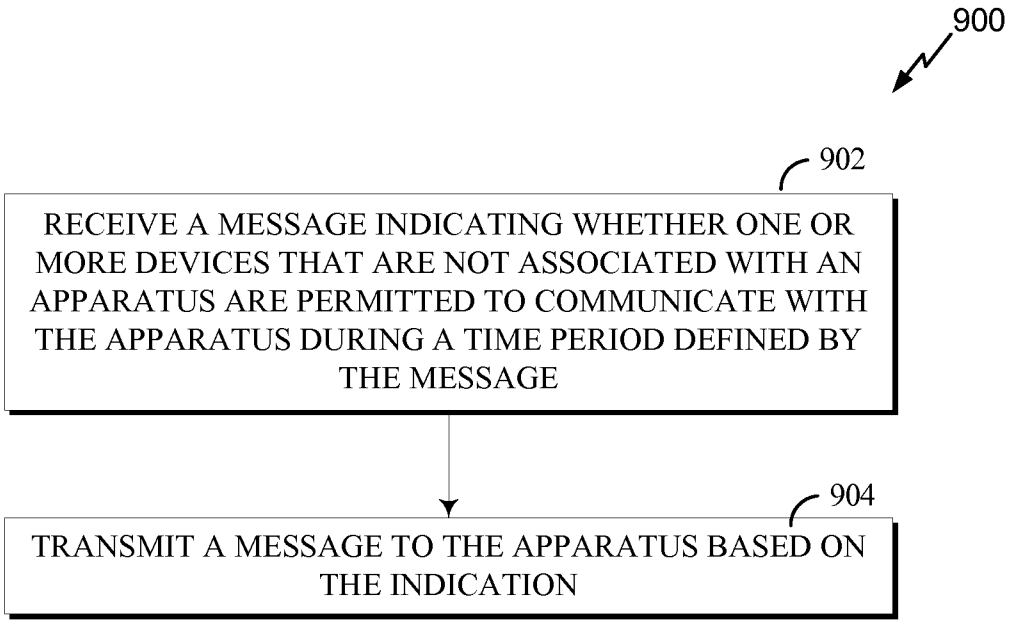
900
902
RECEIVE A MESSAGE INDICATING WHETHER ONE OR MORE DEVICES THAT ARE NOT ASSOCIATED WITH AN APPARATUS ARE PERMITTED TO COMMUNICATE WITH THE APPARATUS DURING A TIME PERIOD DEFINED BY THE MESSAGE
904
TRANSMIT A MESSAGE TO THE APPARATUS BASED ON THE INDICATION

FIG. 9

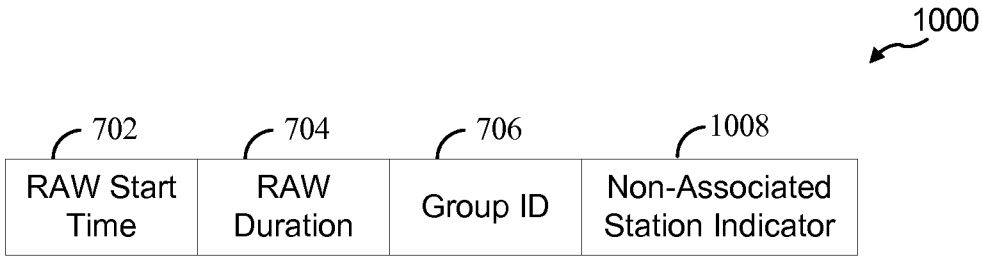
1000
702
704
706
1008
RAW Start Time
RAW Duration
Group ID
Non-Associated Station Indicator

FIG. 10

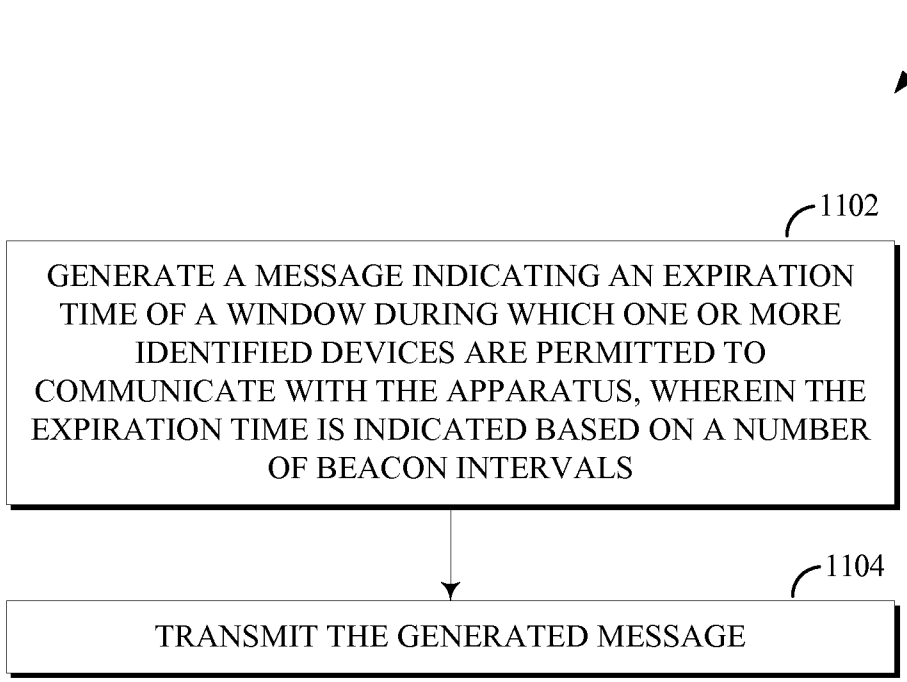
1100
1102
GENERATE A MESSAGE INDICATING AN EXPIRATION TIME OF A WINDOW DURING WHICH ONE OR MORE IDENTIFIED DEVICES ARE PERMITTED TO COMMUNICATE WITH THE APPARATUS, WHEREIN THE EXPIRATION TIME IS INDICATED BASED ON A NUMBER OF BEACON INTERVALS
1104
TRANSMIT THE GENERATED MESSAGE

FIG. 11

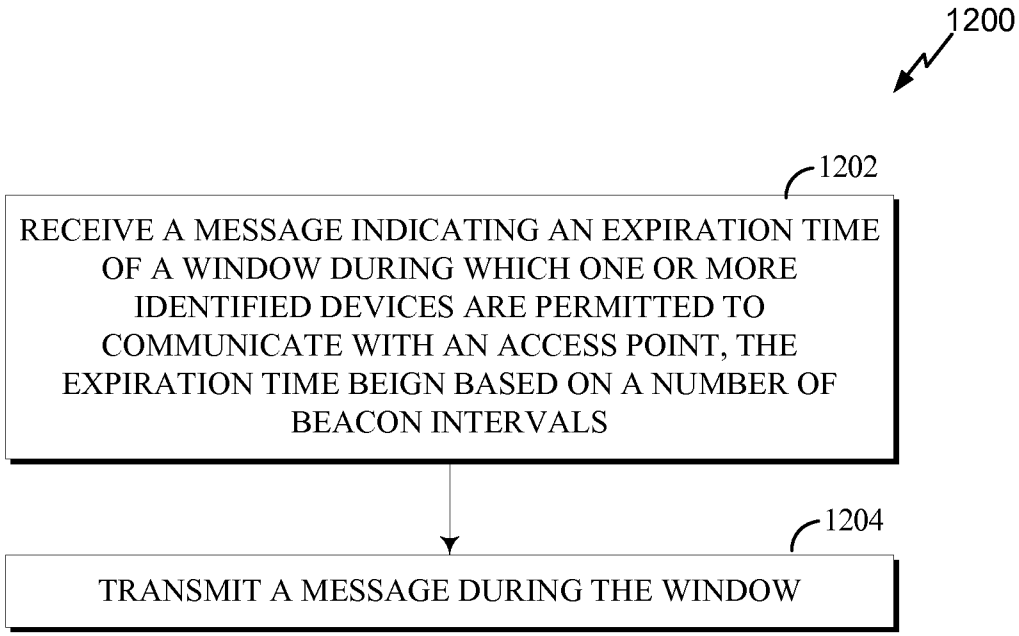
1200
1202
RECEIVE A MESSAGE INDICATING AN EXPIRATION TIME OF A WINDOW DURING WHICH ONE OR MORE IDENTIFIED DEVICES ARE PERMITTED TO COMMUNICATE WITH AN ACCESS POINT, THE EXPIRATION TIME BEIGN BASED ON A NUMBER OF BEACON INTERVALS
1204
TRANSMIT A MESSAGE DURING THE WINDOW

FIG. 12

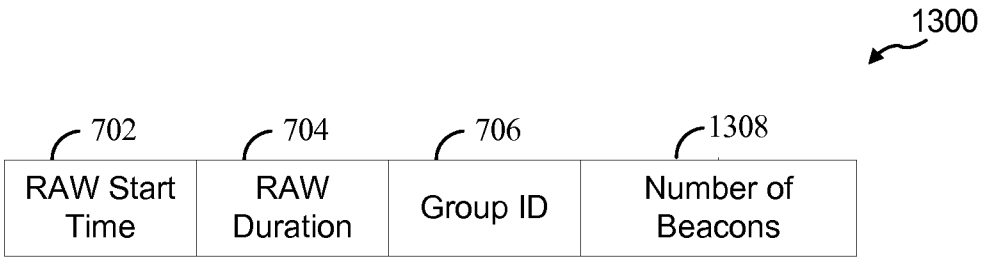
1300
702
704
706
1308
RAW Start Time
RAW Duration
Group ID
Number of Beacons

FIG. 13

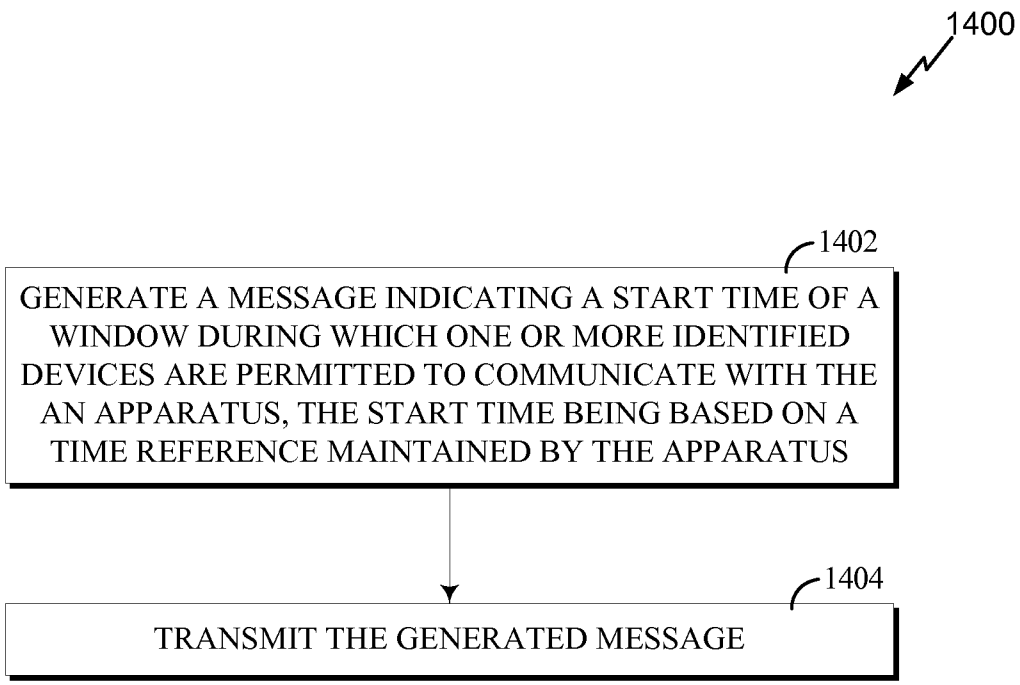
1400
1402
GENERATE A MESSAGE INDICATING A START TIME OF A WINDOW DURING WHICH ONE OR MORE IDENTIFIED DEVICES ARE PERMITTED TO COMMUNICATE WITH THE AN APPARATUS, THE START TIME BEING BASED ON A TIME REFERENCE MAINTAINED BY THE APPARATUS
1404
TRANSMIT THE GENERATED MESSAGE

FIG. 14

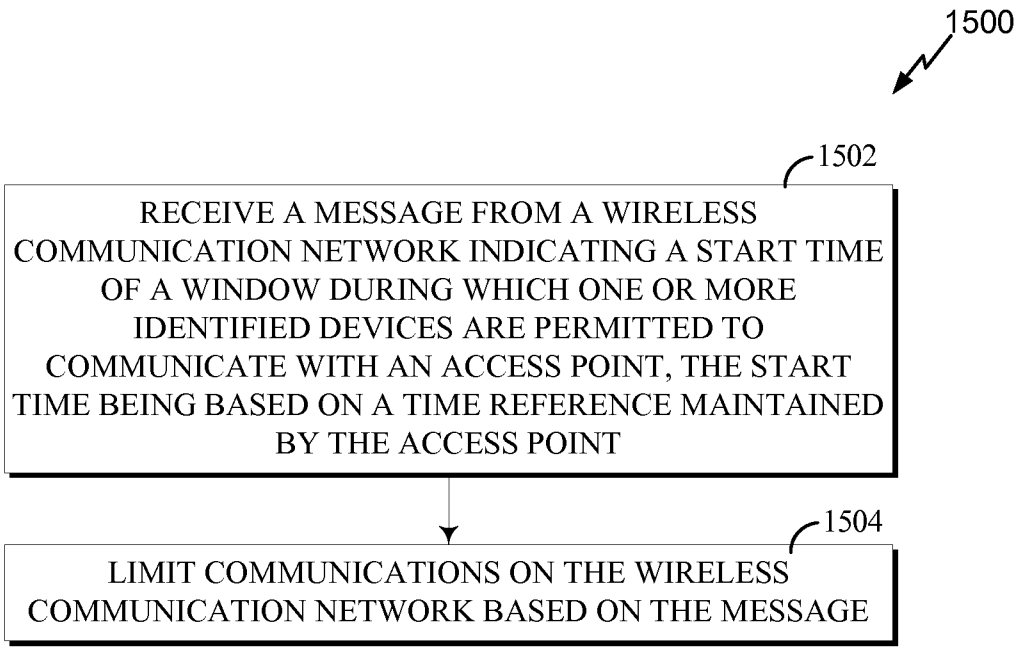
1500
1502
RECEIVE A MESSAGE FROM A WIRELESS COMMUNICATION NETWORK INDICATING A START TIME OF A WINDOW DURING WHICH ONE OR MORE IDENTIFIED DEVICES ARE PERMITTED TO COMMUNICATE WITH AN ACCESS POINT, THE START TIME BEING BASED ON A TIME REFERENCE MAINTAINED BY THE ACCESS POINT
1504
LIMIT COMMUNICATIONS ON THE WIRELESS COMMUNICATION NETWORK BASED ON THE MESSAGE

FIG. 15

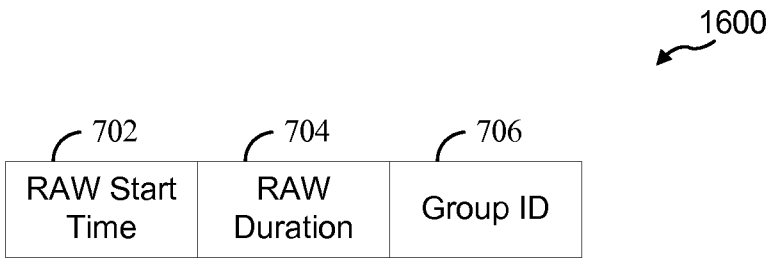

FIG. 16

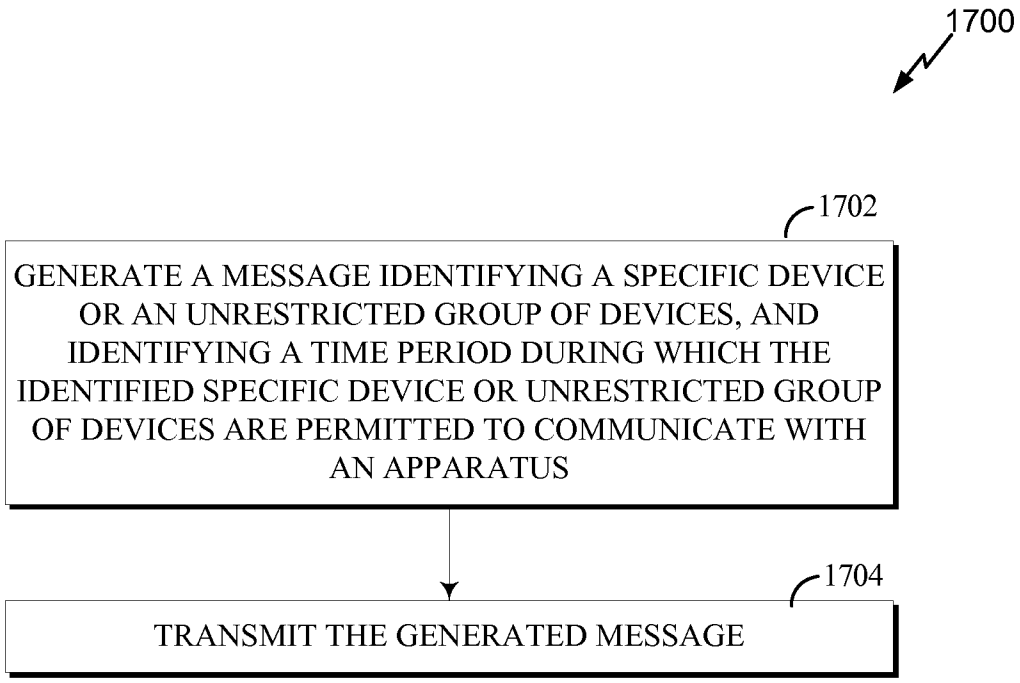
1700
1702
GENERATE A MESSAGE IDENTIFYING A SPECIFIC DEVICE OR AN UNRESTRICTED GROUP OF DEVICES, AND IDENTIFYING A TIME PERIOD DURING WHICH THE IDENTIFIED SPECIFIC DEVICE OR UNRESTRICTED GROUP OF DEVICES ARE PERMITTED TO COMMUNICATE WITH AN APPARATUS
1704
TRANSMIT THE GENERATED MESSAGE

FIG. 17

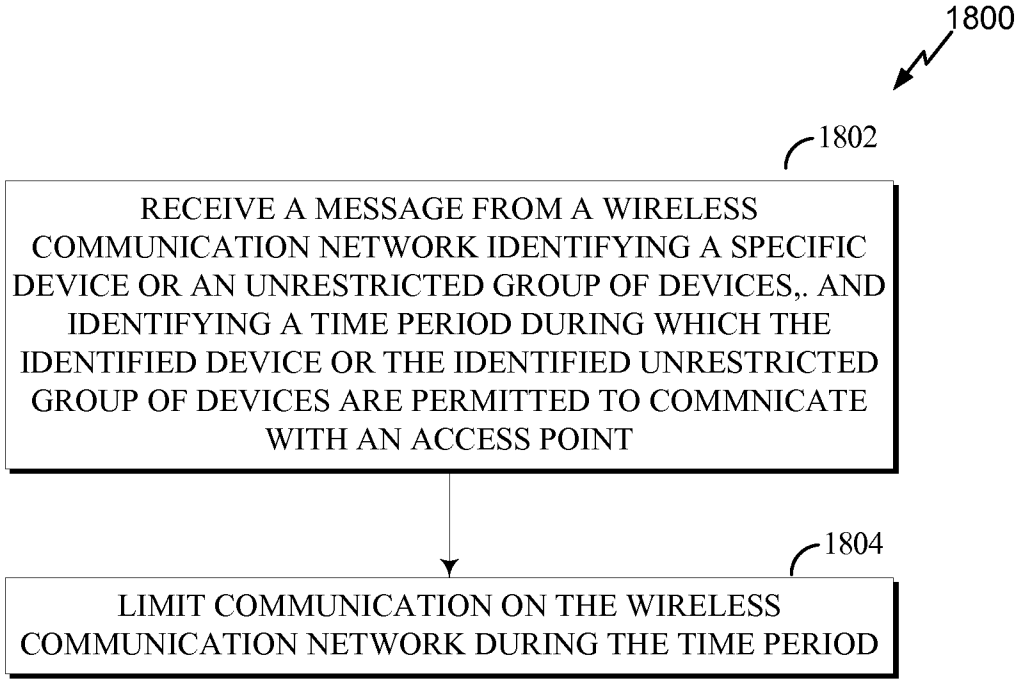
1800
1802
RECEIVE A MESSAGE FROM A WIRELESS COMMUNICATION NETWORK IDENTIFYING A SPECIFIC DEVICE OR AN UNRESTRICTED GROUP OF DEVICES,. AND IDENTIFYING A TIME PERIOD DURING WHICH THE IDENTIFIED DEVICE OR THE IDENTIFIED UNRESTRICTED GROUP OF DEVICES ARE PERMITTED TO COMMNICATE WITH AN ACCESS POINT
1804
LIMIT COMMUNICATION ON THE WIRELESS COMMUNICATION NETWORK DURING THE TIME PERIOD

FIG. 18

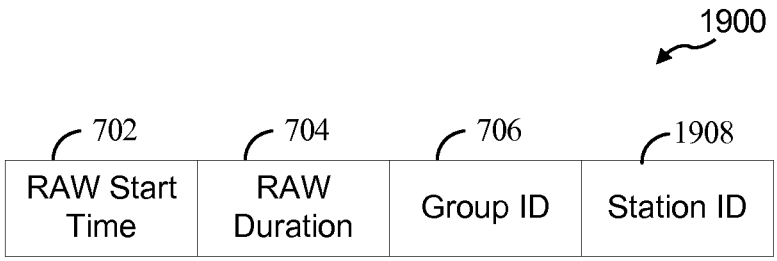
1900
702
704
706
1908
RAW Start Time
RAW Duration
Group ID
Station ID

FIG. 19

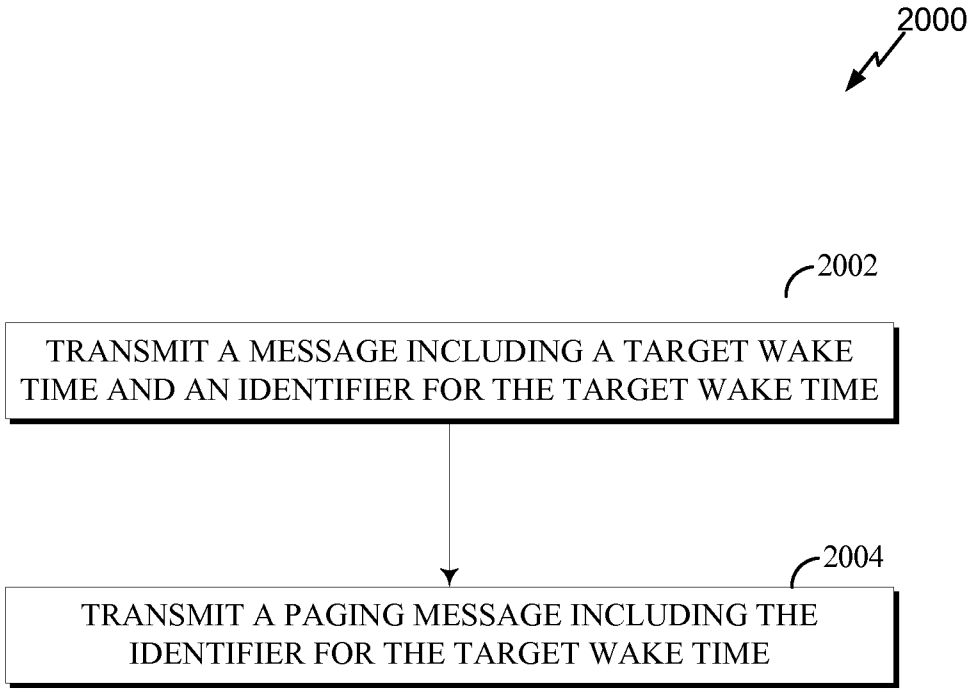
2000
2002
TRANSMIT A MESSAGE INCLUDING A TARGET WAKE TIME AND AN IDENTIFIER FOR THE TARGET WAKE TIME
2004
TRANSMIT A PAGING MESSAGE INCLUDING THE IDENTIFIER FOR THE TARGET WAKE TIME

FIG. 20

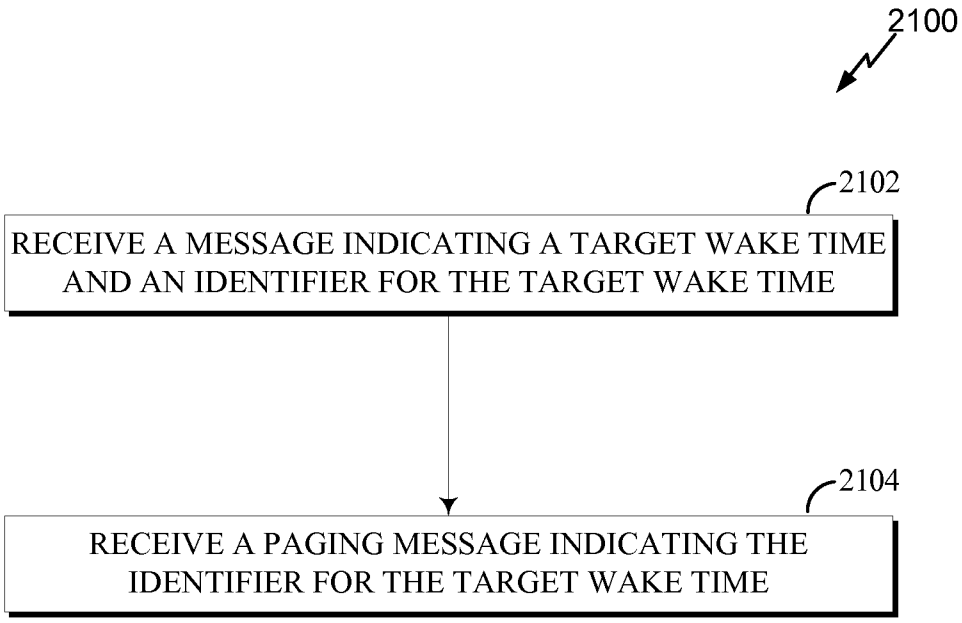
2100
2102
RECEIVE A MESSAGE INDICATING A TARGET WAKE TIME AND AN IDENTIFIER FOR THE TARGET WAKE TIME
2104
RECEIVE A PAGING MESSAGE INDICATING THE IDENTIFIER FOR THE TARGET WAKE TIME

FIG. 21

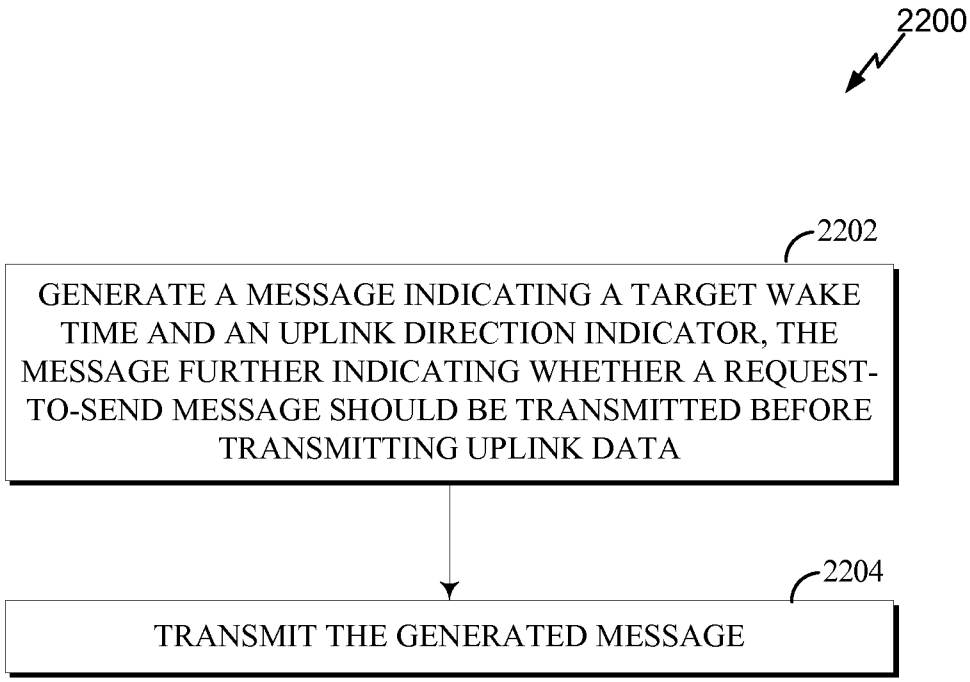
2200
2202
GENERATE A MESSAGE INDICATING A TARGET WAKE TIME AND AN UPLINK DIRECTION INDICATOR, THE MESSAGE FURTHER INDICATING WHETHER A REQUEST-TO-SEND MESSAGE SHOULD BE TRANSMITTED BEFORE TRANSMITTING UPLINK DATA
2204
TRANSMIT THE GENERATED MESSAGE

FIG. 22

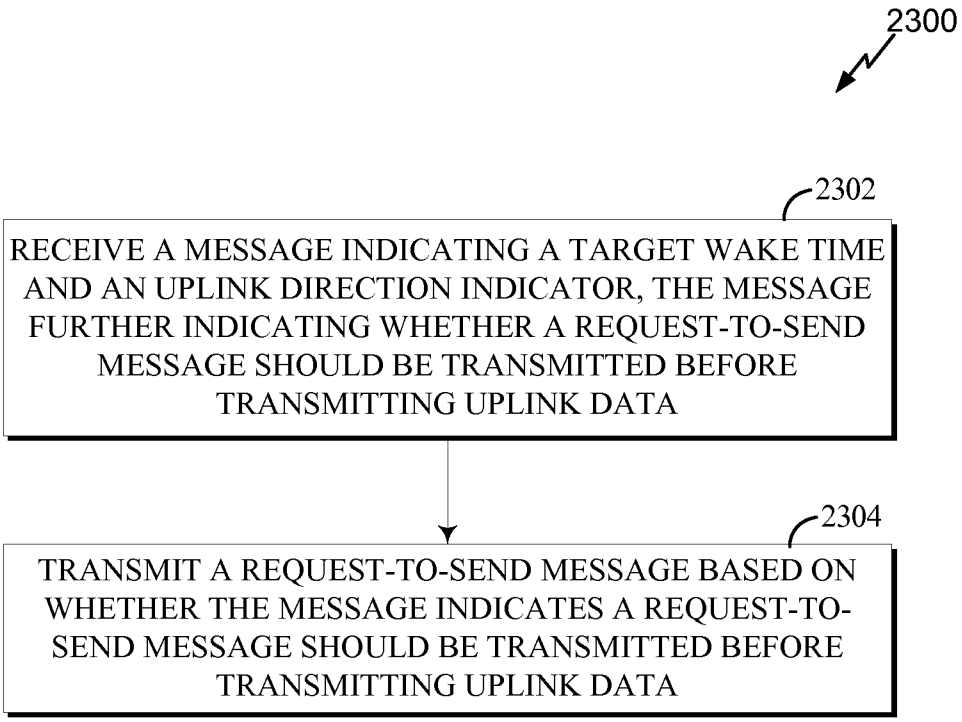
2300
2302
RECEIVE A MESSAGE INDICATING A TARGET WAKE TIME AND AN UPLINK DIRECTION INDICATOR, THE MESSAGE FURTHER INDICATING WHETHER A REQUEST-TO-SEND MESSAGE SHOULD BE TRANSMITTED BEFORE TRANSMITTING UPLINK DATA
2304
TRANSMIT A REQUEST-TO-SEND MESSAGE BASED ON WHETHER THE MESSAGE INDICATES A REQUEST-TO-SEND MESSAGE SHOULD BE TRANSMITTED BEFORE TRANSMITTING UPLINK DATA

FIG. 23

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2013/074413

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04W48/08
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04W

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2012/139075 A1 (QUALCOMM INC [US]; DHANDA MUNGAL SINGH [GB]; CHILDREN PHILIP J [GB]; J) 11 October 2012 (2012-10-11) paragraphs [0005], [0008] paragraphs [0011] - [0015], [0058] paragraphs [0098], [0126], [0127] paragraphs [0138], [0175], [0209] abstract; claims 1,4,6-7 -----	1-28
A	Ghosh Chittabrata: "Restricted access window signaling for uplink channel acces", , 1 July 2012 (2012-07-01), pages 1-13, XP055049761, Retrieved from the Internet: URL:https://mentor.ieee.org [retrieved on 2013-01-15] the whole document -----	1-28

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 May 2014	03/06/2014

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Coppieters, Stefaan

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2013/074413

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2012139075 A1	11-10-2012	CN 103563411 A	05-02-2014
		EP 2695407 A1	12-02-2014
		KR 20140009476 A	22-01-2014
		US 2013095863 A1	18-04-2013
		WO 2012139075 A1	11-10-2012

(19)中华人民共和国国家知识产权局

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代理人 亓云
(51)Int.Cl.
H04W 48/08(2006.01)

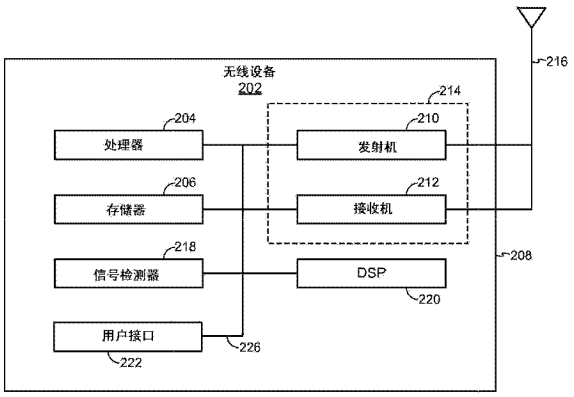
权利要求书2页 说明书35页 附图13页

(54)发明名称

用于无线网络上的改进的通信的系统和方法

(57)摘要

公开了用于无线通信的系统和方法。在一个方面，接入点包括：处理器，其被配置成生成标识期间该装置将与一个或多个无线设备进行数据通信的时间段的消息，该消息进一步包括指示在该时间段期间的无线通信流方向的指示符。该接入点进一步包括发射机，其被配置成传送所生成的消息。



CN 104854914 A

1. 一种用于无线通信的方法，包括：

由一装置生成标识期间所述装置将与一个或多个无线设备进行数据通信的时间段的受限接入窗 (RAW) 消息，所述消息进一步包括指示在所述时间段期间的无线通信流方向的指示符；以及

由所述装置传送所生成的消息。

2. 如权利要求 1 所述的方法，其特征在于，所述指示符指示在所述时间段期间通信的所述数据是上行链路数据还是下行链路数据。

3. 如权利要求 1 所述的方法，其特征在于，所述指示符指示在所述时间段期间通信的所述数据是上行链路数据、下行链路数据、还是双向数据。

4. 如权利要求 1 所述的方法，其特征在于，进一步包括生成所述受限接入窗消息以包括优先级指示符，所述优先级指示符指示在所述时间段期间通信的上行链路数据与下行链路数据之间的优先级。

5. 如权利要求 1 所述的方法，其特征在于，所述无线通信流方向指示符具有一位或两位的位长度。

6. 如权利要求 1 所述的方法，其特征在于，所述时间段标识目标苏醒时间 (TWT)。

7. 如权利要求 1 所述的方法，其特征在于，进一步包括生成所述受限接入窗 (RAW) 消息以包括开始时间指示符和历时指示符，其中所述开始时间指示符指示所述 RAW 的开始时间而所述历时指示符指示所述 RAW 的历时。

8. 一种用于无线通信的装置，包括：

处理系统，其被配置成生成受限接入窗 (RAW) 消息，所述消息标识期间所述装置将与一个或多个无线设备进行数据通信的时间段，所述消息进一步被生成为包括指示在所述时间段期间的无线通信流方向的指示符；以及

发射机，其被配置成传送所生成的消息。

9. 如权利要求 8 所述的装置，其特征在于，所述指示符指示在所述时间段期间通信的数据是上行链路数据还是下行链路数据。

10. 如权利要求 8 所述的装置，其特征在于，所述指示符指示在所述时间段期间通信的数据是上行链路数据、下行链路数据、还是双向数据。

11. 如权利要求 8 所述的装置，其特征在于，所述处理系统被进一步配置成生成所述受限接入窗消息以包括优先级指示符，所述优先级指示符指示在所述时间段期间通信的上行链路数据和下行链路数据的优先级。

12. 如权利要求 8 所述的装置，其特征在于，所述无线通信流方向指示符具有一位或两位的位长度。

13. 如权利要求 8 所述的装置，其特征在于，所述时间段标识目标苏醒时间 (TWT)。

14. 如权利要求 8 所述的装置，其特征在于，所述处理系统被进一步配置成生成所述受限接入窗 (RAW) 消息以包括开始时间指示符和历时指示符，其中所述开始时间指示符指示所述 RAW 的开始时间而所述历时指示符指示所述 RAW 的历时。

15. 一种无线通信的方法，包括：

由一装置接收标识期间第一设备与一个或多个第二设备进行数据通信的时间段的受限接入窗 (RAW) 消息，所述消息进一步包括指示无线通信流方向的指示符；以及

基于所述无线通信流方向指示符而由所述装置与所述第一设备进行数据通信。

16. 如权利要求 15 所述的方法，其特征在于，进一步包括解码所述受限接入窗 (RAW) 消息以确定所通信的数据是上行链路数据还是下行链路数据。

17. 如权利要求 15 所述的方法，其特征在于，进一步包括解码所述受限接入窗 (RAW) 消息以确定所通信的数据是上行链路数据、下行链路数据还是双向数据。

18. 如权利要求 15 所述的方法，其特征在于，进一步包括解码所述受限接入窗 (RAW) 消息以确定在所述时间段期间通信的上行链路数据和下行链路数据的优先级。

19. 如权利要求 15 所述的方法，其特征在于，进一步包括基于所接收到的 RAW 消息的一位或两位来解码所述无线通信流方向指示符。

20. 如权利要求 15 所述的方法，其特征在于，所述时间段标识目标苏醒时间 (TWT)。

21. 如权利要求 15 所述的方法，其特征在于，进一步包括基于所述受限接入窗消息来解码所述 RAW 的开始时间和所述 RAW 的历时。

22. 一种用于无线通信的装置，包括 ：

处理系统，其被配置成接收受限接入窗 (RAW) 消息，所述消息标识期间第一设备与一个或多个第二设备进行数据通信的时间段，所述消息进一步包括指示在所述时间段期间的无线通信流方向的指示符，以及

其中所述处理系统被进一步配置成基于所述无线通信流方向指示符与所述第一设备进行数据通信。

23. 如权利要求 22 所述的装置，其特征在于，所述处理系统被进一步配置成解码所述受限接入窗消息以确定所通信的数据是上行链路数据还是下行链路数据。

24. 如权利要求 22 所述的装置，其特征在于，所述处理系统被进一步配置成解码所述受限接入窗消息以确定所通信的数据是上行链路数据、下行链路数据还是双向数据。

25. 如权利要求 22 所述的装置，其特征在于，所述处理系统被进一步配置成解码所述受限接入窗消息以确定在所述时间段期间通信的上行链路数据和下行链路数据的优先级。

26. 如权利要求 22 所述的装置，其特征在于，所述处理系统被进一步配置成基于所接收到的消息的一位或两位来解码所述无线通信流方向指示符。

27. 如权利要求 22 所述的装置，其特征在于，所述时间段标识目标苏醒时间 (TWT)。

28. 如权利要求 22 所述的装置，其特征在于，所述处理系统被进一步配置成基于所述受限接入窗消息来解码所述 RAW 的开始时间和所述 RAW 的历时。

用于无线网络上的改进的通信的系统和方法

[0001] 背景

[0002] 领域

[0003] 本申请一般涉及无线通信，尤其涉及用于使用受限接入窗来节约功率的系统、方法和设备。

背景技术

[0004] 在许多电信系统中，通信网络被用于在若干个空间上分开的交互设备之间交换消息。网络可根据地理范围来分类，该地理范围可以例如是城市区域、局部区域、或者个人区域。此类网络将分别被命名为广域网 (WAN)、城域网 (MAN)、局域网 (LAN)、或个域网 (PAN)。网络还根据用于互连各种网络节点和设备的交换 / 路由技术（例如，电路交换 - 分组交换）、用于传输的物理介质的类型（例如，有线 - 无线）、和所使用的通信协议集（例如，网际协议集、SONET（同步光学联网）、以太网等）而有所不同。

[0005] 当网络元件是移动的并由此具有动态连通性需求时，或者在网络架构以自组织 (ad hoc) 拓扑结构而非固定拓扑结构来形成的情况下，无线网络往往是优选的。无线网络使用无线电、微波、红外、光等频带中的电磁波以非制导传播模式来采用无形的物理介质。在与固定的有线网络相比较时，无线网络有利地促成用户移动性和快速的现场部署。

[0006] 无线网络中的设备可在彼此之间传送 / 接收信息。该信息可包括分组，其在一些方面可被称为数据单元。各分组可包括帮助通过网络来路由分组、标识分组中的数据、处理分组等的开销信息（例如，报头信息、分组性质等），以及可能在分组的有效载荷中携带的数据（例如，用户数据、多媒体内容等）。

[0007] 概述

[0008] 所附权利要求的范围内的系统、方法和设备的各种实现各自具有若干方面，不是仅靠其中任何单一方面来得到本文中所描述的合意属性。本文中描述一些突出特征，但其并不限定所附权利要求的范围。在考虑此讨论后，并且尤其是在阅读题为“详细描述”的章节之后，将理解各种实现的特征是如何允许接入点的休眠时间的。

[0009] 本公开的一方面提供了一种无线通信的方法。该方法包括由一装置生成消息，该消息标识期间该装置将与一个或多个无线设备进行数据通信的时间段，该消息进一步包括指示在该时间段期间的无线通信流方向的指示符；以及由一装置传送所生成的消息。

[0010] 所公开的另一方面是一种装置。该装置包括：处理系统，其被配置成生成消息，该消息标识期间该装置将与一个或多个无线设备进行数据通信的时间段，该消息进一步包括指示在该时间段期间的无线通信流方向的指示符；以及发射机，其被配置成传送所生成的消息。

[0011] 所公开的另一方面是一种接入点。该接入点包括：天线；处理系统，其被配置成生成消息，该消息标识期间该接入点将与一个或多个无线设备进行数据通信的时间段，该消息进一步包括指示在该时间段期间的无线通信流方向的指示符；以及发射机，其被配置成使用该天线来传送所生成的消息。

[0012] 所公开的另一方面是一种设备。该设备包括：用于生成消息的装置，该消息标识期间该设备将与一个或多个无线设备进行数据通信的时间段，该消息进一步包括指示在该时间段期间的无线通信流方向的指示符；以及用于传送所生成的消息的装置。

[0013] 所公开的另一方面是一种计算机程序产品。该计算机程序产品包括其上编码有指令的计算机可读存储设备，这些指令在被执行时使一装置执行一种无线通信的方法，所述方法包括：生成消息，该消息标识期间该装置将与一个或多个无线设备进行数据通信的时间段，该消息进一步包括指示在该时间段期间的无线通信流方向的指示符；以及传送所生成的消息。

[0014] 本公开的另一方面提供了一种无线通信的方法。该无线通信的方法包括由一装置接收消息，该消息标识期间第一设备与一个或多个第二设备进行数据通信的时间段，该消息进一步包括指示在该时间段期间的无线通信流方向的指示符；以及基于该无线通信流方向指示符由一装置与第一设备进行数据通信。

[0015] 所公开的另一方面是一种装置。该装置包括：接收机，其被配置成接收消息，该消息标识期间第一设备与一个或多个第二设备进行数据通信的时间段，该消息进一步包括指示在该时间段期间的无线通信流方向的指示符；以及处理系统，其被配置成基于该无线通信流方向指示符与第一设备进行数据通信。

[0016] 所公开的另一方面是一种站。该站包括：天线；接收机，其被配置成使用该天线来接收消息，该消息标识期间第一设备与一个或多个第二设备进行数据通信的时间段，该消息进一步包括指示在该时间段期间的无线通信流方向的指示符；以及处理系统，其被配置成基于该无线通信流方向指示符与第一设备进行数据通信。

[0017] 所公开的另一方面是一种设备。该设备包括：用于接收消息的装置，该消息标识期间第一设备与一个或多个第二设备进行数据通信的时间段，该消息进一步包括指示在该时间段期间的无线通信流方向的指示符；以及用于基于该无线通信流方向指示符与第一设备进行数据通信的装置。

[0018] 所公开的另一方面是一种计算机程序产品。该计算机程序产品包括其上编码有指令的计算机可读存储设备，这些指令在被执行时使一装置执行一种无线通信的方法，所述方法包括：接收消息，该消息标识期间第一设备与一个或多个第二设备进行数据通信的时间段，该消息进一步包括指示在该时间段期间的无线通信流方向的指示符；以及基于该无线通信流方向指示符与第一设备进行数据通信。

[0019] 本公开的另一方面提供了一种无线通信的方法。该无线通信的方法包括：由一装置生成消息，该消息包括指示不与一装置相关联的一个或多个设备是否被允许在由该消息定义的时间段期间与该装置通信的指示符；以及由一装置传送所生成的消息。

[0020] 所公开的另一方面是一种装置。该装置包括：处理系统，其被配置成生成消息，该消息指示不与该装置相关联的一个或多个设备是否被允许在由该消息定义的时间段期间与该装置通信；以及发射机，其被配置成传送所生成的消息。

[0021] 所公开的另一方面是一种接入点。该接入点包括：天线；处理系统，其被配置成生成消息，该消息指示不与该接入点相关联的一个或多个设备是否被允许在由该消息定义的时间段期间与该接入点通信；以及发射机，其被配置成使用该天线来传送所生成的消息。

[0022] 所公开的另一方面是一种设备。该设备包括：用于生成消息的装置，该消息指示不

与该设备相关联的一个或多个设备是否被允许在由该消息定义的时间段期间与该设备通信；以及用于传送所生成的消息的装置。

[0023] 所公开的另一方面是一种计算机程序产品。该计算机程序产品包括其上编码有指令的计算机可读存储设备，这些指令在被执行时使一装置执行一种无线通信的方法，所述方法包括：生成消息，该消息指示不与一装置相关联的一个或多个设备是否被允许在由该消息定义的时间段期间与该装置通信；以及传送所生成的消息。

[0024] 本公开的另一方面提供了一种无线通信的方法。该方法包括：由一装备接收消息，该消息指示不与一装置相关联的设备是否被允许在由该消息定义的时间段期间与该装置通信；以及基于该指示由一装备选择性地向该装置传送消息。

[0025] 所公开的另一方面是一种装置。该装置包括：接收机，其被配置成接收消息，该消息指示不与第二装置相关联的设备是否被允许在由该消息定义的时间段期间与第二装置通信；以及发射机，其被配置成基于该指示来选择性地向第二装置传送消息。

[0026] 所公开的另一方面是一种站。该站包括：天线；接收机，其被配置成使用该天线来接收消息，该消息指示不与一装置相关联的设备是否被允许在由该消息定义的时间段期间与该装置通信；以及发射机，其被配置成基于该指示来选择性地向该装置传送消息。

[0027] 所公开的另一方面是一种设备。该设备包括：用于接收消息的装置，该消息指示不与第二设备相关联的设备是否被允许在由该消息定义的时间段期间与第二设备通信；以及用于基于该指示来选择性地向第二设备传送消息的装置。

[0028] 所公开的另一方面是一种计算机程序产品。该计算机程序产品包括其上编码有指令的计算机可读存储设备，这些指令在被执行时使一装置执行一种无线通信的方法，所述方法包括：接收消息，该消息指示不与一装置相关联的设备是否被允许在由该消息定义的时间段期间与该装置通信；以及基于该指示来选择性地向该装置传送消息。

[0029] 本公开的另一方面提供了一种无线通信的方法。该方法包括：由一装置生成消息，该消息指示期间一个或多个所标识的设备被允许与一装置通信的窗口的期满时间，其中该期满时间是基于信标区间数量来指示的；以及由一装置传送所生成的消息。

[0030] 所公开的另一方面是一种装置。该装置包括：处理系统，其被配置成生成消息，该消息指示期间一个或多个所标识的设备被允许与该装置通信的窗口的期满时间，其中该期满时间是基于信标区间数量来指示的；以及发射机，其被配置成传送所生成的消息。

[0031] 所公开的另一方面是一种接入点。该接入点包括：天线；处理系统，其被配置成生成消息，该消息指示期间一个或多个所标识的设备被允许与该接入点通信的窗口的期满时间，其中该期满时间是基于信标区间数量来指示的；以及发射机，其被配置成使用该天线来传送所生成的消息。

[0032] 所公开的另一方面是一种设备。该设备包括：用于生成消息的装置，该消息指示一个或多个所标识的设备被允许与该设备通信的窗口的期满时间，其中该期满时间是基于信标区间数量来指示的；以及用于传送所生成的消息的装置。

[0033] 所公开的另一方面是一种计算机程序产品。该计算机程序产品包括其上编码有指令的计算机可读存储设备，这些指令在被执行时使一装置执行一种无线通信的方法，所述方法包括：生成消息，该消息指示期间一个或多个所标识的设备被允许与该装置通信的窗口的期满时间，其中该期满时间是基于信标区间数量来指示的；以及传送所生成的消息。

[0034] 本公开的另一方面提供了一种无线通信的方法。该方法包括：由一装置接收消息，该消息指示期间一个或多个所标识的设备被允许与接入点通信的窗口的期满时间，该期满时间基于信标区间数量；以及由一装置在该窗口期间传送消息。

[0035] 所公开的另一方面是一种装置。该装置包括：接收机，其被配置成接收消息，该消息指示期间一个或多个所标识的设备被允许与接入点通信的窗口的期满时间，该期满时间基于信标区间数量；以及发射机，其被配置成在该窗口期间传送消息。

[0036] 所公开的另一方面是一种接入点。该接入点包括：天线；接收机，其被配置成用该天线来接收消息，该消息指示期间一个或多个所标识的设备被允许与接入点通信的窗口的期满时间，该期满时间基于信标区间数量；以及发射机，其被配置成使用该天线在该窗口期间传送消息。

[0037] 所公开的另一方面是一种计算机程序产品。该计算机程序产品包括其上编码有指令的计算机可读存储设备，这些指令在被执行时使一装置执行一种无线通信的方法，所述方法包括：接收消息，该消息指示期间一个或多个所标识的设备被允许与接入点通信的窗口的期满时间，该期满时间基于信标区间数量；以及在该窗口期间传送消息。

[0038] 本公开的另一方面提供了一种无线通信的方法。该方法包括：由一装置生成消息，该消息指示期间一个或多个所标识的设备被允许与该装置通信的窗口的开始时间，该开始时间基于由该装置维持的时间基准；以及由一装置传送所生成的消息。

[0039] 所公开的另一方面是一种装置。该装置包括：处理装置，其被配置成生成消息，该消息指示期间一个或多个所标识的设备被允许与该装置通信的窗口的开始时间，该开始时间基于由该装置维持的时间基准；以及发射机，其被配置成传送所生成的消息。

[0040] 所公开的另一方面是一种接入点。该接入点包括：天线；处理装置，其被配置成生成消息，该消息指示期间一个或多个所标识的设备被允许与该接入点通信的窗口的开始时间，该开始时间基于由该接入点维持的时间基准；以及发射机，其被配置成用该天线来传送所生成的消息。

[0041] 所公开的另一方面是一种设备。该设备包括：用于生成消息的装置，该消息指示期间一个或多个所标识的设备被允许与该设备通信的窗口的开始时间，该开始时间基于由该设备维持的时间基准；以及用于传送所生成的消息的装置。

[0042] 所公开的另一方面是一种计算机程序产品。该计算机程序产品包括其上编码有指令的计算机可读存储设备，这些指令在被执行时使一装置执行一种无线通信的方法，所述方法包括：生成消息，该消息指示期间一个或多个所标识的设备被允许与一装置通信的窗口的开始时间，该开始时间基于由该装置维持的时间基准；以及传送所生成的消息。

[0043] 本公开的另一方面提供了一种无线通信的方法。该无线通信的方法包括：由一装置从无线通信网络接收消息，该消息指示期间一个或多个所标识的设备被允许与接入点通信的窗口的开始时间，该开始时间基于由该接入点维持的时间基准；以及由一装置基于该消息来限制在该无线通信网络上的通信。

[0044] 所公开的另一方面是一种装置。该装置包括：接收机，其被配置成从无线通信网络接收消息，该消息指示期间一个或多个所标识的设备被允许与接入点通信的窗口的开始时间，该开始时间基于由该接入点维持的时间基准；以及处理系统，其被配置成基于该消息来限制在该无线通信网络上的通信。

[0045] 所公开的另一方面是一种站。该站包括：天线；接收机，其被配置成使用该天线从无线通信网络接收消息，该消息指示期间一个或多个所标识的设备被允许与接入点通信的窗口的开始时间，该开始时间基于由该接入点维持的时间基准；以及处理系统，其被配置成基于该消息来限制在该无线通信网络上的通信。

[0046] 所公开的另一方面是一种设备。该设备包括：用于从无线通信网络接收消息的装置，该消息指示期间一个或多个所标识的设备被允许与接入点通信的窗口的开始时间，该开始时间基于由该接入点维持的时间基准；以及用于基于该消息来限制在该无线通信网络上的通信的装置。

[0047] 所公开的另一方面是一种计算机程序产品。该计算机程序产品包括其上编码有指令的计算机可读存储设备，这些指令在被执行时使一装置执行一种无线通信的方法，所述方法包括：从无线通信网络接收消息，该消息指示期间一个或多个所标识的设备被允许与接入点通信的窗口的开始时间，该开始时间基于由该接入点维持的时间基准；以及基于该消息来限制在该无线通信网络上的通信。

[0048] 所公开的另一方面是一种无线通信的方法。该方法包括：由一装置生成消息，该消息标识特定设备或不受限设备群，并且标识期间所标识的特定设备或不受限设备群被允许与该装置通信的时间段；以及由一装置传送所生成的消息。

[0049] 另一方面公开了一种装置。该装置包括：处理系统，其被配置成生成消息，该消息标识特定设备或不受限设备群，并且标识期间所标识的特定设备或不受限设备群被允许与该装置通信的时间段；以及发射机，其被配置成传送所生成的消息。

[0050] 所公开的另一方面是一种接入点。该接入点包括：天线；处理系统，其被配置成生成消息，该消息标识特定设备或不受限设备群，并且标识期间所标识的特定设备或不受限设备群被允许与该装置通信的时间段；以及发射机，其被配置成使用该天线来传送所生成的消息。

[0051] 所公开的另一方面是一种设备。该设备包括：用于生成消息的装置，该消息标识特定设备或不受限设备群，并且标识期间所标识的特定设备或不受限设备群被允许与该设备通信的时间段；以及用于传送所生成的消息的装置。

[0052] 所公开的另一方面是一种计算机程序产品。该计算机程序产品包括其上编码有指令的计算机可读存储设备，这些指令在被执行时使一装置执行一种无线通信的方法，所述方法包括：生成消息，该消息标识特定设备或不受限设备群，并且标识期间所标识的特定设备或不受限设备群被允许与该装置通信的时间段；以及传送所生成的消息。

[0053] 本公开的另一方面提供了一种无线通信的方法。该方法包括：由一装置从无线通信网络接收消息，该消息标识特定设备或不受限设备群，并且标识期间所标识的设备或所标识的不受限设备群被允许与接入点通信的时间段；以及在该时间段期间由一装置限制在该无线通信网络上的通信。

[0054] 所公开的另一方面是一种装置。该装置包括：接收机，其被配置成从无线通信网络接收消息，该消息标识特定设备或不受限设备群，并且标识期间所标识的设备或所标识的不受限设备群被允许与接入点通信的时间段；以及处理系统，其被配置成在该时间段期间限制在该无线通信网络上的通信。

[0055] 所公开的另一方面是一种站。该站包括：天线；接收机，其被配置成用天线从无线

通信网络接收消息，该消息标识特定设备或不受限设备群，并且标识期间所标识的设备或所标识的不受限设备群被允许与接入点通信的时间段；以及处理系统，其被配置成在该时间段期间限制在该无线通信网络上的通信。

[0056] 所公开的另一方面是一种设备。该设备包括：用于从无线通信网络接收消息的装置，该消息标识特定设备或不受限设备群，并且标识期间所标识的设备或所标识的不受限设备群被允许与接入点通信的时间段；以及用于在该时间段期间限制在该无线通信网络上的通信的装置。

[0057] 所公开的另一方面是一种计算机程序产品。该计算机程序产品包括其上编码有指令的计算机可读存储设备，这些指令在被执行时使一装置执行一种无线通信的方法，所述方法包括：从无线通信网络接收消息，该消息标识特定设备或不受限设备群，并且标识期间所标识的设备或所标识的不受限设备群被允许与接入点通信的时间段；以及在该时间段期间限制在该无线通信网络上的通信。

[0058] 本公开的另一方面提供了一种无线通信的方法。该方法包括由一装置传送消息，该消息包括目标苏醒时间和该目标苏醒时间的标识符；以及由一装置传送包括该目标苏醒时间的标识符的寻呼消息。

[0059] 所公开的另一方面是一种装置。该装置包括：发射机，其被配置成传送消息，该消息包括目标苏醒时间和该目标苏醒时间的标识符，其中该发射机被进一步配置成传送包括该目标苏醒时间的标识符的寻呼消息。

[0060] 所公开的另一方面是一种接入点。该接入点包括：天线；发射机，其被配置成使用该天线来传送消息，该消息包括目标苏醒时间和该目标苏醒时间的标识符，其中该发射机被进一步配置成使用该天线来传送包括该目标苏醒时间的标识符的寻呼消息。

[0061] 所公开的另一方面是一种设备。该设备包括：用于传送消息的装置，该消息包括目标苏醒时间和该目标苏醒时间的标识符；以及用于传送包括该目标苏醒时间的标识符的寻呼消息的装置。

[0062] 所公开的另一方面是一种计算机程序产品。该计算机程序产品包括其上编码有指令的计算机可读存储设备，这些指令在被执行时使一装置执行一种无线通信的方法，所述方法包括：传送消息，该消息包括目标苏醒时间和该目标苏醒时间的标识符；以及传送包括该目标苏醒时间的标识符的寻呼消息。

[0063] 本公开的另一方面提供了一种无线通信的方法。该方法包括：由一装置接收消息，该消息指示目标苏醒时间和该目标苏醒时间的标识符，其中该接收机被进一步配置成接收指示该目标苏醒时间的标识符的寻呼消息；由一装置进入休眠状态；以及由一装置基于收到指示该目标苏醒时间的标识符的寻呼消息而在该目标苏醒时间苏醒。

[0064] 所公开的另一方面是一种装置。该装置包括：接收机，其被配置成接收消息，该消息指示目标苏醒时间和该目标苏醒时间的标识符，其中该接收机被进一步配置成接收指示该目标苏醒时间的标识符的寻呼消息；以及处理装置，其被配置成进入休眠状态并基于收到指示该目标苏醒时间的标识符的寻呼消息而在该目标苏醒时间苏醒。

[0065] 所公开的另一方面是一种站。该站包括：天线；接收机，其被配置成使用该天线来接收消息，该消息指示目标苏醒时间和该目标苏醒时间的标识符，其中该接收机被进一步配置成接收指示该目标苏醒时间的标识符的寻呼消息；处理装置，其被配置成进入休眠状

态并基于收到指示该目标苏醒时间的标识符的寻呼消息而在该目标苏醒时间苏醒。

[0066] 所公开的另一方面是一种设备。该设备包括：用于接收消息的装置，该消息指示目标苏醒时间和该目标苏醒时间的标识符，其中该用于接收的装置被进一步配置成接收指示该目标苏醒时间的标识符的寻呼消息；以及用于进入休眠状态并基于收到指示该目标苏醒时间的标识符的寻呼消息而在该目标苏醒时间苏醒的装置。

[0067] 所公开的另一方面是一种计算机程序产品。该计算机程序产品包括其上编码有指令的计算机可读存储设备，这些指令在被执行时使一装置执行一种无线通信的方法，所述方法包括：接收消息，该消息指示目标苏醒时间和该目标苏醒时间的标识符，其中该接收机被进一步配置成接收指示该目标苏醒时间的标识符的寻呼消息；进入休眠状态；以及基于收到指示该目标苏醒时间的标识符的寻呼消息而在该目标苏醒时间苏醒。

[0068] 本公开的另一方面提供了一种无线通信的方法。该方法包括：由一装置生成消息，该消息指示目标苏醒时间和上行链路方向指示符，其中该消息进一步指示是否应在传送上行链路数据之前传送请求发送(request-to-send)消息；以及由一装置传送所生成的消息。

[0069] 所公开的另一方面是一种装置。该装置包括：处理装置，其被配置成生成消息，该消息指示目标苏醒时间和上行链路方向指示符，其中该消息进一步指示是否应在传送上行链路数据之前传送请求发送消息；以及发射机，其被配置成传送所生成的消息。

[0070] 所公开的另一方面是一种接入点。该接入点包括：天线；处理装置，其被配置成生成消息，该消息指示目标苏醒时间和上行链路方向指示符，其中该消息进一步指示是否应在传送上行链路数据之前传送请求发送消息；以及发射机，其被配置成使用该天线来传送所生成的消息。

[0071] 所公开的另一方面是一种设备。该设备包括：用于生成消息的装置，该消息指示目标苏醒时间和上行链路方向指示符，其中该消息进一步指示是否应在传送上行链路数据之前传送请求发送消息；以及用于传送所生成的消息的装置。

[0072] 所公开的另一方面是一种计算机程序产品。该计算机程序产品包括其上编码有指令的计算机可读存储设备，这些指令在被执行时使一装置执行一种无线通信的方法，所述方法包括：生成消息，该消息指示目标苏醒时间和上行链路方向指示符，其中该消息进一步指示是否应在传送上行链路数据之前传送请求发送消息；以及传送所生成的消息。

[0073] 本公开的另一方面提供了一种无线通信的方法。该方法包括：由一装置接收消息，该消息指示目标苏醒时间和上行链路方向指示符，其中该消息进一步指示是否应在传送上行链路数据之前传送请求发送消息；以及基于该消息是否指示应在传送上行链路数据之前传送请求发送消息而由一装置选择性地传送请求发送消息。

[0074] 所公开的另一方面是一种装置。该装置包括：接收机，其被配置成接收消息，该消息指示目标苏醒时间和上行链路方向指示符，其中该消息进一步指示是否应在传送上行链路数据之前传送请求发送消息；以及发射机，其被配置成基于该消息是否指示应在传送上行链路数据之前传送请求发送消息而选择性地传送请求发送消息。

[0075] 所公开的另一方面是一种站。该站包括：天线；接收机，其被配置成使用该天线来接收消息，该消息指示目标苏醒时间和上行链路方向指示符，其中该消息进一步指示是否应在传送上行链路数据之前传送请求发送消息；以及发射机，其被配置成基于该消息是否

指示应在传送上行链路数据之前传送请求发送消息而选择性地传送请求发送消息。

[0076] 所公开的另一方面是一种设备。该设备包括：用于接收消息的装置，该消息指示目标苏醒时间和上行链路方向指示符，其中该消息进一步指示是否应在传送上行链路数据之前传送请求发送消息；以及用于基于该消息是否指示应在传送上行链路数据之前传送请求发送消息而选择性地传送请求发送消息的装置。

[0077] 所公开的另一方面是一种计算机程序产品。该计算机程序产品包括其上编码有指令的计算机可读存储设备，这些指令在被执行时使一装置执行一种无线通信的方法，所述方法包括：接收消息，该消息指示目标苏醒时间和上行链路方向指示符，其中该消息进一步指示是否应在传送上行链路数据之前传送请求发送消息；以及基于该消息是否指示应在传送上行链路数据之前传送请求发送消息而选择性地传送请求发送消息。

[0078] 所公开的另一方面是一种方法。该方法包括：由一装置生成消息，该消息指示期间一个或多个所标识的设备被允许与一装置通信的窗口的期满时间，其中该期满时间是基于信标区间数量来指示的，以及由该装置传送所生成的消息。在一些方面，该方法进一步包括通过生成该消息以指示特定信标区间数量来指示该窗口未期满。在一些方面，该方法进一步包括生成该消息以指示该窗口未期满；生成指示该窗口的期满时间的第二消息，其中该期满时间是基于不等于特定值的第二信标区间数量来指示的；以及由该装置传送第二消息。在一些方面，该方法进一步包括：作为受限接入窗（RAW）消息来生成该消息，其中该受限接入窗消息定义接入点声明为被保留用于所选无线站群的时间段。在一些方面，该方法还包括：生成该受限接入窗（RAW）消息以指示该受限接入窗的开始时间和历时。

[0079] 所公开的另一方面是一种装置。该装置包括：处理系统，其被配置成生成消息，该消息指示期间一个或多个所标识的设备被允许与该装置通信的窗口的期满时间，其中该期满时间是基于信标区间数量来指示的，并且该处理系统被进一步配置成传送所生成的消息。在一些方面，如果信标区间数量等于特定值，则期满时间指示窗口未期满。在一些方面，该处理系统被进一步配置成生成该消息以指示窗口未期满，并且该处理系统被进一步配置成生成指示该窗口的期满时间的第二消息，其中该期满时间是基于不等于该特定值的信标区间数量来指示的，并且其中该处理系统被进一步配置成传送第二消息。

[0080] 在该装置的一些方面，该处理系统被进一步配置成作为受限接入窗（RAW）消息来生成该消息，其中该受限接入窗消息定义接入点声明为被保留用于所选无线站群的时间段。在一些方面，该处理系统被进一步配置成生成该受限接入窗（RAW）消息以指示该受限接入窗的开始时间和历时。

[0081] 所公开的另一方面是一种方法。该方法包括：由一装置接收第一消息，解码第一消息以确定第一信标区间数量，基于第一信标区间数量来确定期间一个或多个所标识的设备被允许与接入点通信的窗口的期满时间；以及由该装置在该窗口期间传送第二消息。在一些方面，该方法还包括：如果第一信标区间数量等于特定值，则确定该窗口未期满。在一些方面，该方法还包括：基于第一信标区间数量来确定该窗口未期满，接收第三消息，基于第二消息来确定第二信标区间数量；以及基于第二信标区间数量不等于该特定值而确定该窗口期满。该方法的一些方面还包括：作为受限接入窗（RAW）消息来解码收到消息，其中该受限接入窗消息定义接入点声明为被保留用于所选无线站群的时间段。在一些方面，该方法还包括：解码受限接入窗（RAW）消息以确定受限接入窗的开始时间和历时。

[0082] 所公开的另一方面是一种装置。该装置包括：处理系统，其被配置成接收第一消息；解码第一消息以确定第一信标区间数量；基于第一信标区间数量来确定期间一个或多个所标识的设备被允许与接入点通信的窗口的期满时间；以及在该窗口期间传送第二消息。在一些方面，该处理系统被进一步配置成在第一信标区间数量等于特定值的情况下确定该窗口未期满。在一些方面，该处理系统被进一步配置成基于第一信标区间数量来确定该窗口未期满；接收第三消息；基于第三消息来确定第二信标区间数量；以及基于第二信标区间数量不等于该特定值而确定该窗口期满。

[0083] 在该装置的一些方面，该处理系统被进一步配置成作为受限接入窗消息来解码收到消息，其中该受限接入窗消息定义接入点声明为被保留用于所选无线站群的时间段。在该装置的一些方面，该处理系统被进一步配置成解码受限接入窗 (RAW) 消息以确定受限接入窗的开始时间和历时。

[0084] 所公开的另一方面是一种用于无线通信的方法。该方法包括：由一装置生成受限接入窗 (RAW) 消息，该消息标识期间该装置将与一个或多个无线设备进行数据通信的时间段，该消息进一步包括指示在该时间段期间的无线通信流方向的指示符；由该装置传送所生成的消息。在一些方面，该指示符指示在该时间段期间通信的数据是上行链路数据还是下行链路数据。在一些方面，该指示符指示在该时间段期间通信的数据是上行链路数据、下行链路数据还是双向数据。在一些方面，该方法进一步包括生成受限接入窗消息以包括优先级指示符，该优先级指示符指示在该时间段期间通信的上行链路数据与下行链路数据之间的优先级。在一些方面，该无线通信流方向指示符具有一位或两位的位长度。在一些方面，该时间段标识目标苏醒时间 (TWT)。在一些方面，该方法还包括生成受限接入窗 (RAW) 消息以包括开始时间指示符和历时指示符，其中开始时间指示符指示 RAW 的开始时间而历时指示符指示 RAW 的历时。

[0085] 所公开的另一方面是一种用于无线通信的装置。该装置包括：处理系统，其被配置成生成受限接入窗 (RAW) 消息，该消息标识期间该装置将与一个或多个无线设备进行数据通信的时间段，该消息进一步被生成为包括指示在该时间段期间的无线通信流方向的指示符；以及发射机，其被配置成传送所生成的消息。在一些方面，该指示符指示在该时间段期间通信的数据是上行链路数据还是下行链路数据。在一些方面，该指示符指示在该时间段期间通信的数据是上行链路数据、下行链路数据、还是双向数据。在一些方面，该处理系统被进一步配置成生成受限接入窗消息以包括优先级指示符，该优先级指示符指示在该时间段期间通信的上行链路数据和下行链路数据的优先级。在一些方面，该无线通信流方向指示符具有一位或两位的位长度。在一些方面，该时间段标识目标苏醒时间 (TWT)。

[0086] 在一些方面，该处理系统被进一步配置成生成该受限接入窗 (RAW) 消息以包括开始时间指示符和历时指示符，其中开始时间指示符指示 RAW 的开始时间而历时指示符指示 RAW 的历时。

[0087] 所公开的另一方面是一种无线通信的方法。该方法包括：由一装置接收标识期间第一设备与一个或多个第二设备进行数据通信的时间段的受限接入窗 (RAW) 消息，该消息进一步包括指示无线通信流方向的指示符；以及基于该无线通信流方向指示符而由该装置与第一设备进行数据通信。在一些方面，该方法还包括：解码受限接入窗 (RAW) 消息以确定所通信的数据是上行链路数据还是下行链路数据。在一些方面，该方法还包括：解码受

限接入窗 (RAW) 消息以确定所通信的数据是上行链路数据、下行链路数据、还是双向数据。在一些方面，该方法还包括 :解码受限接入窗 (RAW) 消息以确定在该时间段期间通信的上行链路数据和下行链路数据的优先级。在一些方面，该方法还包括基于所接收到的 RAW 消息的一位或两位来解码无线通信流方向指示符。在一些方面，该时间段标识目标苏醒时间 (TWT)。在一些方面，该方法还包括 :基于受限接入窗消息来解码 RAW 的开始时间和 RAW 的历时。

[0088] 所公开的另一方面是一种用于无线通信的装置。该装置包括 :处理系统，其被配置成接收受限接入窗 (RAW) 消息，该消息标识第一设备与一个或多个第二设备进行数据通信的时间段，该消息进一步包括指示在该时间段期间的无线通信流方向的指示符。该处理系统被进一步配置成基于该无线通信流方向指示符与第一设备进行数据通信。在一些方面，该处理系统被进一步配置成 :解码受限接入窗消息以确定所通信的数据是上行链路数据还是下行链路数据。在一些方面，该处理系统被进一步配置成 :解码受限接入窗消息以确定所通信的数据是上行链路数据、下行链路数据、还是双向数据。在一些方面，该处理系统被进一步配置成解码受限接入窗消息以确定在该时间段期间通信的上行链路数据和下行链路数据的优先级。在一些方面，该处理系统被进一步配置成基于所接收到的消息的一位或两位来解码该无线通信流方向指示符。在一些方面，该时间段标识目标苏醒时间 (TWT)。在一些方面，该处理系统被进一步配置成 :基于受限接入窗消息来解码 RAW 的开始时间和 RAW 的历时。

[0089] 所公开的另一方面是一种无线通信的方法。该方法包括 :由一装置生成受限接入窗消息，该消息指示不与该装置相关联的设备被允许在由该消息定义的时间段期间与该装置通信 ;以及由该装置传送所生成的消息。在一些方面，该方法还包括在该时间段期间禁止休眠或打盹状态。在一些方面，该方法包括 :生成受限接入窗消息以指示相关联设备是否也可以使用该时间段来与该装置通信。在一些方面，该方法进一步包括 :生成受限接入窗消息以包括被允许在该时间段期间与该装置通信的设备的唯一性设备标识符。在一些方面，该方法包括 :在该时间段期间从第一非关联设备接收第一消息，如果在该时间段期间收到第一消息则传送对第一消息的响应。在一些方面，该方法进一步包括 :生成受限接入窗消息进一步包括生成该消息以包括指示该时间段的开始时间的指示符，该开始时间基于绝对时间基准。

[0090] 所公开的另一方面是一种用于无线通信的装置。该装置包括 :处理系统，其被配置成生成受限接入窗 (RAW) 消息，该消息指示不与该装置相关联的设备被允许在由该消息定义的时间段期间与该装置通信 ;以及发射机，其被配置成传送所生成的消息。在一些方面，该处理系统被进一步配置成在该时间段期间禁止休眠或打盹状态。在一些方面，该处理系统被进一步配置成 :生成受限接入窗消息以包括被允许在此时间段期间与该装置通信的设备的唯一性设备标识符。在一些方面，该处理系统被进一步配置成 :生成受限接入窗消息以指示相关联设备是否也可以使用该时间段来与该装置通信。在一些方面，该处理系统被进一步配置成 :在该时间段期间从第一非关联设备接收第一消息，并且其中该发射机被进一步配置成如果在该时间段期间收到第一消息则传送对第一消息的响应。在一些方面，该处理系统被进一步配置成 :生成受限接入窗消息以进一步包括指示该时间段的开始时间的指示符，该开始时间基于绝对时间基准。

[0091] 所公开的另一方面是一种用于无线通信的方法。该方法包括：由第一装置解码受限接入窗 (RAW) 消息以确定不与第二装置相关联的设备被允许在由该受限接入窗消息定义的时间段期间与第二装置通信；以及基于第一装置是否与第二装置相关联而由第一装置在该时间段期间向第二装置传送另一消息。在一些方面，该传送包括如果第一装置不与第二装置相关联则向第二装置传送关联消息。在一些方面，该方法还包括解码受限接入窗 (RAW) 消息以确定与第二装置相关联的设备是否被允许在该时间段期间与第二装置通信，其中该传送包括如果与第二装置相关联的设备被允许在该时间段期间与第二装置通信并且第一装置与第二装置相关联则在该时间段期间向第二装置传送该另一消息。

[0092] 在一些方面，该方法包括：基于第一装置的唯一性设备标识符是否被包括在受限接入窗消息中来确定第一装置是否被允许在该时间段期间与第二装置通信。在一些方面，该方法进一步包括：解码受限接入窗消息以标识该时间段的开始时间的指示符，该开始时间基于绝对时间基准。

[0093] 所公开的另一方面是用于无线通信的第一装置。第一装置包括：处理系统，其被配置成接收受限接入窗消息，该消息指示不与第二装置相关联的设备被允许在由该受限接入窗消息定义的时间段期间与第二装置通信；以及发射机，其被配置成基于第一装置是否与第二装置相关联而在该时间段期间向第二装置传送另一消息。在一些方面，该发射机被进一步配置成在第一装置不与第二装置相关联的情况下向第二装置传送关联消息。在一些方面，该处理系统被进一步配置成：解码受限接入窗 (RAW) 消息以确定与第二装置相关联的设备是否被允许在该时间段期间与第二装置通信，并且该发射机被进一步配置成在与第二装置相关联的设备被允许在该时间段期间与第二装置通信并且第一装置与第二装置相关联的情况下在该时间段期间向第二装置传送该另一消息。在一些方面，该处理系统被进一步配置成：基于第一装置的唯一性设备标识符是否被包括在受限接入窗消息中来确定第一装置是否被允许在该时间段期间与第二装置通信。在一些方面，该处理系统被进一步配置成：解码受限接入窗消息以标识该时间段的开始时间的指示符，该开始时间基于绝对时间基准。

[0094] 所公开的另一方面是一种用于无线通信的方法。该方法包括：由一装置生成消息，该消息指示期间一个或多个设备被允许与该装置通信的窗口的开始时间，该开始时间基于绝对时间基准；以及由该装置传送所生成的消息。在一些方面，该绝对时间基准基于目标信标传送时间 (TBTT)。在一些方面，该绝对时间基准基于定时同步功能 (TSF)。在一些方面，生成该消息进一步包括生成受限接入窗消息以指示受限接入窗的开始时间和历时。在一些方面，该消息被生成为目标苏醒时间信息元素 (TWT IE)。在一些方面，该消息被生成为进一步包括在该窗口期间的无线通信流方向的指示符。在一些方面，无线通信流方向的指示符指示该装置在该窗口期间传送还是接收数据。

[0095] 所公开的另一方面是一种用于无线通信的装置。该装置包括：处理系统，其被配置成生成消息，该消息指示期间一个或多个设备被允许与该装置通信的窗口的开始时间，该开始时间基于绝对时间基准；以及发射机，其被配置成传送所生成的消息。在一些方面，绝对时间基准基于目标信标传送时间 (TBTT)。在一些方面，绝对时间基准基于定时同步功能 (TSF)。在一些方面，生成该消息进一步包括生成受限接入窗消息以指示受限接入窗的开始时间和历时。在一些方面，该处理系统被配置成将该消息生成为目标苏醒时间信息元素

(TWT IE)。在一些方面，该消息被生成为进一步包括在该窗口期间的无线通信流方向的指示符。在一些方面，无线通信流方向的指示符指示该装置在该窗口期间传送还是接收数据。

[0096] 所公开的另一方面是一种用于无线通信的装备。该装备包括：用于生成消息的装置，该消息指示期间一个或多个设备被允许与该装备通信的窗口的开始时间，该开始时间基于绝对时间基准；以及用于传送所生成的消息的装置。在一些方面，该绝对时间基准基于目标信标传送时间(TBTT)。在一些方面，该绝对时间基准基于定时同步功能(TSF)。在一些方面，用于生成的装置被配置成将该消息生成为受限接入窗消息，该受限接入窗消息包括指示受限接入窗的开始时间和历时的指示符。在一些方面，用于生成的装置被配置成将该消息生成为目标苏醒时间信息元素(TWT IE)。在一些方面，用于生成的装置被配置成生成该消息以进一步包括在该窗口期间的无线通信流方向的指示符。在一些方面，无线通信流方向的指示符指示该装备在该窗口期间传送还是接收数据。

[0097] 所公开的另一方面是用于无线通信的无线节点。该无线节点包括：天线；处理系统，其被配置成生成消息，该消息指示期间一个或多个设备被允许与该装置通信的窗口的开始时间，该开始时间基于绝对时间基准；以及发射机，其被配置成使用该天线来传送所生成的消息。

[0098] 所公开的另一方面是一种用于无线通信的方法。该方法包括：由一装置生成消息，该消息标识至少一个特定设备，并且生成该消息以标识期间所标识的至少一个特定设备被允许与该装置通信的时间段；以及由该装置传送所生成的消息。在一些方面，生成该消息进一步包括生成受限接入窗消息。在一些方面，该方法包括：生成受限接入窗消息以指示该时间段的开始时间和历时。在一些方面，该方法进一步包括：生成该消息以包括被允许在该时间段期间与该装置通信的该至少一个特定设备的列表。在一些方面，该方法进一步包括：生成该消息以包括被允许在该时间段期间与该装置通信的该一个或多个特定设备中的每个特定设备的指示符。在一些方面，该方法进一步包括：在该时间段期间从该特定设备接收消息；以及如果在该时间段期间收到该特定设备的消息，则生成对该特定设备的消息的响应。

[0099] 所公开的另一方面是一种用于无线通信的装置。该装置包括：处理系统，其被配置成生成消息，该消息标识至少一个特定设备，以及被配置成生成该消息以包括期间该至少一个所标识的特定设备被允许与该装置通信的时间段的指示符；以及发射机，其被配置成传送所生成的消息。在一些方面，生成该消息进一步包括生成受限接入窗消息。在一些方面，该处理系统被进一步配置成生成受限接入窗消息以指示该时间段的开始时间和历时。在一些方面，该处理系统被进一步配置成：生成该消息以包括被允许在该时间段期间与该装置通信的该一个或多个特定设备的列表。在一些方面，该处理系统被进一步配置成：生成该消息以包括被允许在该时间段期间与该装置通信的该一个或多个特定设备中的每个特定设备的指示符。在一些方面，该处理系统被进一步配置成：在该时间段期间从该特定设备接收消息，并且其中该处理系统被进一步配置成在该时间段期间如果收到该特定设备的消息则生成对该特定设备的响应。

[0100] 所公开的另一方面是一种用于无线通信的方法。该方法包括：由第一装置解码接收自无线通信网络的消息以标识特定设备，解码该消息以标识期间所标识的特定设备被允许与第二装置通信的时间段；以及由第一装置在该时间段期间限制与第二装置的通信。在一些方面，该方法包括将收到消息解码为受限接入窗消息。在一些方面，该方法包括：基于

受限接入窗消息来确定受限接入窗的开始时间和历时。在一些方面，该方法包括：解码受限接入窗消息以标识被允许在该时间段期间与第二装置通信的设备群的列表。在一些方面，该方法进一步包括：解码该消息以标识被允许在该时间段期间与第二装置通信的该一个或多个特定设备中的每个特定设备的指示符。在一些方面，由第一装置在该时间段期间限制与第二装置的通信进一步包括：基于此解码来确定第一装置是否被所接收的消息标识，如果第一装置被标识则在该时间段期间向第二装置传送消息，以及如果第一装置不被标识则在该时间段期间不向第二装置传送消息。

[0101] 所公开的另一方面是用于无线通信的第一装置。第一装置包括：处理系统，其被配置成解码接收自无线通信网络的消息以标识至少一个特定设备，解码该消息以标识期间该至少一个特定设备被允许与第二装置通信的时间段，以及在该时间段期间限制与第二装置的通信。在一些方面，该处理系统被进一步配置成将所接收的消息解码为受限接入窗消息。在一些方面，该处理系统被进一步配置成：基于受限接入窗消息来确定该受限接入窗的开始时间和历时。在一些方面，该处理系统被进一步配置成：解码受限接入窗消息以标识被允许在该窗口期间与第二装置通信的该一个或多个特定设备的列表。在一些方面，该处理系统被进一步配置成：解码该消息以标识被允许在该时间段期间与第二装置通信的该一个或多个特定设备中的每个特定设备的指示符。在一些方面，该处理系统被配置成通过以下操作来在该时间段期间限制与第二装置的通信：基于解码来确定第一装置是否被所接收的消息标识；其中第一装置进一步包括发射机，其被配置成若第一装置被标识则在该时间段期间向第二装置传送消息，以及该发射机被进一步配置成若第一装置不被标识则在该时间段期间不向第二装置传送该消息。

[0102] 所公开的另一方面是一种无线通信的方法。该方法包括：由一装置生成第一消息，第一消息包括期间一个或多个设备被允许与该装置通信的窗口的历时的第一指示符，其中基于第一指示符指示信标区间数量来指示有限历时；以及由该装置传送第一消息。在一些方面，如果第一指示符指示了特定值，则该历时是无限的。在一些方面，第一消息中的第一指示符指示该窗口具有无限历时，该方法进一步包括：生成第二消息，第二消息包括指示该窗口的经更新历时的第二指示符，其中第二指示符通过指示不同于该特定值的值来指示该经更新历时是有限的；以及由该装置传送第二消息。在一些方面，第一消息被生成为受限接入窗（RAW）消息，其中该窗口是受限接入窗。在一些方面，生成受限接入窗（RAW）消息以包括指示该受限接入窗的开始时间的开始时间指示符。在一些方面，生成该消息以包括该一个或多个设备的列表。

[0103] 所公开的另一方面是一种用于无线通信的装置。该装置包括：处理系统，其被配置成生成第一消息，第一消息包括指示期间一个或多个设备被允许与该装置通信的窗口的历时的第一指示符，其中基于指示信标区间数量来指示有限历时；以及发射机，其被配置成传送所生成的消息。在一些方面，如果第一指示符指示了特定值，则该历时是无限的。在一些方面，该处理系统被进一步配置成生成第一消息以指示该窗口具有无限历时，并且该处理系统被进一步配置成生成包括指示该窗口的经更新历时的第二指示符的第二消息，其中该第二指示符通过指示不同于该特定值的值来指示该经更新历时是有限的，以及该发射机被进一步配置成传送第二消息。在一些方面，第一消息被生成为受限接入窗（RAW）消息，其中该窗口是受限接入窗（RAW）。在一些方面，该处理系统被进一步配置成生成受限接入窗

(RAW)消息以包括指示该受限接入窗的开始时间的开始时间指示符。在一些方面，该处理系统被进一步配置成生成第一消息以包括该一个或多个设备的列表。

[0104] 所公开的另一方面是一种无线通信的方法。该方法包括：由第一装置解码第一消息，第一消息包括期间一个或多个设备被允许与第二装置通信的窗口的历时的第一指示符，其中第一指示符基于信标区间数量来指示有限历时；以及由第一装置基于所指示的历时在该窗口期间向第二装置传送第二消息。

[0105] 在一些方面，该方法还包括：如果第一指示符具有特定值，则确定该窗口具有无限历时。在一些方面，该方法还包括：基于第一指示符指示该特定值而确定该窗口具有无限历时；以及在收到的第三消息包括第二指示符的基础上，基于第二指示符指示信标区间数量而确定该窗口的经更新历时是有限的。在一些方面，该方法还包括：将第一消息解码为受限接入窗消息，其中该窗口是受限接入窗。在一些方面，该方法包括：解码受限接入窗(RAW)消息以标识指示该受限接入窗的开始时间的开始时间指示符。在一些方面，该方法还包括：解码第一消息以标识被允许在该窗口期间与该装置通信的该一个或多个设备的列表。

[0106] 所公开的另一方面是用于无线通信的第一装置。该方法包括处理系统，其被配置成：解码第一消息，第一消息包括期间一个或多个设备被允许与第二装置通信的窗口的历时的第一指示符，其中第一指示符基于信标区间数量来指示有限历时；以及发射机，其被配置成在该窗口期间向第二装置传送第二消息。在一些方面，该处理系统被进一步配置成：如果第一指示符具有特定值，则确定该窗口具有无限历时。在一些方面，该处理系统被进一步配置成：基于第一指示符指示该特定值而确定该窗口具有无限历时，该处理系统被进一步配置成：基于收到的第三消息包括第二指示符而确定经更新历时，以及基于第二指示符指示不同于该特定值的值而确定经更新历时是有限的。

[0107] 在一些方面，该处理系统被进一步配置成：将第一收到消息解码为受限接入窗消息，其中该窗口是受限接入窗。在一些方面，该处理系统被进一步配置成解码受限接入窗(RAW)消息以基于在该受限接入窗(RAW)消息中包括的开始时间指示符来确定该受限接入窗的开始时间。在一些方面，该处理系统被进一步配置成解码第一消息以标识该一个或多个设备的列表。

[0108] 所公开的另一方面是一种无线通信的方法。该方法包括：由一装置生成第一消息，第一消息包括指示信标区间数量的第一指示符，这些信标区间各自具有期间一个或多个设备被允许与该装置通信的窗口；以及由该装置传送第一消息。在一些方面，如果第一指示符指示了特定值，则该信标区间数量是无限的。在一些方面，第一消息中的第一指示符指示该信标区间数量是无限的，该方法进一步包括：生成包括第二指示符的第二消息，第二指示符通过指示不同于特定值的值来指示有限的信标区间数量，这些信标区间各自具有期间一个或多个设备被允许与该装置通信的窗口；以及由该装置传送第二消息。在一些方面，该方法进一步包括：生成第一消息包括生成raw参数集(RPS)元素。在一些方面，第一消息被生成为包括开始时间指示符，该开始时间指示符指示这些信标区间内的每个窗口的开始时间。在一些方面，第一消息进一步包括历时指示符，该历时指示符指示这些信标区间内的每个窗口的历时。在一些方面，生成该消息以包括该一个或多个设备的列表。

[0109] 所公开的另一方面是一种用于无线通信的装置。该装置包括：处理系统，其被配置成：生成第一消息，第一消息包括指示信标区间数量的第一指示符，这些信标区间各自具

有期间一个或多个设备被允许与该装置通信的窗口；以及发射机，其被配置成传送所生成的消息。在一些方面，如果第一指示符指示了特定值，则信标区间数量是无限的。在该装置的一些方面，该处理系统被进一步配置成：生成第一消息以指示信标区间数量是无限的，并且该处理系统被进一步配置成生成包括第二指示符的第二消息，第二指示符通过指示不同于该特定值的值来指示有限的信标区间数量，这些信标区间具有期间一个或多个设备被允许与该装置通信的窗口；以及发射机，其被进一步配置成传送第二消息。在该装置的一些方面，生成第一消息包括生成 raw 参数集 (RPS) 元素。

[0110] 在该装置的一些方面，该处理系统被进一步配置成：生成第一消息以包括开始时间指示符，该开始时间指示符指示这些信标区间内的每个窗口的开始时间。在一些方面，该处理系统被进一步配置成：生成第一消息以包括历时指示符，该历时指示符指示这些信标区间内的每个窗口的历时。在一些方面，该处理系统被进一步配置成生成第一消息以包括该一个或多个设备的列表。

[0111] 所公开的另一方面是一种无线通信的方法。该方法包括：由第一装置解码第一消息，第一消息包括指示信标区间数量的第一指示符，这些信标区间各自具有期间一个或多个设备被允许与第二装置通信的窗口；以及由第一装置基于第一指示符在这些窗口之一期间向第二装置传送第二消息。在一些方面，该方法进一步包括：如果第一指示符具有特定值则确定信标区间数量是无限的。在一些方面，该方法还包括：基于第一指示符指示了该特定值而确定信标区间数量是无限的；以及在收到的第三消息包括第二指示符的基础上，基于第二指示符指示不同于该特定值的信标区间数量而确定有限的信标区间数量，这些信标区间各自具有期间一个或多个设备被允许与第二装置通信的窗口。在一些方面，该方法进一步包括：解码第一消息以标识开始时间指示符，该开始时间指示符指示这些信标区间内的每个窗口的开始时间。在一些方面，该方法还包括：解码第一消息以标识历时指示符，该历时指示符指示这些信标区间内的每个窗口的历时。在一些方面，该方法进一步包括：解码第一消息以标识被允许在该窗口期间与该装置通信的该一个或多个设备的列表。

[0112] 所公开的另一方面是用于无线通信的第一装置。该方法包括处理系统，其被配置成：解码包括信标区间数量的第一指示符的第一消息，这些信标区间各自具有期间一个或多个设备被允许与第二装置通信的窗口；以及发射机，其被配置成基于第一指示符在这些窗口之一期间向第二装置传送第二消息。在一些方面，该处理系统被进一步配置成：如果第一指示符具有特定值，则确定信标区间数量是无限的。在一些方面，该处理系统被进一步配置成：基于第一指示符指示了该特定值而确定信标区间数量是无限的，并且该处理系统被进一步配置成：基于收到的第三消息包括第二指示符而确定经更新的信标区间数量，并且基于第二指示符指示了不同于该特定值的值而确定经更新的信标区间数量是有限的，这些信标区间各自具有期间一个或多个设备被允许与第二装置通信的窗口。

[0113] 在该装置的一些方面，该处理系统被进一步配置成：解码第一消息以基于第一消息中包括的开始时间指示符来确定这些信标区间内的每个窗口的开始时间。在该装置的一些方面，该处理系统被进一步配置成：解码第一消息以基于第一消息中包括的历时指示符来确定信标区间内的每个窗口的历时。在该装置的一些方面，该处理系统被进一步配置成解码第一消息以标识该一个或多个设备的列表。

[0114] 附图简述

[0115] 图 1 解说了其中可采用本公开的各方面的无线通信系统的示例。

[0116] 图 2 解说了可在图 1 的无线通信系统内采用的无线设备的示例。

[0117] 图 3 解说了可被包括在图 2 的无线设备内以用于传送无线通信的组件的示例。

[0118] 图 4 解说了可被包括在图 2 的无线设备中以用于传送无线通信的组件的示例。

[0119] 图 5 是根据一种实现的无线通信方法的流程图。

[0120] 图 6 是根据一种实现的无线通信方法的流程图。

[0121] 图 7 示出了标识无线通信流方向的消息的一种实现。

[0122] 图 8 是根据一种实现的无线通信方法的流程图。

[0123] 图 9 是根据一种实现的无线通信方法的流程图。

[0124] 图 10 示出了标识无线通信流方向的消息的一种实现。

[0125] 图 11 是根据一种实现的无线通信方法的流程图。

[0126] 图 12 是根据一种实现的无线通信方法的流程图。

[0127] 图 13 示出了标识无线通信流方向的消息的一种实现。

[0128] 图 14 是根据一种实现的无线通信方法的流程图。

[0129] 图 15 是根据一种实现的无线通信方法的流程图。

[0130] 图 16 示出了标识无线通信流方向的消息的一种实现。

[0131] 图 17 是根据一种实现的无线通信方法的流程图。

[0132] 图 18 是根据一种实现的无线通信方法的流程图。

[0133] 图 19 示出了标识无线通信流方向的消息的一种实现。

[0134] 图 20 是根据一种实现的无线通信方法的流程图。

[0135] 图 21 是根据一种实现的无线通信方法的流程图。

[0136] 图 22 是根据一种实现的无线通信方法的流程图。

[0137] 图 23 是根据一种实现的无线通信方法的流程图。

[0138] 详细描述

[0139] 以下参照附图更全面地描述本新颖系统、装置和方法的各种方面。然而，本教义公开可用许多不同的形式来实施并且不应被解释为被限定于本公开通篇所给出的任何特定结构或功能。确切而言，提供这些方面是为了使本公开将是透彻和完整的，并且其将向本领域技术人员完全传达本公开的范围。基于本文的教导，本领域技术人员应领会，本公开的范围旨在覆盖本文所公开的这些新颖的系统、装置和方法的任何方面，不论其是独立实现的还是与本发明的任何其他方面组合实现的。例如，可以使用本文所阐述的任何数目的方面来实现装置或实践方法。另外，本发明的范围旨在覆盖使用作为本文中所阐述的本发明各种方面的补充或者与之不同的其他结构、功能性、或者结构及功能性来实践的装置或方法。应当理解，本文披露的任何方面可以由权利要求的一个或多个要素来实施。

[0140] 尽管本文描述了特定方面，但这些方面的众多变体和置换落在本公开的范围之内。尽管提到了优选方面的一些益处和优点，但本公开的范围并非旨在被限定于特定益处、用途或目标。确切而言，本公开的各方面旨在宽泛地适用于不同的无线技术、系统配置、网络、和传输协议，其中一些藉由示例在附图和以下对优选方面的描述中解说。详细描述和附图仅仅解说本公开而非限定本公开，本公开的范围由所附权利要求及其等效技术方案来定义。

[0141] 无线网络技术可包括各种类型的无线局域网 (WLAN)。WLAN 可被用于采用广泛使用的联网协议来将近旁设备互连在一起。本文描述的各个方面可应用于任何通信标准，诸如 WiFi、或者更一般地 IEEE 802.11 无线协议族中的任何成员。例如，本文描述的各个方面可被用作使用亚 1GHz 频带的 IEEE 802.11ah 协议的一部分。

[0142] 在一些方面，亚千兆赫频带中的无线信号可根据 802.11ah 协议使用正交频分复用 (OFDM)、直接序列扩频 (DSSS) 通信、OFDM 和 DSSS 通信的组合、或其他方案来传送。802.11ah 协议的实现可被用于传感器、计量、和智能电网。有利地，实现 802.11ah 协议的某些设备的各方面可以比实现其他无线协议的设备消耗更少的功率，和 / 或可被用于跨相对较长的距离（例如，约 1 公里或更长）来传送无线信号。

[0143] 在一些实现中，WLAN 包括作为接入无线网络的组件的各种设备。例如，可以有两种类型的设备 :接入点 (“AP”) 和客户端（亦称为站，或“STA”）。一般而言，AP 用作 WLAN 的中枢或基站，而 STA 用作 WLAN 的用户。例如，STA 可以是膝上型计算机、个人数字助理 (PDA)、移动电话等。在一示例中，STA 经由遵循 WiFi（例如，IEEE 802.11 协议，诸如 802.11ah) 的无线链路连接到 AP 以获得至因特网或至其它广域网的一般连通性。在一些实现中，STA 也可被用作 AP。

[0144] 接入点 (“AP”) 还可包括、被实现为、或被称为 B 节点、无线电网络控制器 (“RNC”)、演进型 B 节点、基站控制器（“BSC”)、基收发机站（“BTS”)、基站（“BS”)、收发机功能 (“TF”)、无线电路由器、无线电收发机或其他某个术语。接入点可以是主基站或中继基站。中继基站在无线站和另一基站（主基站或另一中继基站）之间中继数据。

[0145] 站“STA”还可包括、被实现为、或被称为接入终端（“AT”)、订户站、订户单元、移动站、远程站、远程终端、用户终端、用户代理、用户设备、用户装备或其他某个术语。在一些实现中，接入终端可包括蜂窝电话、无绳电话、会话发起协议（“SIP”）话机、无线本地环路（“WLL”）站、个人数字助理（“PDA”)、具有无线连接能力的手持式设备、或连接至无线调制解调器的其他某种合适的处理设备。因此，本文所教导的一个或多个方面可被纳入到电话（例如，蜂窝电话或智能电话)、计算机（例如，膝上型设备)、便携式通信设备、手持机、便携式计算设备（例如，个人数据助理)、娱乐设备（例如，音乐或视频设备、或卫星无线电)、游戏设备或系统、全球定位系统设备、或被配置成经由无线介质通信的任何其他合适的设备中。

[0146] 如以上所讨论的，本文描述的某些设备可实现例如 802.11ah 标准。此类设备（无论是用作 STA 或 AP 还是其他设备）可被用于智能计量或者用在智能电网中。此类设备可提供传感器应用或者用在家庭自动化中。这些设备可代替地或者附加地用在医疗保健环境中，例如用于个人医疗保健。这些设备也可被用于监督以使得能够实现范围扩展的因特网连通性（例如，以供与热点联用)、或者实现机器对机器通信。

[0147] 图 1 解说了其中可采用本公开的各方面的无线通信系统 100 的示例。无线通信系统 100 可按照无线标准（例如 802.11ah 标准）来操作。无线通信系统 100 可包括与 STA 106 通信的 AP 104。

[0148] 可以将各种过程和方法用于无线通信系统 100 中在 AP 104 与 STA 106 之间的传输。例如，可以根据 OFDM/OFDMA 技术在 AP 104 与 STA 106 之间发送和接收信号。如果是这种情形，则无线通信系统 100 可以被称为 OFDM/OFDMA 系统。替换地，可以根据 CDMA 技术

在 AP 104 与 STA 106 之间发送和接收信号。如果是这种情形，则无线通信系统 100 可被称为 CDMA 系统。

[0149] 促成从 AP 104 至一个或多个 STA 106 的传输的通信链路可被称为下行链路 (DL)108，而促成从一个或多个 STA 106 至 AP 104 的传输的通信链路可被称为上行链路 (UL)110。替换地，下行链路 108 可被称为前向链路或前向信道，而上行链路 110 可被称为反向链路或反向信道。

[0150] AP 104 可充当基站并提供基本服务区域 (BSA)102 中的无线通信覆盖。AP 104 连同与 AP 104 相关联的使用 AP 104 来通信的 STA 106 一起可被称为基本服务集 (BSS)。应注意，无线通信系统 100 可以不具有中央 AP 104，而是可以作为 STA 106 之间的对等网络起作用。相应地，本文中所描述的 AP 104 的功能可替换地由一个或多个 STA 106 来执行。

[0151] STA 106 在类型上不受限制，并且可包括各种不同的 STA。例如，如图 1 中解说的，STA 106 可包括蜂窝电话 106a、电视机 106b、膝上型计算机 106c、以及数个传感器 106d（例如，天气传感器或能够使用无线协议进行通信的其他传感器），这里仅列举了少数示例。

[0152] 图 2 解说了可在无线通信系统 100 内采用的无线设备 202 中利用的各种组件。无线设备 202 是可被配置成实现本文描述的各种方法的设备的示例。例如，无线设备 202 可包括 AP 104 或者各 STA 106 中的一个 STA。

[0153] 无线设备 202 可包括控制无线设备 202 的操作的处理器 204。处理器 204 也可被称为中央处理单元 (CPU)。可包括只读存储器 (ROM) 和随机存取存储器 (RAM) 两者的存储器 206 向处理器 204 提供指令和数据。存储器 206 的一部分还可包括非易失性随机存取存储器 (NVRAM)。处理器 204 通常基于存储器 206 内存储的程序指令来执行逻辑和算术运算。存储器 206 中的指令可以是可执行的以实现本文描述的方法。

[0154] 当无线设备 202 被实现为或用作传送节点时，处理器 204 可被配置成选择多种媒体接入控制 (MAC) 报头类型中的一种类型，并且生成具有该 MAC 报头类型的分组。例如，处理器 204 可被配置成生成包括 MAC 报头和有效载荷的分组并且确定要使用何种类型的 MAC 报头，如以下进一步详细讨论的。

[0155] 当无线设备 202 被实现为或用作接收节点时，处理器 204 可被配置成处理多种不同 MAC 报头类型的分组。例如，处理器 204 可被配置成确定分组中所使用的 MAC 报头的类型并且相应地处理该分组和 / 或该 MAC 报头的字段，如以下进一步讨论的。

[0156] 处理器 204 可包括用一个或多个硬件处理器实现的处理系统或者可以是其组件。这一个或多个处理器可以用通用微处理器、微控制器、数字信号处理器 (DSP)、现场可编程门阵列 (FPGA)、可编程逻辑器件 (PLD)、控制器、状态机、选通逻辑、分立硬件组件、专用硬件有限状态机、或能够对信息执行演算或其他操纵的任何其他合适实体的任何组合来实现。

[0157] 处理系统还可包括用于存储软件的机器可读介质。软件应当被宽泛地解释成意指任何类型的指令，无论其被称作软件、固件、中间件、微代码、硬件描述语言、或是其他。指令可包括代码（例如，呈源代码格式、二进制代码格式、可执行代码格式、或任何其他合适的代码格式）。这些指令在由该一个或多个处理器执行时使处理系统执行本文描述的各种功能。

[0158] 无线设备 202 还可包括发射机 210 和接收机 212，以允许在无线设备 202 与远程

位置之间进行数据的传送和接收。此外，发射机 210 和接收机 212 可配置成允许在无线设备 202 与远程位置（包括例如 AP）之间传送和接收设置和 / 或配置分组或帧。发射机 210 和接收机 212 可被组合成收发机 214。天线 216 可被附连至外壳 208 并且电耦合至收发机 214。替换地或补充地，无线设备 202 可包括形成为外壳 208 的一部分的天线 216 或者可以是内部天线。无线设备 202 还可包括（未示出）多个发射机、多个接收机、多个收发机、和 / 或多个天线。

[0159] 无线设备 202 还可包括可被用于力图检测和量化由收发机 214 收到的信号电平的信号检测器 218。信号检测器 218 可检测诸如总能量、每副载波每码元能量、功率谱密度之类的信号以及其它信号。无线设备 202 还可包括用于处理信号的数字信号处理器 (DSP)220。DSP 220 可被配置成生成数据单元以供传输。在一些方面，数据单元可包括物理层数据单元 (PPDU)。在一些方面，PPDU 被称为分组或帧。

[0160] 在一些方面，无线设备 202 可进一步包括用户接口 222。用户接口 222 可包括按键板、话筒、扬声器、和 / 或显示器。用户接口 222 可包括向无线设备 202 的用户传达信息和 / 或从该用户接收输入的任何元件或组件。

[0161] 无线设备 202 的各种组件可被容纳在外壳 208 内。此外，无线设备 202 的各种组件可由总线系统 226 耦合在一起。总线系统 226 可包括例如数据总线，以及除了数据总线之外还有电源总线、控制信号总线、和状态信号总线。本领域技术人员将领会，无线设备 202 的各组件可使用某种其他机制耦合在一起，或者可使用某种其他机制来彼此接受或提供输入。

[0162] 尽管图 2 中解说了数个分开的组件，但本领域技术人员将认识到，这些组件中的一个或多个组件可被组合或者共同地实现。例如，处理器 204 可被用于不仅实现以上关于处理器 204 描述的功能性，而且还实现以上关于信号检测器 218 和 / 或 DSP 220 描述的功能性。另外，图 2 中解说的每个组件可使用多个分开的元件来实现。

[0163] 如以上所讨论的，无线设备 202 可包括 AP 104 或 STA 106，并且可被用于传送和 / 或接收通信。图 3 解说了可在无线设备 202 中用于传送无线通信的各种组件。图 3 中所解说的组件可以例如被用于传送 OFDM 通信。在一些方面，图 3 中所解说的组件被用于传送具有尽可能低的峰均功率比的训练字段的数据单元，如将在以下更详细地讨论的。为了便于引用，配置有图 3 中所解说的组件的无线设备 202 在下文中被称为无线设备 202a。

[0164] 无线设备 202a 可包括调制器 302，该调制器 302 被配置成调制诸比特以供传输。例如，调制器 302 可例如通过根据星座将各个比特映射至多个码元来从接收自处理器 204 或用户接口 222 的比特来确定多个码元。这些比特可对应于用户数据或者控制信息。在一些方面，这些比特是在码字中接收的。在一个方面，调制器 302 包括 QAM（正交振幅调制）调制器，例如 16-QAM 调制器或者 64-QAM 调制器。在其他方面，调制器 302 包括二进制相移键控 (BPSK) 调制器或者正交相移键控 (QPSK) 调制器。

[0165] 无线设备 202a 可进一步包括变换模块 304，该变换模块 304 被配置成将来自调制器 302 的码元或以其他方式调制的比特转换到时域中。在图 3 中，变换模块 304 被解说为是通过快速傅里叶逆变换 (IFFT) 模块来实现的。在一些实现中，可以有变换不同大小的数据单元的多个变换模块（未示出）。

[0166] 在图 3 中，调制器 302 和变换模块 304 被解说为在 DSP 220 中实现。然而，在一些

方面，调制器 302 和变换模块 304 中的一者或两者是在处理器 204 中或者是在无线设备 202 的另一元件中实现的。

[0167] 如以上所讨论的，DSP 220 可被配置成生成数据单元以供传输。在一些方面，调制器 302 和变换模块 304 可被配置成生成包括多个字段的数据单元，该多个字段包括控制信息和多个数据码元。包括控制信息的字段可包括例如一个或多个训练字段和一个或多个信号 (SIG) 字段。这些训练字段中的每一个训练字段可包括已知的比特序列或码元序列。这些 SIG 字段中的每一个 SIG 字段可包括关于数据单元的信息，例如对数据单元的长度或数据率的描述。

[0168] 返回至图 3 的描述，无线设备 202a 可进一步包括数模转换器 (D/A)306，该数模转换器 306 被配置成将变换模块的输出转换成模拟信号。例如，变换模块 306 的时域输出可由数模转换器 306 转换成基带 OFDM 信号。数模转换器 306 可在处理器 204 中或者在无线设备 202 的另一元件中实现。在一些方面，数模转换器 306 是在收发机 214 中或者在数据发射处理器中实现的。

[0169] 模拟信号可由发射机 210 来无线地传送。模拟信号可在由发射机 210 传送之前被进一步处理，例如被滤波或者被上变频至中频或载波频率。在图 3 中所解说的实现中，发射机 210 包括发射放大器 308。在被传送之前，模拟信号可由发射放大器 308 放大。在一些方面，放大器 308 包括低噪声放大器 (LNA)。

[0170] 发射机 210 被配置成基于模拟信号在无线信号中传送一个或多个分组、帧或数据单元。这些数据单元可使用处理器 204 和 / 或 DSP 220 来生成，例如使用以上所讨论的调制器 302 和变换模块 304 来生成。

[0171] 图 4 解说可被用在无线设备 202 中以接收无线通信的各种组件。图 4 中所解说的组件可以例如被用于接收 OFDM 通信。在一些实现中，图 4 中解说的组件被用于接收包括一个或多个训练字段的分组、帧或数据单元，如以下将更详细地讨论的。例如，图 4 中所解说的组件可被用于接收由以上关于图 3 所讨论的组件传送的数据单元。为了便于引用，配置有图 4 中所解说的组件的无线设备 202 在下文中被称为无线设备 202b。

[0172] 接收机 212 被配置成接收无线信号中的一个或多个分组、帧或数据单元。

[0173] 在图 4 中所解说的实现中，接收机 212 包括接收放大器 401。接收放大器 401 可被配置成放大由接收机 212 接收的无线信号。在一些方面，接收机 212 被配置成使用自动增益控制 (AGC) 规程来调整接收放大器 401 的增益。在一些方面，自动增益控制使用一个或多个接收到的训练字段 (诸如举例而言接收到的短训练字段 (STF)) 中的信息来调整增益。本领域普通技术人员将理解用于执行 AGC 的方法。在一些方面，放大器 401 包括 LNA。

[0174] 无线设备 202b 可包括模数转换器 (A/D)402，该模数转换器 402 被配置成将来自接收机 212 的经放大无线信号转换成其数字表示。继被放大之后，无线信号可在由数模转换器 402 转换之前被处理，例如被滤波或者被下变频至中频或基带频率。模数转换器 402 可在处理器 204 中或者在无线设备 202 的另一元件中实现。在一些方面，模数转换器 402 是在收发机 214 中或者在数据接收处理器中实现的。

[0175] 无线设备 202b 可进一步包括变换模块 404，该变换模块 404 被配置成将无线信号的表示转换到频谱中。在图 4 中，变换模块 404 被解说为是由快速傅里叶变换 (FFT) 模块来实现的。在一些方面，变换模块可针对其使用的每个点标识一码元。

[0176] 无线设备 202b 可进一步包括信道估计器与均衡器 405，该信道估计器与均衡器 405 被配置成形成对在其上接收到数据单元的信道的估计，并且基于该信道估计来移除该信道的某些效应。例如，信道估计器可被配置成逼近信道函数，并且信道均衡器可被配置成在频谱中对数据应用该函数的逆函数。

[0177] 在一些方面，信道估计器与均衡器 405 使用一个或多个接收到的训练字段（诸如举例而言长训练字段 (LTF)）中的信息来估计信道。信道估计可基于在数据单元开始处接收到的一个或多个 LTF 来形成。此信道估计可随后被用于均衡跟随于该一个或多个 LTF 后面的数据码元。在某个时间段之后或者在某个数目的数据码元之后，可在数据单元中接收一个或多个附加 LTF。可使用这些附加 LTF 来更新信道估计或者形成新的估计。该新的或更新的信道估计可被用于均衡跟随于这些附加 LTF 后面的数据码元。在一些方面，该新的或经更新的信道估计被用于重新均衡居于这些附加的 LTF 前面的数据码元。本领域普通技术人员将理解用于形成信道估计的方法。

[0178] 无线设备 202b 可进一步包括解调器 406，该解调器 406 被配置成解调经均衡的数据。例如，解调器 406 可以例如通过在星座中倒转比特至码元的映射来从变换模块 404 和信道估计器与均衡器 405 输出的码元确定多个比特。这些比特可被处理器 204 处理或评估，或者被用于向用户接口 222 显示或以其他方式输出信息。以此方式，数据和 / 或信息可被解码。在一些方面，这些比特对应于码字。在一个方面，解调器 406 包括 QAM（正交振幅调制）解调器，例如，16-QAM 解调器或者 64-QAM 解调器。在其他方面，解调器 406 包括二进制相移键控 (BPSK) 解调器或者正交相移键控 (QPSK) 解调器。

[0179] 在图 4 中，变换模块 404、信道估计器与均衡器 405 以及解调器 406 被解说为是在 DSP 220 中实现的。然而，在一些方面，变换模块 404、信道估计器与均衡器 405、和解调器 406 中的一者或多者实现在处理器 204 中或者在无线设备 202 的另一元件中。

[0180] 如以上所讨论的，在接收机 212 处接收到的无线信号包括一个或多个数据单元。通过使用以上所描述的功能或组件，数据单元或其中的数据码元可被解码、评估、或以其他方式评估或处理。例如，处理器 204 和 / 或 DSP 220 可被用于使用变换模块 404、信道估计器与均衡器 405 和解调器 406 来解码数据单元中的数据码元。

[0181] 由 AP 104 和 STA 106 交换的数据单元可包括控制信息或数据，如以上所讨论的。在物理 (PHY) 层，这些数据单元可被称为物理层协议数据单元 (PPDU)。在一些方面，PPDU 可被称为分组、帧或物理层分组。每个 PPDU 可包括前置码和有效载荷。前置码可包括训练字段和 SIG 字段。有效载荷可包括例如媒体接入控制 (MAC) 报头或其他层的数据、和 / 或用户数据。有效载荷可使用一个或多个数据码元来传送。本文中的系统、方法和设备可利用带有峰值功率比已被最小化的训练字段的数据单元。

[0182] 在无线通信（诸如 IEEE 802.11 无线协议族中规定的那些无线通信）中，多个站使用媒体接入控制协议来共享传输介质。信标帧（其是支持数据传输的管理和控制帧之一）可被用于以有序的方式来建立和维持通信。在一些应用（诸如 802.11ah 协议中规定的那些应用）中，受限接入窗可被用来定义接入点声明为被保留用于所选无线站群的时间段。然而，不与该接入点相关联的站不能在受限接入窗打开时争用该介质。另外，受限接入窗当前不能被专门定义为仅用于上行链路或下行链路传输。因此，具有定义其中接入点将接受来自非关联站的消息的时间段的消息是有益的。提供指定在受限接入窗期间允许的通

信类型的能力是额外有益的。

[0183] 在如下将描述的实现中，接入点 (AP) 生成关于被接入点声明为保留用于所选无线站群的时间段的消息，并将该消息发送给相关联的无线站。在接收到该消息之际，诸无线站可以在所标识的时间段期间向该接入点传送分组。在一种实现中，该消息指示关于非关联站是否被允许在该时间段期间向该接入点传送请求的指示。在另一实现中，该消息指示在该时间段期间各站与该接入点之间的通信的本质。例如，该消息可以指示在该时间段期间的通信是包括上行链路数据、下行链路数据、还是两者。在一种实现中，该消息被发送给与该接入点相关联的所有无线站。这些实现可以应用于与 IEEE 802.11 和 / 或 802.11ah 等相关联的过程和标准中。

[0184] 图 5 是根据一种实现的无线通信方法的流程图。方法 500 可由用于无线通信的装置（诸如接入点 (AP)104（图 1 中示出）或图 2 中示出的无线设备 202）来执行。方法 500 可以使得能够在为接入点与一个或多个站之间的数据传递所保留的时间段期间实现对此类数据传递的改进的管理。因为此类时间段具有有限历时，因此指定可在该时间段期间传递的话务类型能导致无线通信网络的更为高效的操作。

[0185] 在框 502，该方法包括生成消息，该消息标识其中一装置将与一个或多个无线设备进行消息通信的时间段。该消息进一步指示无线通信流方向。在一方面，该消息中的无线通信流方向指示符指示在该时间段期间的消息通信是上行链路数据还是下行链路数据。例如，该消息可被生成为指示执行过程 500 的装置将在该时间段期间传送消息还是接收消息。在一方面，该消息被生成为指示下行链路数据和上行链路数据的优先级。例如，该消息可被生成为指示下行链路数据比上行链路数据的优先级高。在一方面，该消息可被生成为进一步指示可在该时间段期间进行双向数据的通信。该消息中的字段可以提供该指示。在一方面，该字段可以是 1 位长。在另一方面，该字段的长度可以不止 1 位，例如，该字段可以是 2 位长。在一些方面，该消息可被生成为受限接入窗 (RAW) 消息，诸如 802.11 或 802.11ah 协议中的 RAW 消息。

[0186] 框 502 的一些方面可以执行关于框 802、1102、1402、1702 和 / 或 2202 所讨论的功能中的一个或多个功能。

[0187] 在一方面，处理器 204 可被配置成执行关于框 502 所讨论的功能中的一个或多个功能。在一方面，用于生成的装置可以是处理器 204。

[0188] 在框 504，传送所生成的消息。在一个方面，发射机 210 可被配置成执行关于框 504 所讨论的功能中的一个或多个功能。在一方面，用于传送所生成的消息的装置可包括图 2 的发射机 210。在另一方面，处理器 204 可被配置成执行以上关于框 504 所讨论的功能中的一个或多个功能。在一方面，用于传送所生成的消息的装置可包括处理器 204。

[0189] 图 6 是根据一种实现的无线通信方法的流程图。方法 600 可由用于无线通信的装置（诸如站 106（图 1 中示出）或图 2 中示出的无线设备 202）来执行。方法 600 可以使站能与执行以上过程 500 的接入点互操作。在框 602，该方法包括接收消息，该消息标识其中第一设备与一个或多个第二无线设备进行消息通信的时间段，该消息进一步包括指示在该时间段期间的无线通信流方向的指示符。在一方面，该消息中的无线通信流方向指示符指示在该时间段期间的消息通信是上行链路数据还是下行链路数据。例如，该消息指示执行过程 600 的装置将在该时间段期间传送消息还是接收消息。在一方面，该消息可进一步指

示可在该时间段期间进行双向数据的通信。该消息中的字段可以提供该指示。在一方面，该字段可以是 1 位长。在另一方面，该字段的长度可以不止 1 位，例如，该字段可以是 2 位长。

[0190] 框 602 的一些方面包括将收到消息解码为受限接入窗 (RAW) 消息。在一些方面，解码收到消息以确定在该时间段期间的数据通信是上行链路数据还是下行链路数据。在一些方面，解码收到消息以确定在该时间段期间的数据通信是上行链路数据、下行链路数据、还是双向数据。在框 602 的一些方面，收到消息中的无线通信流方向的指示符被解码为一字节或两字节长。在一些方面，用于解码的装置可包括硬件处理器 204。

[0191] 框 602 的一些方面可以执行关于框 902、1202、1502、1802 和 / 或 2302 讨论的功能中的一个或多个功能。

[0192] 在一方面，接收机 212 被配置成执行关于框 602 所讨论的功能中的一个或多个功能。在一方面，用于接收的装置可以是图 2 的接收机 212。在另一方面，处理器 204 可被配置成执行以上关于框 602 所讨论的功能中的一个或多个功能。在一方面，用于接收的装置可包括处理器 204。在框 604，基于无线通信流方向指示来与接入点进行消息通信。例如，如果所指示的流方向是针对上行链路话务的，则框 604 可包括向第一设备传送消息。如果所指示的流方向是针对下行链路话务的，则框 604 可包括从第一设备接收消息。

[0193] 在一方面，处理器 204 被配置成执行关于框 604 所讨论的功能中的一个或多个功能。在一方面，用于与第一设备进行消息通信的装置可包括处理器 204。在一些方面，第一设备是接入点。

[0194] 指示无线通信流方向的该消息（例如，在框 502 中生成的消息或在框 602 中接收到的消息）可按各种方式来组成。图 7 示出了包括标识无线通信流方向的指示符的消息的一种实现。消息 700 或基本类似的消息可以如上关于图 5 所述地从 AP 传送至相关联的无线站。消息 700 或基本类似的消息还可在过程 600 的框 602 中被接收。消息 700 可以使用适于从 AP 至站的传输的任何过程和方法来传送。

[0195] 在解说性实现中，该消息定义受限接入窗，即接入点声明为被保留用于所选无线站群（诸如 802.11ah 协议中所指定的无线站群）的时间段。该消息包括指示受限接入窗的开始时间的 RAW 开始时间 702。该消息还包括指示受限接入窗的历时的 RAW 历时 704。该消息还包括列出被允许在该受限接入窗期间向该接入点发送分组的所选无线站群的群 ID 706。

[0196] 另外，该消息包括用于指示无线通信流方向的字段 708。在一方面，字段 708 可包括可被设为逻辑值 0 或 1 的一个位，其中逻辑值 1 指示在受限接入窗期间的无线通信流是上行链路方向，而逻辑值 0 指示在受限接入窗期间的无线通信流是下行链路方向。在另一方面，这些逻辑值可被反转。在另一方面，字段 708 可包括不止 1 个位。在这些方面，字段 708 可以指示在受限接入窗期间的无线通信流是上行链路方向、下行链路方向、或是双向的。在一方面，字段 708 可以对下行链路数据和上行链路数据进行优先级排序。例如，字段 708 可以指示下行链路数据比上行链路数据的优先级高。替换地，字段 708 可以指示上行链路数据比下行链路数据的优先级高。

[0197] 图 8 是根据一种实现的无线通信方法的流程图。方法 800 可由用于无线通信的装置（诸如接入点 (AP)104（图 1 中示出）或图 2 中示出的无线设备 202）来执行。方法 800

可以改进接入点管理其在某些时间段期间接收的通信类型的能力。例如，一些接入点可以确定非关联站不应该在受限接入窗期间与其通信。其它接入点可以确定它们将允许非关联站在某些时间段期间（例如，在某些受限接入窗期间）与它们通信。接入点管理其在一个或多个时间段（诸如一个或多个受限接入窗）期间接收的话务的这种改进的能力可以提供无线通信网络的更为高效的操作。

[0198] 在框 802，该方法包括生成消息，该消息指示不与一装置相关联的一个或多个设备是否被允许在由该消息定义的时间段期间与该装置通信。在一方面，该消息进一步指示该时间段由接入点声明为被保留供所选无线站群（诸如 802.11ah 协议中指定的站群）进行通信。例如，在一些方面，BSSID 可被包括在所生成的消息中以标识站群。

[0199] 在一方面，该消息可以指示该时间段将仅被用于站的关联。在这一方面，仅非关联站可以在由该消息所定义的时间段期间与该装置通信。替换地，该消息可以指示该时间段可被相关联站群以及非关联站两者使用。在一些方面，该消息包括至少两个特异的指示符，第一指示符指示非关联站是否可以利用该时间段，而第二指示符指示相关联站是否可以利用该时间段或者哪些相关联站可以利用该时间段。

[0200] 在一方面，该消息被生成为受限接入窗 (RAW) 消息。在一些方面，该消息被生成为指示相关联设备（诸如特定设备）是否也可以使用该时间段来与该装置通信。在这些方面，这些特定设备可在该消息中例如通过唯一性设备标识符或网络地址来标识。在一些方面，该消息被生成为指示相关联站群是否也可以使用该时间段来与该装置通信。框 802 的一些方面可以执行关于框 502、1102、1402、1702 和 / 或 2202 讨论的功能中的一个或多个功能。

[0201] 在一些方面，该消息可以经由短信标帧中的 raw 参数集 (RPS) 元素来指示不与该装置相关联的设备被允许与该装置通信。RPS 元素可以指示期间所有 STA 被允许接入介质或与接入点通信的 RAW。在一些方面，这可以经由 RPS 元素中为全零的 RAW 群字段来指示。此种 RAW 可被用于关联新 STA。

[0202] 在一方面，处理器 204 可被配置成执行关于框 802 所讨论的功能中的一个或多个功能。在一方面，用于生成的装置可包括处理器 204。

[0203] 在框 804，传送所生成的消息。在一方面，发射机 210 可被配置成执行关于框 804 所讨论的功能中的一个或多个功能。在一方面，该消息被传送给站。在一方面，用于传送的装置可包括发射机 210。在另一方面，处理器 204 可被配置成执行以上关于框 804 所讨论的功能中的一个或多个功能。在一方面，用于传送所生成的消息的装置可包括处理器 204。

[0204] 过程 800 的一些方面进一步包括在所指示的时间段期间从非关联设备（诸如站）接收消息，并基于在该时间段内接收到该消息而传送对该消息的响应。该过程还可包括在该时间段以外从非关联设备（诸如站）接收消息。作为响应，一消息可被传送，其实质上是“否定确收 (nak-ing)”或者另行向该消息的发射机提供关于该装置将因为它是在该时间段以外被接收到而不会处理该消息的否定指示。在其它方面，在该时间段以外接收到的消息可以简单地被接收该消息的设备丢弃或忽略。在该时间段以外接收消息可由接收机 212 或处理器 204 来执行。用于接收的装置可包括处理器 204 和 / 或接收机 212。用于丢弃或忽略的装置可包括处理器 204。用于传送响应的装置可包括处理器 204 和 / 或发射机 210。

[0205] 过程 800 的一些方面包括如果所生成的消息指示各设备不被允许在该时间段期间与该装置通信，则在该时间段期间休眠。用于在该时间段期间休眠的装置可包括处理器

204。

[0206] 图 9 是根据一种实现的无线通信方法的流程图。方法 900 可由用于无线通信的装置（诸如站 106（图 1 中示出）或图 2 中示出的无线设备 202）来执行。在一些方面，方法 900 可以使站能在无线通信网络上与执行过程 800 的接入点互操作。

[0207] 在框 902，该方法包括接收消息，该消息指示不与一装置相关联的一个或多个设备是否被允许在由该消息定义的时间段期间与该装置通信。在一方面，该消息进一步指示该时间段被保留供所选无线站群进行通信。例如，该消息可以是受限接入窗 (RAW) 消息，类似于 802.11ah 协议中规定的 RAW 消息。框 902 的一些方面可以执行关于框 602、1202、1502、1802 和 / 或 2302 讨论的功能中的一个或多个功能。

[0208] 在一方面，接收机 212 被配置成执行关于框 902 所讨论的功能中的一个或多个功能。在一方面，用于接收的装置可包括接收机 212。在另一方面，处理器 204 可被配置成执行以上关于框 902 所讨论的功能中的一个或多个功能。在一方面，用于接收的装置可包括处理器 204。

[0209] 框 902 可进一步包括 :解码收到消息以确定不与该装置相关联的一个或多个设备是否被允许在由该消息定义的时间段期间与该装置通信。框 902 还可包括解码收到消息以确定接入点声明为被保留用于所选无线站群的时间段。框 902 还可包括将收到消息解码为受限接入窗消息。在一些方面，用于解码的装置包括处理器 204。

[0210] 在框 904，基于该指示来选择性地向该装置传送消息。在一方面，如果该指示是指示了第一值，则关联消息被传送给该装置，并且如果该指示是指示了第二值，则关联消息不被传送给该装置。在一方面，发射机 210 被配置成执行关于框 904 所讨论的功能中的一个或多个功能。在一方面，用于传送的装置可包括发射机 210。在另一方面，处理器 204 可被配置成执行以上关于框 904 所讨论的功能中的一个或多个功能。在一方面，用于传送所生成的消息的装置可包括处理器 204。

[0211] 指示不与该装置相关联的一个或多个设备是否被允许在一时间段期间与该装置通信的消息（诸如以上在框 802 中生成的消息、或以上在框 902 中收到的消息）可按各种方式来组成。图 10 示出了指示不与该装置相关联的一个或多个设备是否被允许在一时间段期间与该装置通信的消息的一种实现。消息 1000 可以如上关于图 8 所述地从 AP 传送至无线站。消息 1000 可以使用适于从 AP 至站的传输的任何过程和方法来传送。

[0212] 在解说性实现中，该消息定义受限接入窗，即接入点声明为被保留用于所选无线站群（诸如 802.11ah 协议中所指定的无线站群）的时间段。该消息包括指示受限接入窗的开始时间的 RAW 开始时间 702。该消息还包括指示受限接入窗的历时的 RAW 历时 704。该消息还包括列出被允许在该受限接入窗期间向该接入点发送分组的所选无线站群的群 ID 706。

[0213] 另外，该消息包括字段 1008，字段 1008 用于指示不与该装置相关联的一个或多个设备是否被允许在由 RAW 开始时间 702 和 RAW 历时 704 定义的时间段期间与该装置通信。该消息还包括列出被允许在该受限接入窗期间向该接入点发送分组的所选无线站群的群 ID 706。在一方面，字段 1008 可包括可被设为逻辑值 0 或 1 的一个位，其中逻辑值 1 指示不与该装置相关联的一个或多个设备被允许在该时间段期间与该装置通信，而逻辑值 0 指示在该时间段期间不允许此种通信。在一方面，这些逻辑值可被反转。在另一方面，字段 1008

可包括不止 1 个位。在这些方面，字段 1008 可以指示该时间段被分配仅用于非关联站的关联。替换地，此种字段可以指示该时间段被分配用于站群，但非关联站也可以在该时间段期间与该装置通信。在又一替换方案中，该字段可以指示该时间段被分配仅用于相关联站。

[0214] 图 11 是根据一种实现的无线通信方法的流程图。方法 1100 可由用于无线通信的装置（诸如接入点 (AP)104（图 1 中示出）或图 2 中示出的无线设备 202）来执行。方法 1100 可以提供对时间段或窗口的期满时间的改进确定。在一些目前方法中，时间段的期满时间可基于可能不为接入点所知的参数来确定。例如，一些期满时间基于信标传输的结束。因为有一些无线节点要预测信标信号的结束可能是困难的或不可能的，所以这些节点可能无法确定时间段或窗口的期满时间。这可能妨碍这些节点在与该时间段或窗口的期满方面的不确定性相等效的时间段里进入休眠状态。方法 1100 规定时间段的期满基于信标区间数量。因为信标区间的长度是已知的，因此无线网络上利用以下过程 1100 和 1200 的站或接入点可以改进其对时间段或窗口的结束的预测。

[0215] 在框 1102，该方法包括生成消息，该消息指示期间一个或多个所标识的设备被允许与该装置通信的窗口的期满时间，其中该期满时间是基于信标区间数量来指示的。在一方面，该消息被生成为受限接入窗消息，诸如 802.11ah 协议中指定的受限接入窗消息。在一些方面，该消息被生成为指示相关联站群也可以使用该时间段来与该装置通信。

[0216] 在一些方面，特定值可被保留以指示该窗口未期满。例如，在一些方面，为这一目的所保留的特定值是零 (0)。在这些方面，如果信标区间数量被设为零，则该消息指示该窗口未期满。在一些方面，该消息可被生成为基本上遵照消息 1300 的格式，如以下关于图 13 所讨论的。

[0217] 在一些方面，所生成的消息可包括周期性操作参数子字段。在一些方面，该周期性操作参数子字段可以是三个八位位组长。在一些方面，该周期性操作参数子字段包括周期性受限接入窗 (PRAW) 周期性、PRAW 有效性、以及 PRAW 开始偏移子字段。PRAW 周期性子字段以短信标区间为单位指示当前 PRAW 发生的周期，并且在一些方面是 8 位。PRAW 有效性子字段指示 PRAW 重复的周期数，并且在一些方面是 8 位长。例如，PRAW 有效性子字段可以如上所讨论地基于信标区间数量来指示 PRAW 的历时。PRAW 开始偏移子字段指示该 PRAW 的第一窗口的出现距（短）信标帧的结束的以时间单位 (TU) 计的偏移值，并且为 8 位长。

[0218] 框 1102 的一些方面可以执行关于框 502、1802、1402、1702 和 / 或 2202 所讨论的功能中的一个或多个功能。

[0219] 在一方面，处理器 204 被配置成执行关于框 1102 所讨论的功能中的一个或多个功能。在一方面，用于生成消息的装置可包括处理器 204。

[0220] 在框 1104，传送所生成的消息。在一方面，该消息可包括信标区间数量字段。在这些方面中的一些方面，信标区间数量字段的特定值可被保留以指示该窗口未期满。在这些方面，传送其中该信标区间数量字段被设为该保留值的消息指示该窗口未期满。在这些方面，可以传送其中该信标区间数量字段被设为除该保留值以外的值的第二消息以指示将在所指示的信标区间数量之后期满的窗口。

[0221] 在一个方面，发射机 210 被配置成执行关于框 1104 所讨论的功能中的一个或多个功能。在另一方面，处理器 204 可被配置成执行以上关于框 1104 所讨论的功能中的一个或多个功能。在一方面，用于传送所生成的消息的装置可包括发射机 210 和 / 或处理器 204。

[0222] 方法 1100 可进一步包括从一个或多个所标识的设备接收第二消息，并基于该消息是否在该窗口期间和 / 或在该窗口期满之前被接收到来处理该消息。用于接收第二消息的装置可以由处理器 204 和 / 或接收机 212 中的一个或多个来执行。

[0223] 过程 1100 的一些方面进一步包括生成和传送也包括该窗口的期满时间的后续消息。这一后续消息有效地重新定义了该窗口的由任何先前生成并传送的消息所定义的期满时间。例如，在这些方面，如果先前传送的消息指示了该窗口未期满，则后续生成并传送的消息可以指示该窗口会在特定数量的信标区间之后期满。该生成和传送可以由处理器 204 和 / 或发射机 210 中的一个或多个来执行。用于生成的装置和用于传送的装置可包括处理器 204 和 / 或发射机 210 中的一者或多者。

[0224] 图 12 是根据一种实现的无线通信方法的流程图。方法 1200 可由用于无线通信的装置（诸如站 106（图 1 中示出）或图 2 中示出的无线设备 202）来执行。在一个方面，方法 1200 可以使站能与执行过程 1100 的接入点互操作。

[0225] 在框 1202，该方法包括接收消息，该消息指示期间一个或多个所标识的设备被允许与接入点通信的窗口的期满时间，该期满时间基于信标区间数量。框 1202 的一些方面可以执行关于框 602、902、1502、1802 和 / 或 2302 所讨论的功能中的一个或多个功能。

[0226] 在一方面，接收机 212 被配置成执行关于框 1202 所讨论的功能中的一个或多个功能。在一方面，用于接收指示期满时间的消息的装置可包括接收机 212。在另一方面，处理器 204 可被配置成执行以上关于框 1202 所讨论的功能中的一个或多个功能。在一方面，用于接收的装置可包括处理器 204。

[0227] 在一些方面，框 1202 包括解码收到消息以确定该窗口的期满时间。在一些方面，该解码可由处理器 204 来执行。在一些方面，用于解码的装置可包括处理器 204。

[0228] 在一方面，收到消息进一步指示接入点声明为被保留用于所选无线站群（诸如 802.11ah 协议中指定的无线站群）的时间段。在一方面，收到消息是受限接入窗消息。在一些方面，收到消息可以基本上遵照消息 1300 的格式，如以下所讨论的。一些方面包括解码收到消息以确定接入点声明为被保留用于所选无线站群的时间段。在一些方面，用于解码的装置可包括处理器 204。过程 1200 的一些方面包括将收到消息解码为受限接入窗消息。用于解码的装置可包括硬件处理器 204。

[0229] 在框 1204，在该窗口期间传送消息。在一些方面，在该窗口期间的消息传送基于在框 1202 中接收到的消息。在一方面，发射机 210 被配置成执行关于框 1204 所讨论的功能中的一个或多个功能。在一方面，用于在该窗口期间传送消息的装置可包括发射机 210。在另一方面，处理器 204 可被配置成执行以上关于框 1204 所讨论的功能中的一个或多个功能。在一方面，用于在该窗口期间传送消息的装置可包括处理器 204。

[0230] 在一方面，所传送的消息可包括信标区间数量字段。在这些方面中的一些方面，信标区间数量字段的特定值可以指示该窗口未期满。在这些方面，接收其中该信标区间数量字段被设为特定值的消息指示该窗口未期满。在这些方面，可以接收其中该信标区间数量字段被设为除该特定值以外的值的第二消息以指示该窗口将在所指示数量的信标区间之后期满。

[0231] 指示窗口的期满时间的消息（如以上关于图 11 和 12 所讨论的）可按各种方式来组成。图 13 示出了指示窗口的期满时间的消息的一种实现。消息 1300 可以如上关于图 11

所述地从 AP 传送至相关联的无线站。消息 1300 可以使用适于从 AP 至站的传输的任何过程和方法来传送。

[0232] 在解说性实现中，该消息定义受限接入窗，即接入点声明为被保留用于所选无线站群（诸如 802.11ah 协议中所指定的无线站群）的时间段。该消息包括指示受限接入窗的开始时间的 RAW 开始时间 702。该消息还包括指示受限接入窗的历时的 RAW 历时 704。该消息还包括列出被允许在该受限接入窗期间向该接入点发送分组的所选无线站群的群 ID 706。

[0233] 另外，该消息包括用于指示受限接入窗的期满时间的字段 1308。在所解说的方面，该期满时间是基于信标数量来指示的。如以上所讨论的，字段 1308 的特定值可被保留以指示该窗口未期满。在这些方面，具有被设为该特定值的字段 1308 的消息 1300 的第一版本可被发送，由此指示该窗口未期满。稍后，具有被设为除该特定值以外的值的字段 1308 的消息 1300 的第二版本可被传送。第二消息指示该窗口的期满时间在字段 1308 中指定的信标区间数量之后。

[0234] 图 14 是根据一种实现的无线通信方法的流程图。方法 1400 可由用于无线通信的装置（诸如接入点 (AP)104（图 1 中示出）或图 2 中示出的无线设备 202）来执行。在一些目前方法中，时间段的开始时间可基于可能不为无线网络上的一个或多个设备所知的参数来确定。例如，一些开始时间基于信标传输的结束。因为有一些无线节点要预测信标信号的结束可能是困难的或不可能的，所以这些节点可能无法确定时间段或窗口的开始时间。这可能妨碍这些节点在与该时间段或窗口的开始方面的不确定性相等效的时间段里进入休眠状态。方法 1400 规定时间段的开始基于由装置维持的时间基准。因为该装置维持该时间基准，并可向无线网络上的其它设备传达基于该时间基准的同步信号，所以该时间段的开始可被容易地确定。因为这一点，所以无线网络上利用以下过程 1400 和 1500 的站或接入点可以改进其对时间段或窗口的开始的预测。

[0235] 在框 1402，该方法包括生成消息，该消息指示期间一个或多个所标识的设备被允许与该装置通信的窗口的开始时间，该开始时间基于由该装置维持的绝对时间基准。在一方面，该时间基准是目标信标传送时间 (TBTT)。在另一方面，该时间基准是定时同步功能 (TSF)。在一些方面，该消息被生成为受限接入窗 (RAW) 消息。受限接入窗消息指示该受限接入窗的开始时间和历时。

[0236] 在一些方面，框 1402 可以执行关于框 502、802、1102、1702（以下讨论）和 / 或 2202（也在以下讨论）所讨论的功能中的一个或多个功能。

[0237] 在一方面，处理器 204 可被配置成执行关于框 1402 所讨论的功能中的一个或多个功能。在一方面，用于生成指示窗口的开始时间的消息的装置可包括处理器 204。

[0238] 在框 1404，传送所生成的消息。在一方面，该消息是目标苏醒时间信息元素 (TWT IE)。在一方面，发射机 210 被配置成执行关于框 1404 所讨论的功能中的一个或多个功能。在一方面，用于传送所生成的消息的装置可包括发射机 210。在另一方面，处理器 204 可被配置成执行以上关于框 1404 所讨论的功能中的一个或多个功能。在一方面，用于传送所生成的消息的装置可包括处理器 204。

[0239] 图 15 是根据一种实现的无线通信方法的流程图。方法 1500 可由用于无线通信的装置（诸如站 106（图 1 中示出）或图 2 中示出的无线设备 202）来执行。在一方面，方法

1500 可以使站能与执行以上方法 1400 的接入点互操作。

[0240] 在框 1502，该方法包括接收消息，该消息指示期间一个或多个所标识的设备被允许与接入点通信的窗口的开始时间，该开始时间基于由该接入点维持的绝对时间基准。在一方面，该消息是目标苏醒时间信息元素 (TWT IE)。在一方面，该时间基准是目标信标传送时间 (TBTT)。在一方面，该时间基准是定时同步功能 (TSF)。

[0241] 在一方面，接收机 212 被配置成执行关于框 1502 所讨论的功能中的一个或多个功能。在一方面，用于接收指示窗口的开始时间的消息的装置可包括接收机 212。在另一方面，处理器 204 可被配置成执行以上关于框 1502 所讨论的功能中的一个或多个功能。在一方面，用于接收的装置可包括处理器 204。

[0242] 框 1502 的一些方面包括解码收到消息以确定该窗口的开始时间。在一些方面，处理器 204 可以执行该解码。在一些方面，用于解码收到消息的装置包括处理器 204。在一些方面，用于解码的装置被被配置成将时间基准解码为目标信标传送时间 (TBTT) 或解码为定时同步功能 (TSF)。在一些方面，用于解码的装置被配置成将收到消息解码为受限接入窗消息。

[0243] 框 1502 的一些方面可以执行关于框 602、902、1202、1802（以下讨论）和 / 或 2302（也在以下讨论）所讨论的功能中的一个或多个功能。

[0244] 在框 1504，基于该消息来限制无线通信网络上的通信。在一些方面，由过程 1500 接收第二消息。第二消息基于是否是在该窗口期间接收到第二消息而被处理。该窗口可以至少部分地由在框 1502 中收到的消息中所指示的开始时间来定义。过程 1500 的一些方面包括传送指示从由该装置维持的时间基准推导出的第二时间基准的信标消息。

[0245] 在一方面，处理器 204 被配置成执行关于框 1504 所讨论的功能中的一个或多个功能。在一方面，用于限制无线通信网络上的通信的装置可包括处理器 204。在一些方面，用于限制的装置可包括用于传送指示从由该装置维持的时间基准推导出的第二时间基准的信标消息的装置。在一些方面，用于传送的装置可包括发射机 210 和 / 或处理器 204。在一些方面，用于接收第二消息的装置可包括接收机 212 或硬件处理器 204 中的一者或多者。在一些方面，用于基于是否是在该窗口期间收到第二消息来处理第二消息的装置可包括硬件处理器 204。

[0246] 指示窗口的开始时间的消息可按各种方式来组成。图 16 示出了指示窗口的开始时间的一种实现。消息 1600、或者具有与消息 1600 基本上类似字段的消息可以如上关于图 14 所述地从 AP 传送至相关联的无线站。消息 1600、或包括与消息 1600 基本上类似字段的消息可在过程 1500 的框 1502 中被接收，如以上所讨论的。消息 1600 可以使用适于从 AP 至站的传输的任何过程和方法来传送。

[0247] 在解说性实现中，该消息定义受限接入窗，即接入点声明为被保留用于所选无线站群（诸如 802.11ah 协议中所指定的无线站群）的时间段。该消息包括指示受限接入窗的开始时间的 RAW 开始时间 702。在一些方面，RAW 开始时间 702 可以是八 (8) 位长并指示从包括 EPS 元素的（短）信标或（短）探测响应帧传输的结束到受限接入窗 (RAW) 的开始时间的以时间单位 (TU) 计的历时。用于 RAW 开始时间子字段 802 的时间单位是 2 个时间单位 (TU)。

[0248] 在一些方面，该消息还包括指示受限接入窗的历时的 RAW 历时 704。该消息还包括

列出被允许在该受限接入窗期间向该接入点发送分组的所选无线站群的群 ID 706。

[0249] 在以上所述的方法的一个方面，RAW 开始时间 702 可以基于由装置（例如，传送消息 1600 的装置）维持的时间基准。如以上关于过程 1400 和 1500 所讨论的，在一些方面，RAW 开始时间 702 可以基于目标信标传送时间 (TBTT)。在另一方面，RAW 开始时间 702 可基于定时同步功能 (TSF)。

[0250] 图 17 是根据一种实现的无线通信方法的流程图。方法 1700 可由用于无线通信的装置（诸如接入点 (AP)104（图 1 中示出）或图 2 的无线设备 202）来执行。方法 1700 可以提供一个或多个站与用于无线网络上的传输的时间段的改进关联。例如，一些目前方法可能不允许个体站与用于传输的时间段相关联。相反，这些方法可以提供站群与用于传输的时间段的关联。通过使时间段或窗口能与一个或多个站相关联，可以得到对无线网络上的通信的改进控制，从而导致无线网络的改进的效率和性能。

[0251] 在框 1702，该方法包括生成消息，该消息标识特定设备或不受限设备群，并且标识期间所标识的特定设备或不受限设备群被允许与一装置通信的时间段。在一方面，该消息标识不受限设备群的每个成员。例如，该消息可包括提供关于不受限设备群中的每个设备的设备标识符的字段或其它指示。在一方面，该消息标识两个或更多个特定设备，并且该时间段标识期间该两个或更多个特定设备被允许与该装置通信的时间。例如，该消息可以标识多于 64 个不同设备。

[0252] 在一方面，该消息是受限接入窗消息。受限接入窗消息可包括指示在该受限接入窗时段期间被允许受限接入的站的 AID 的群子字段。在一些方面，该群子字段可包括寻呼索引、在受限接入窗时段期间被允许接入的站的起始 AID、以及在受限接入窗时段期间被允许接入的站的结束 AID。在这些方面，根据 AID 的阶层式寻址方法，具有在起始 AID 与结束 AID 之间或包括起始 AID 和结束 AID 的 AID 的任何站被允许在受限接入窗时段期间接入。以此方式，可被允许在受限接入窗时段期间接入的站的数量不受限制。

[0253] 框 1702 的一些方面可以执行关于框 502、802、1102、1402 和 / 或 2202（以下讨论）所讨论的功能中的一个或多个功能。

[0254] 在一方面，处理器 204 可被配置成执行关于框 1702 所讨论的功能中的一个或多个功能。在一方面，用于生成标识特定设备或不受限设备群的消息的装置可包括处理器 204。

[0255] 在框 1704，传送所生成的消息。在一些方面，过程 1700 进一步包括：在由所生成和传送的消息标识的时间段期间从源设备接收消息。收到消息是基于该消息来自源设备并且基于该收到消息是在由所生成和传送的消息所标识的时间段内被接收到而被处理的。例如，因为该消息是在该时间段期间从源设备接收的，所以如果所生成的消息标识了该源设备，则该消息可被完全处理。如果该消息向接收方设备请求某种资源，则在源设备被在框 1702 中生成的消息所标识的情况下，这些资源可被分配并且响应被发送给该源设备。如果所生成的消息没有直接经由设备标识符或间接通过标识该源设备所属的群来标识收到消息的源设备，则在该时间段期间从源设备收到的消息可以不按常规方式被处理。例如，该消息可被丢弃或忽略，而不对源设备作出响应。在一些方面，响应可被生成并传送给源设备，但是该响应可以指示否定确收，或者另行传达出错状态，因为该消息是在该时间段期间接收自源设备的，但是源设备未被准许在该时间段期间向执行过程 1700 的设备传送消息。

[0256] 在一方面，处理器 204 和 / 或发射机 210 中的一者或多者可被配置成执行关于框

1704 所讨论的功能中的一个或多个功能。在一方面，用于传送消息的装置可包括发射机 210 和 / 或处理器 204。

[0257] 图 18 是根据一种实现的无线通信方法的流程图。方法 1800 可由用于无线通信的装置（诸如站 106（图 1 中示出）或图 2 的无线设备 202）来执行。在一方面，方法 1800 可以使站能与执行过程 1700 的接入点交互。

[0258] 在框 1802，该方法包括接收消息，该消息指示期间一个或多个所标识的设备被允许与接入点通信的窗口的开始时间。在一方面，该消息可被解码以标识两个或更多个特定设备，并且标识期间该两个或更多个特定设备被允许与该装置通信的时间段。例如，在一个方面，该消息可被解码以标识被允许与该装置通信的 64 个以上设备。在一方面，该消息被解码为受限接入窗消息。

[0259] 框 1802 的一些方面可包括关于框 602、902、1202、1502 和 / 或 2302（以下讨论）所讨论的功能中的一个或多个功能。

[0260] 在一方面，处理器 204 和 / 或接收机 212 中的一者或多者可被配置成执行关于框 1802 所讨论的功能中的一个或多个功能。在一方面，用于接收指示窗口的开始时间的消息的装置可包括接收机 212。在另一方面，处理器 204 可被配置成执行以上关于框 1802 所讨论的功能中的一个或多个功能。在一方面，用于接收的装置可包括处理器 204。在一方面，用于解码收到消息以标识窗口的开始时间的装置可包括处理器 204。用于解码收到消息以标识时间段的装置也可包括处理器 204。在一些方面，用于解码收到消息的装置被配置成解码该消息以标识两个或更多个特定设备，如上所讨论的。用于解码的装置还可被配置成解码该时间段以标识期间这两个或更多个特定设备被允许与接入点通信的时间。在一些方面，用于解码的装置被配置成将收到消息解码为受限接入窗消息。

[0261] 在框 1804，基于该消息来限制无线通信网络上的通信。例如，在一些方面，如果收到消息被解码以标识接收该消息的设备的设备标识符，则接收方设备可以在由该消息所标识的时间段期间与该装置通信。例如，该设备可以在该时段期间向该接入点传送消息。替换地，如果接收方设备不被该消息所标识，则该设备可以确定不在所标识的时间段期间与接入点通信。

[0262] 类似地，如果收到消息标识了不包括接收方设备的不受限设备群，则接收方设备可以不在所标识的时间段期间与传送该消息的装置通信。替换地，如果接收方设备在该消息中被标识（具体地经由设备标识符、或间接经由接收方设备是其一部分的设备群的标识），则接收方设备可在所标识的时间段期间与传送了该收到消息的装置通信。

[0263] 在一方面，处理器 204 可被配置成执行以上关于框 1804 所讨论的功能中的一个或多个功能。在一方面，用于限制无线通信网络上的通信的装置可包括处理器 204。在一个方面，用于限制的装置被进一步配置成确定该装置是否被收到消息所标识，并在该装置被标识的情况下在该时间段期间向接入点传送消息。在一些方面，用于限制的装置被进一步配置成在该装置不被标识的情况下在该时间段期间不向接入点传送消息。

[0264] 在过程 1700 中生成和传送的消息以及在过程 1800 中接收和解码的消息可按各种方式来组成。图 19 示出了标识特定设备或不受限设备群的消息的一种实现。消息 1900 可以如上关于图 17 所述地从 AP 传送至相关联的无线站。例如，消息 1900、或基本上类似于消息 1900 的消息可在框 1702 中生成并在框 1704 中被传送。类似地，消息 1900、或基本上类

似于消息 1900 的消息可在框 1802 中被接收和 / 或解码。消息 1900 可以使用适于从 AP 至站的传输的任何过程和方法来传送。

[0265] 在解说性实现中，该消息定义受限接入窗，即接入点声明为被保留用于所选无线站群（诸如 802.11ah 协议中所指定的无线站群）的时间段。该消息包括指示受限接入窗的开始时间的 RAW 开始时间 702。该消息还包括指示受限接入窗的历时的 RAW 历时 704。该消息还包括列出被允许在该受限接入窗期间向该接入点发送分组的所选无线站群的群 ID 706。

[0266] 另外，该消息包括用于指示特定站的字段 1908。在所解说的方面，由字段 1908 所标识的特定站被允许在由受限接入窗所标识的时间段期间与接入点通信。

[0267] 在消息 1900 的一些方面，该消息可包括指示在该受限接入窗时段期间被允许受限接入的站的 AID 的群子字段。在一些方面，该群子字段可包括寻呼索引、在受限接入窗时段期间被允许接入的站的起始 AID、以及在受限接入窗时段期间被允许接入的站的结束 AID。在这些方面，根据 AID 的阶层式寻址方法，具有在起始 AID 与结束 AID 之间或包括起始 AID 和结束 AID 的 AID 的任何站被允许在受限接入窗时段期间接入。以此方式，可被允许在受限接入窗时段期间接入的站的数量不受限制。

[0268] 图 20 是根据一种实现的无线通信方法的流程图。方法 2000 可由用于无线通信的装置（诸如接入点 (AP)104（图 1 中示出））来执行。方法 2000 可以提供使与无线网络上的多个群相关联的站进入休眠状态的改进能力。例如，通过先前的方法，与无线网络上的多个群相关联的站可以在与该站所关联的每个群相关联的目标苏醒时间期间保持苏醒并监听网络话务。

[0269] 在框 2002，该方法包括传送消息，该消息包括目标苏醒时间和该目标苏醒时间的标识符。在一方面，该消息是（或者包括）目标苏醒时间信息元素 (TWT IE)。

[0270] 在一方面，发射机 210 可被配置成执行关于框 2002 所讨论的功能中的一个或多个功能。在一方面，用于传送包括目标苏醒时间和该目标苏醒时间的标识符的消息的装置是发射机 210。在另一方面，处理器 204 可被配置成执行以上关于框 2002 所讨论的功能中的一个或多个功能。在一方面，用于传送包括目标苏醒时间和该目标苏醒时间的标识符的消息的装置可包括处理器 204。

[0271] 在框 2004，传送包括目标苏醒时间的标识符的寻呼消息。在一方面，发射机 210 可被配置成执行关于框 2004 所讨论的功能中的一个或多个功能。在一方面，用于传送包括目标苏醒时间和该目标苏醒时间的标识符的消息的装置可包括发射机 210。在一方面，用于传送寻呼消息的装置可包括发射机 210。在另一方面，处理器 204 可被配置成执行以上关于框 2004 所讨论的功能中的一个或多个功能。在一方面，用于传送寻呼消息的装置可包括处理器 204。

[0272] 图 21 是根据一种实现的无线通信方法的流程图。方法 2100 可由用于无线通信的装置（诸如站 106（图 1 中示出）或图 2 中示出的无线设备 202）来执行。在一方面，方法 2100 可以使站能与执行以上讨论的方法 2000 的接入点互操作。在框 2102，该方法包括接收消息，该消息指示目标苏醒时间和该目标苏醒时间的标识符。在一方面，该消息是（或者包括）目标苏醒时间信息元素 (TWT IE)。在一方面，接收机 212 可被配置成执行关于框 2102 所讨论的功能中的一个或多个功能。在一方面，用于接收指示目标苏醒时间和该目标

苏醒时间的标识符的消息的装置可包括接收机 212。在另一方面，处理器 204 可被配置成执行以上关于框 2102 所讨论的功能中的一个或多个功能。在一方面，用于接收的装置可包括处理器 204。

[0273] 在框 2104，接收指示目标苏醒时间的标识符的寻呼消息。在一些方面，框 2104 可包括解码该寻呼消息以确定该标识符。在一方面，接收机 212 可被配置成执行关于框 2104 所讨论的一个或多个功能。在一方面，用于接收指示目标苏醒时间的标识符的寻呼消息的装置可包括接收机 212。在另一方面，处理器 204 可被配置成执行以上关于框 2104 所讨论的功能中的一个或多个功能。在一方面，用于接收指示目标苏醒时间的标识符的寻呼消息的装置可包括处理器 204。

[0274] 图 22 是根据一种实现的无线通信方法的流程图。方法 2200 可由用于无线通信的装置（诸如接入点 (AP)104（图 1 中示出）或图 2 的无线设备 202）来执行。方法 2200 可以提供用于管理由第一设备向第二设备传送的上行链路话务的改进能力。在一方面，第一设备是站而第二设备是接入点。在目前方法中，目标苏醒时间消息可被标识为提供传送上行链路话务或下行链路话务的机会。如果上行链路话务将被发送，则上行链路话务的发射机（第一设备）将在由目标苏醒时间所标识的传输区间期间的数据传输之前传送请求发送消息。作为响应，清除发送 (clear to send) 消息可由第二设备传送给第一设备。在收到清除发送消息后，上行链路话务的发射机将发起数据传递。在一些网络环境中，第二设备可以确定请求发送 / 清除发送消息通信交换是不必要的。在这些网络环境中，方法 2200 提供了使第二设备向第一设备指示在发起数据传输之前不需要请求发送消息的能力。这可导致无线通信网络的改进的操作效率。

[0275] 在框 2202，该方法包括生成消息，该消息指示目标苏醒时间和上行链路方向指示符，该消息进一步指示是否应在传送上行链路数据之前传送请求发送消息。框 2202 的一些方面可以执行关于框 502、802、1102、1402 和 / 或 1702 所讨论的功能中的一个或多个功能。

[0276] 在一方面，处理器 204 可被配置成执行关于框 2202 所讨论的一个或多个功能。在一方面，用于生成指示目标苏醒时间和上行链路方向指示符的消息的装置可包括处理器 204。在框 2204，传送所生成的消息。在一方面，发射机 210 被配置成执行以上关于框 2204 所讨论的功能中的一个或多个功能。在一方面，用于传送所生成的消息的装置可包括发射机 210。在另一方面，处理器 204 可被配置成执行以上关于框 2204 所讨论的功能中的一个或多个功能。在一方面，用于传送所生成的消息的装置可包括处理器 204。

[0277] 图 23 是根据一种实现的无线通信方法的流程图。方法 2300 可由用于无线通信的装置（诸如站 106（图 1 中示出））来执行。在一方面，方法 2300 可以使站能与执行以上讨论的方法 2200 的接入点互操作。在框 2302，该方法包括接收消息，该消息指示目标苏醒时间和上行链路方向指示符，该消息进一步指示是否应在传送上行链路数据之前传送请求发送消息。框 2302 的一些方面可以执行关于框 602、902、1202、1502 和 / 或 1802 所讨论的功能中的一个或多个功能。

[0278] 在一方面，接收机 212 可被配置成执行关于框 2302 所讨论的功能中的一个或多个功能。在一方面，用于接收指示目标苏醒时间和上行链路方向指示符的消息的装置包括接收机 212。在另一方面，处理器 204 可被配置成执行以上关于框 2302 所讨论的功能中的一个或多个功能。在一方面，用于接收的装置可包括处理器 204。

[0279] 在框 2304，基于该消息是否指示应在传送上行链路数据之前传送请求发送消息而传送请求发送消息。在一方面，发射机 210 可被配置成执行以上关于框 2304 所讨论的功能中的一个或多个功能。在一方面，用于传送请求发送消息的装置可包括发射机 210。在另一方面，处理器 204 可被配置成执行以上关于框 2304 所讨论的功能中的一个或多个功能。在一方面，用于传送请求发送消息的装置可包括处理器 204。

[0280] 在以上实现中的一些实现中，来自接入点的消息指定受限接入窗，即接入点声明为被保留用于所选无线站群（诸如 802.11ah 协议中所指定的无线站群）的时间段。替换地，该消息可以指定期间向所有无线站授予对介质的接入的接入窗口。换言之，接入点在该接入窗口期间将接受来自所有无线站的分组。在一种实现中，该消息可进一步包括用于指示在该接入窗口之外没有接入的标志，诸如标志 708（参加图 7）。这允许接入点定义该接入点的活跃时间段和非活跃时段。

[0281] 如本文所使用的，术语“确定”涵盖各种各样的动作。例如，“确定”可包括演算、计算、处理、推导、研究、查找（例如，在表、数据库或其他数据结构中查找）、探知及诸如此类。而且，“确定”可包括接收（例如，接收信息）、访问（例如，访问存储器中的数据）及诸如此类。而且，“确定”还可包括解析、选择、选取、确立及类似动作。另外，如本文中所使用的“信道宽度”可在某些方面涵盖或者还可称为带宽。

[0282] 如本文中所使用的，引述一列项目中的“至少一个”的短语是指这些项目的任何组合，包括单个成员。作为示例，“a、b 或 c 中的至少一个”旨在涵盖 :a、b、c、a-b、a-c、b-c 和 a-b-c。

[0283] 上面描述的方法的各种操作可由能够执行这些操作的任何合适的装置来执行，诸如各种硬件和 / 或软件组件、电路、和 / 或模块。一般而言，在附图中所解说的任何操作可由能够执行这些操作的相对应的功能性装置来执行。

[0284] 结合本公开所描述的各种解说性逻辑框、模块、以及电路可用设计成执行本文所描述功能的通用处理器、数字信号处理器 (DSP)、专用集成电路 (ASIC)、现场可编程门阵列信号 (FPGA) 或其他可编程逻辑器件 (PLD)、分立的门或晶体管逻辑、分立的硬件组件或其任何组合来实现或执行。通用处理器可以是微处理器，但在替换方案中，该处理器可以是任何市售的处理器、控制器、微控制器或状态机。处理器还可以被实现为计算设备的组合，例如 DSP 与微处理器的组合、多个微处理器、与 DSP 核心协同的一个或多个微处理器、或任何其它此类配置。

[0285] 在一个或多个方面中，所描述的功能可在硬件、软件、固件或其任何组合中实现。如果在软件中实现，则各功能可以作为一条或多条指令或代码存储在计算机可读介质上或藉其进行传送。计算机可读介质包括计算机存储介质和通信介质两者，包括促成计算机程序从一地向另一地转移的任何介质。存储介质可以是能被计算机访问的任何可用介质。作为示例而非限定，这样的计算机可读介质可包括 RAM、ROM、EEPROM、CD-ROM 或其它光盘存储、磁盘存储或其它磁存储设备、或能被用来携带或存储指令或数据结构形式的期望程序代码且能被计算机访问的任何其它介质。任何连接也被正当地称为计算机可读介质。例如，如果软件是使用同轴电缆、光纤电缆、双绞线、数字订户线 (DSL)、或诸如红外、无线电、以及微波之类的无线技术从 web 网站、服务器、或其它远程源传送而来，则该同轴电缆、光纤电缆、双绞线、DSL、或诸如红外、无线电、以及微波之类的无线技术就被包括在介质的定义之

中。如本文中所使用的盘 (disk) 和碟 (disc) 包括压缩碟 (CD)、激光碟、光碟、数字多用碟 (DVD)、软盘和蓝光碟，其中盘 (disk) 往往以磁的方式再现数据，而碟 (disc) 用激光以光学方式再现数据。因此，在一些方面，计算机可读介质可包括非暂态计算机可读介质（例如，有形介质）。另外，在一些方面，计算机可读介质可包括暂态计算机可读介质（例如，信号）。上述的组合应当也被包括在计算机可读介质的范围内。

[0286] 本文所公开的方法包括用于实现所描述的方法的一个或多个步骤或动作。这些方法步骤和 / 或动作可以彼此互换而不会脱离权利要求的范围。换言之，除非指定了步骤或动作的特定次序，否则具体步骤和 / 或动作的次序和 / 或使用可以改动而不会脱离权利要求的范围。

[0287] 所描述的功能可在硬件、软件、固件或其任何组合中实现。如果在软件中实现，则各功能可以作为一条或多条指令存储在计算机可读介质上。存储介质可以是能被计算机访问的任何可用介质。作为示例而非限定，这样的计算机可读介质可包括 RAM、ROM、EEPROM、CD-ROM 或其它光盘存储、磁盘存储或其它磁存储设备、或能被用来携带或存储指令或数据结构形式的期望程序代码且能被计算机访问的任何其它介质。如本文中所使用的盘 (disk) 和碟 (disc) 包括压缩碟 (CD)、激光碟、光碟、数字多用碟 (DVD)、软盘、和蓝光®碟，其中盘 (disk) 常常磁性地再现数据，而碟 (disc) 用激光来光学地再现数据。

[0288] 因此，一些方面可包括用于执行本文中给出的操作的计算机程序产品。例如，此种计算机程序产品可包括其上存储（和 / 或编码）有指令的计算机可读介质，这些指令能由一个或多个处理器执行以执行本文中所描述的操作。对于一些方面，计算机程序产品可包括包装材料。

[0289] 软件或指令还可以在传输介质上传送。例如，如果软件是使用同轴电缆、光纤电缆、双绞线、数字订户线 (DSL)、或诸如红外、无线电、以及微波等无线技术从 web 站点、服务器或其它远程源传送而来的，则该同轴电缆、光纤电缆、双绞线、DSL、或诸如红外、无线电以及微波等无线技术就被包括在传输介质的定义里。

[0290] 此外，应当领会，用于执行本文中所描述的方法和技术的模块和 / 或其它恰适装置能由用户终端和 / 或基站在适用的场合下载和 / 或以其他方式获得。例如，此类设备能被耦合至服务器以促成用于执行本文中所描述的方法的装置的转移。替换地，本文所述的各种方法能经由存储装置（例如，RAM、ROM、诸如压缩碟 (CD) 或软盘等物理存储介质等）来提供，以使得一旦将该存储装置耦合至或提供给用户终端和 / 或基站，该设备就能获得各种方法。此外，可利用适于向设备提供本文中所描述的方法和技术的任何其他合适的技术。

[0291] 将理解，权利要求并不被限定于以上所解说的精确配置和组件。可在以上所描述的方法和设备的布局、操作和细节上作出各种改动、更换和变形而不会脱离权利要求的范围。

[0292] 尽管上述内容针对本公开的各方面，然而可设计出本公开的其他和进一步的方面而不会脱离其基本范围，且其范围是由所附权利要求来确定的。

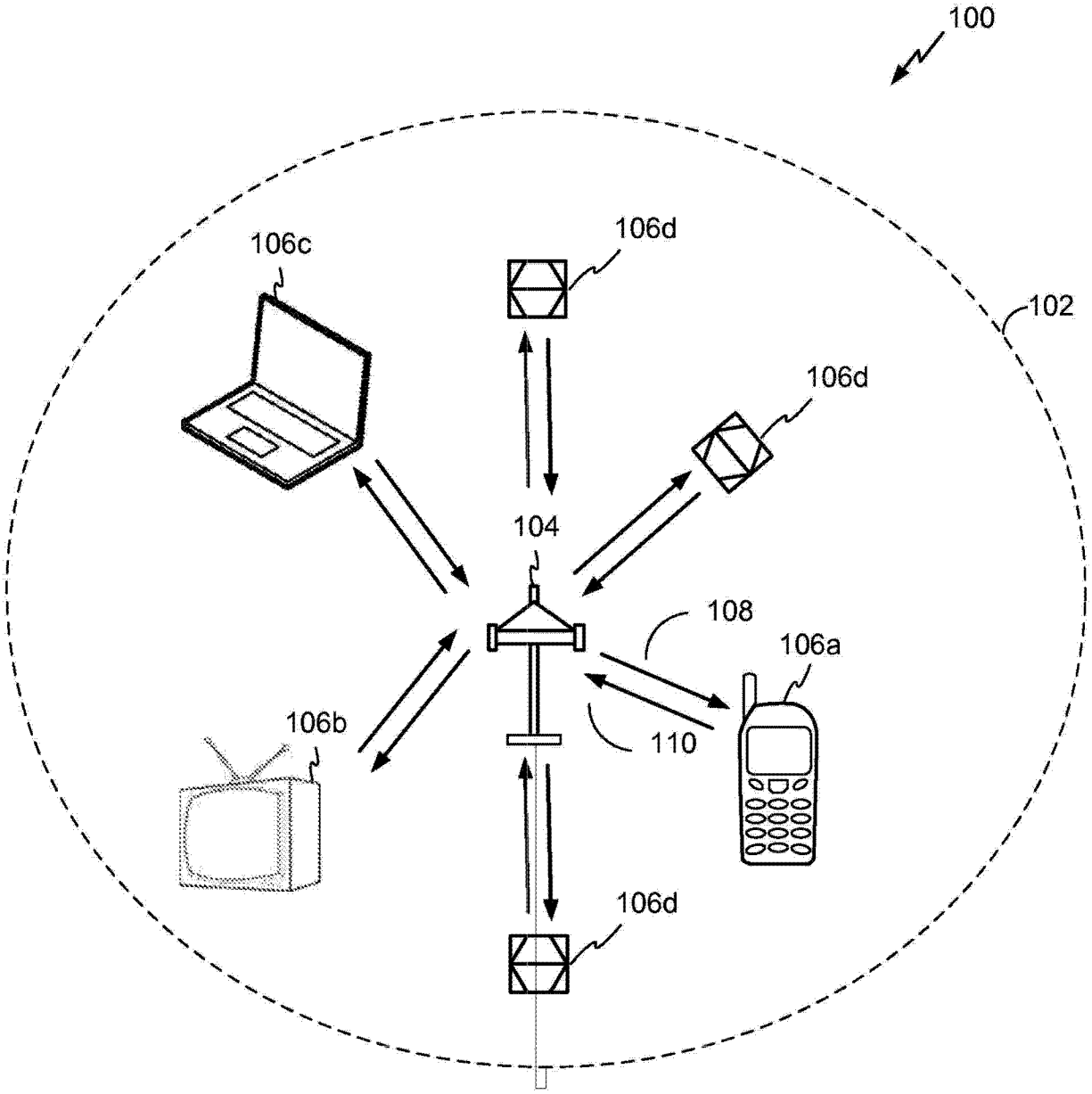


图 1

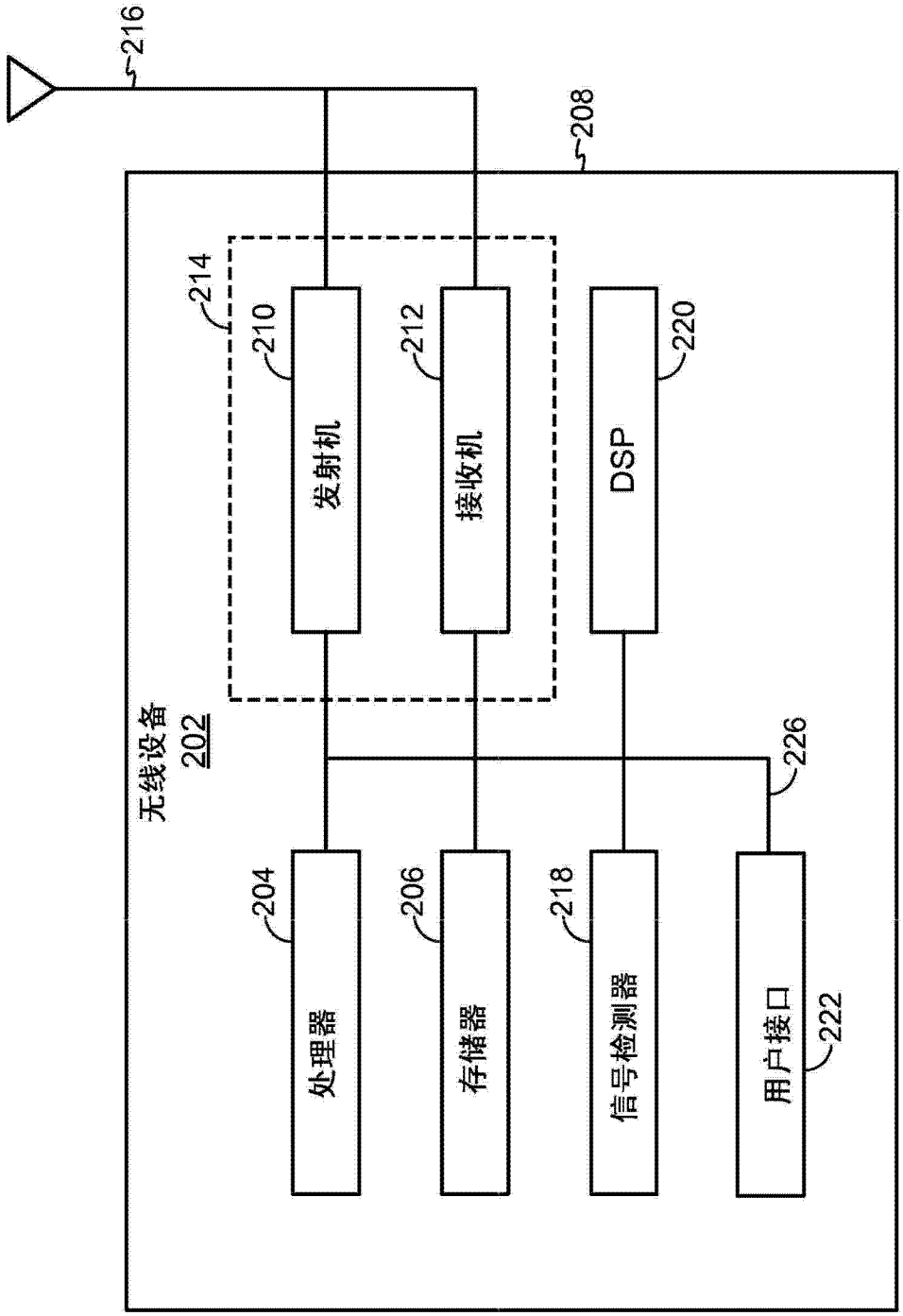

216
208
214
210
发射机
212
接收机
220
DSP
无线设备
202
226
204
处理器
206
存储器
218
信号检测器
222
用户接口

图 2

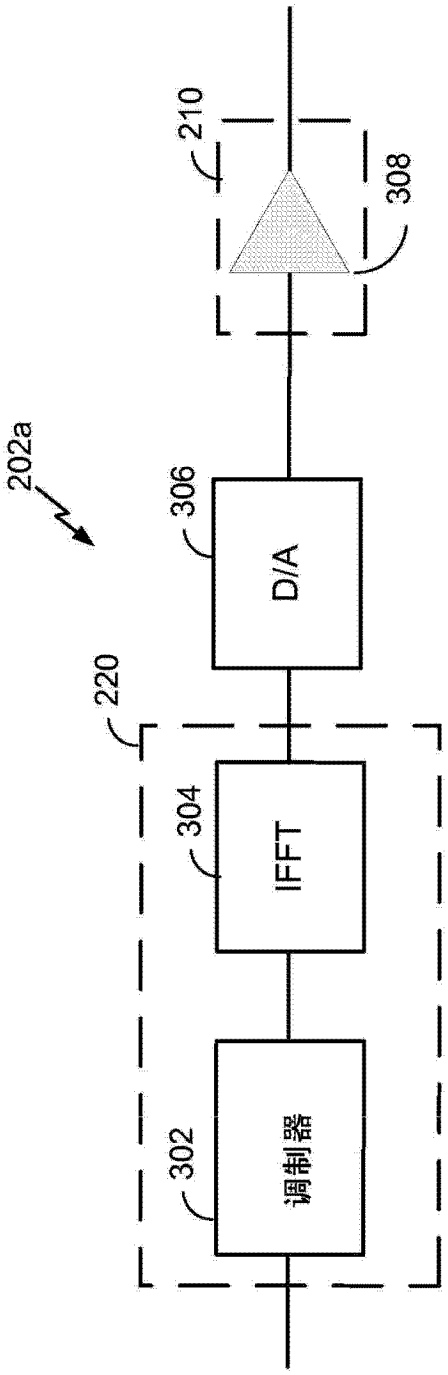

202a
210
308
306
D/A
220
304
IFFT
302
调制器

图 3

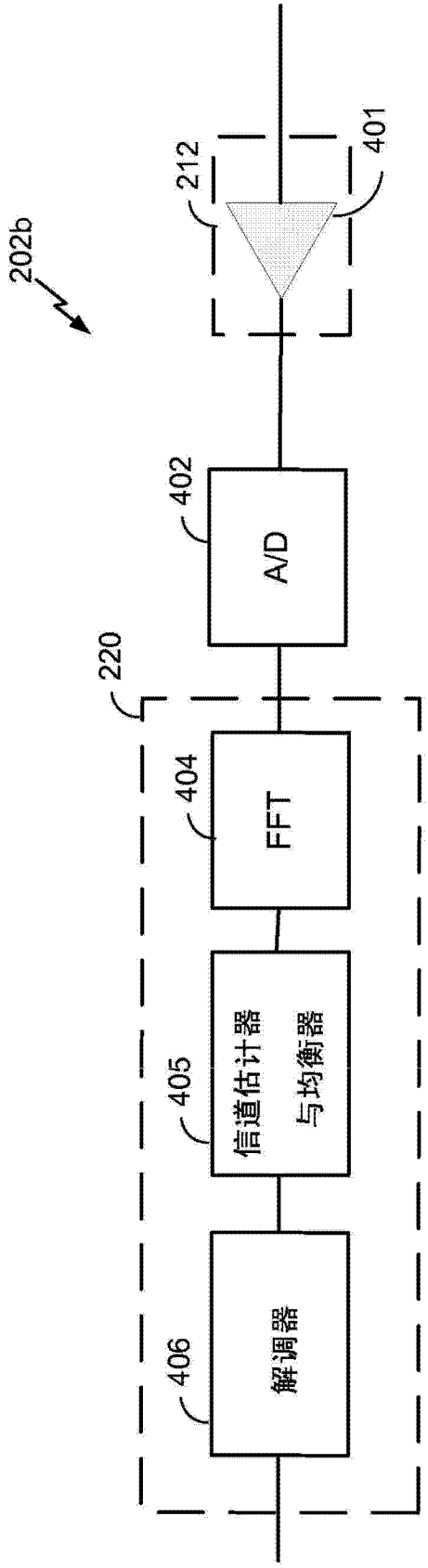

202b
212
401
402
A/D
220
404
FFT
405
信道估计器
与均衡器
406
解调器

图 4

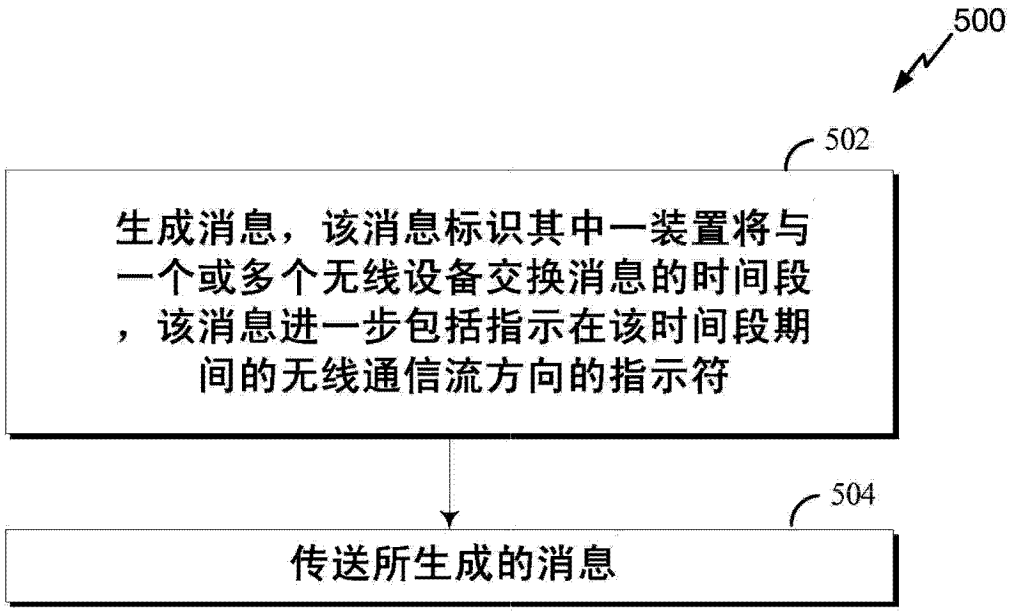

500
502
生成消息，该消息标识其中一装置将与一个或多个无线设备交换消息的时间段，该消息进一步包括指示在该时间段期间的无线通信流方向的指示符
504
传送所生成的消息

图 5

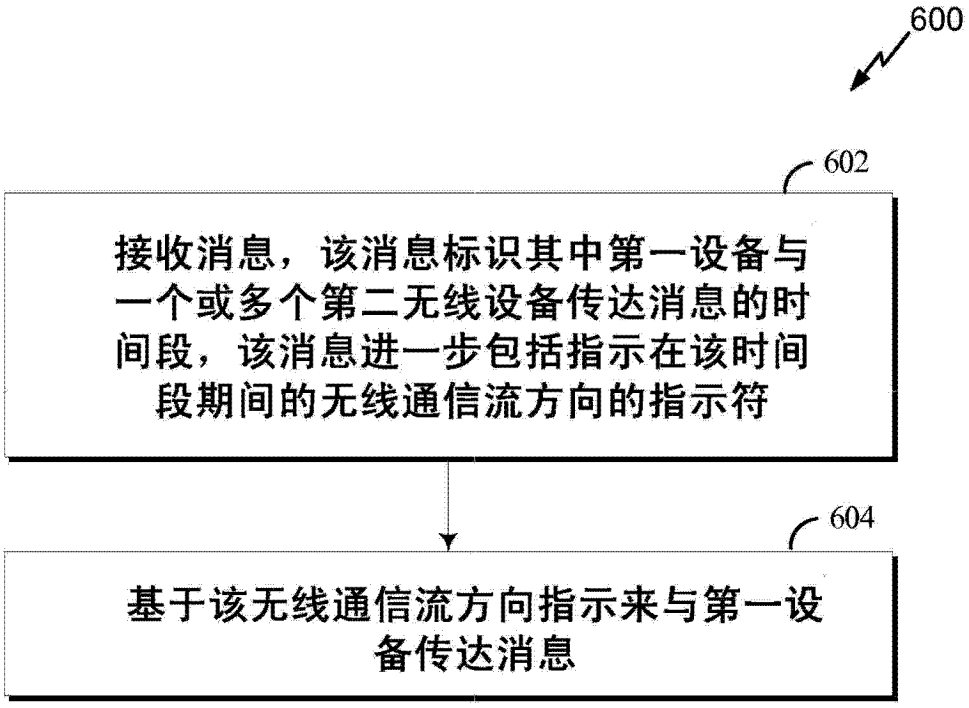

600
602
接收消息，该消息标识其中第一设备与一个或多个第二无线设备传达消息的时间段，该消息进一步包括指示在该时间段期间的无线通信流方向的指示符
604
基于该无线通信流方向指示来与第一设备传达消息

图 6


700
702
704
706
708
RAW开始时间
RAW历时
群ID
流方向

图 7

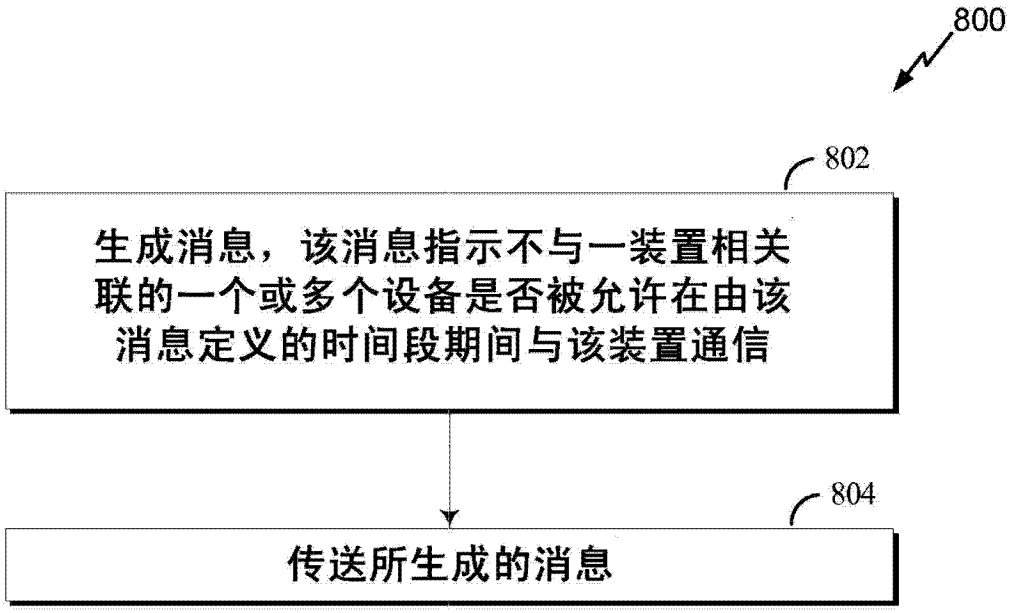

800
802
生成消息，该消息指示不与一装置相关联的一个或多个设备是否被允许在由该消息定义的时间段期间与该装置通信
804
传送所生成的消息

图 8

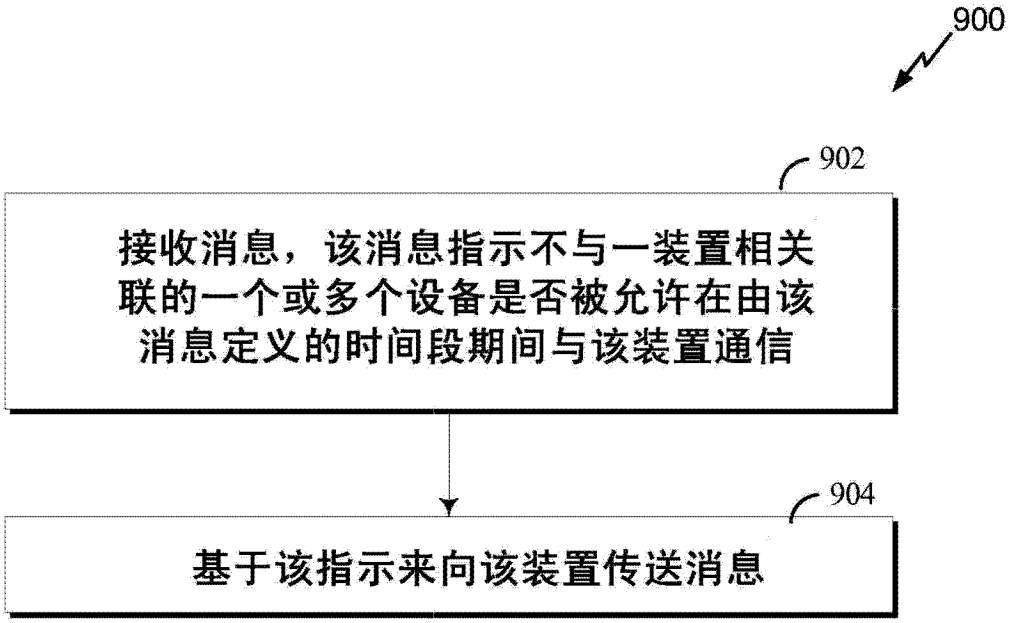

900
902
接收消息，该消息指示不与一装置相关联的一个或多个设备是否被允许在由该消息定义的时间段期间与该装置通信
904
基于该指示来向该装置传送消息

图 9

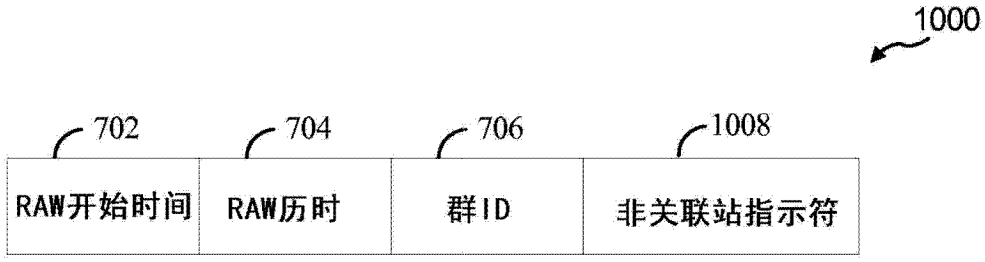

1000
702
704
706
1008
RAW开始时间
RAW历时
群ID
非关联站指示符

图 10

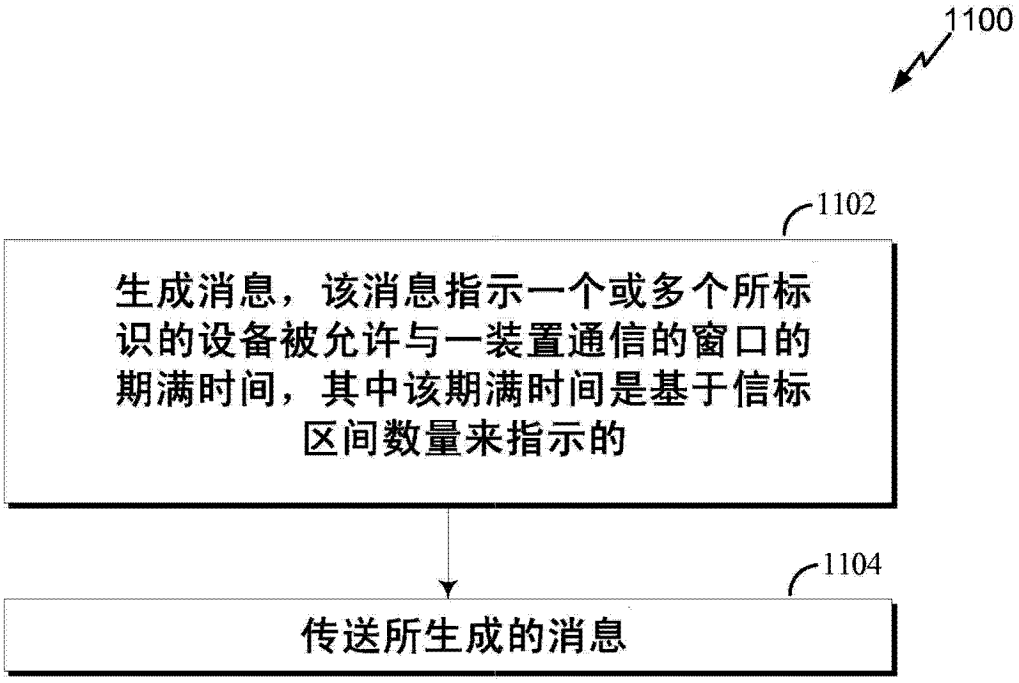

1100
1102
生成消息，该消息指示一个或多个所标识的设备被允许与一装置通信的窗口的期满时间，其中该期满时间是基于信标区间数量来指示的
1104
传送所生成的消息

图 11

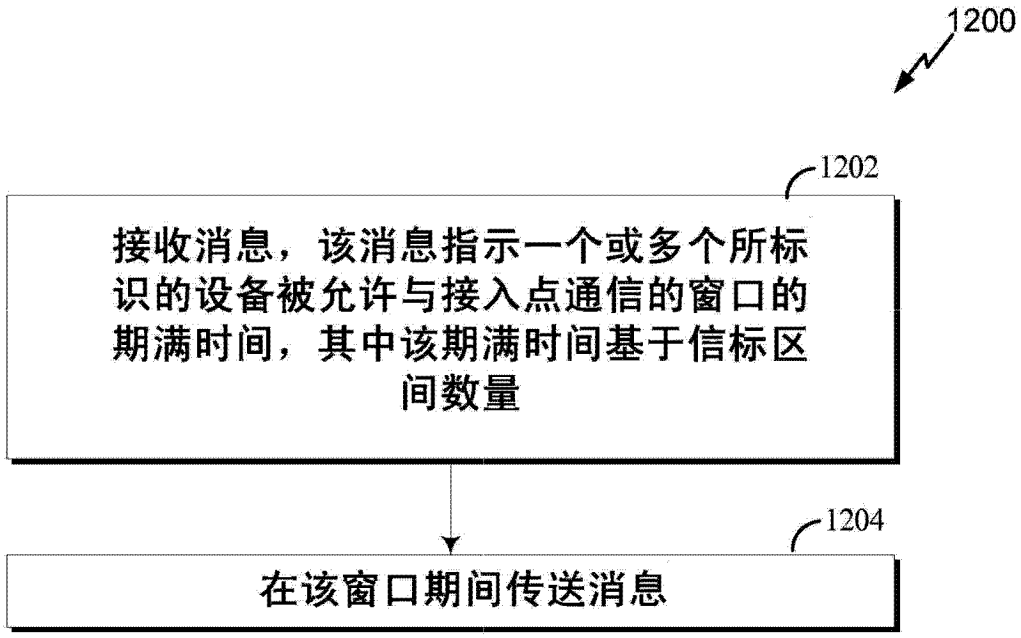

1200
1202
接收消息，该消息指示一个或多个所标识的设备被允许与接入点通信的窗口的期满时间，其中该期满时间基于信标区间数量
1204
在该窗口期间传送消息

图 12

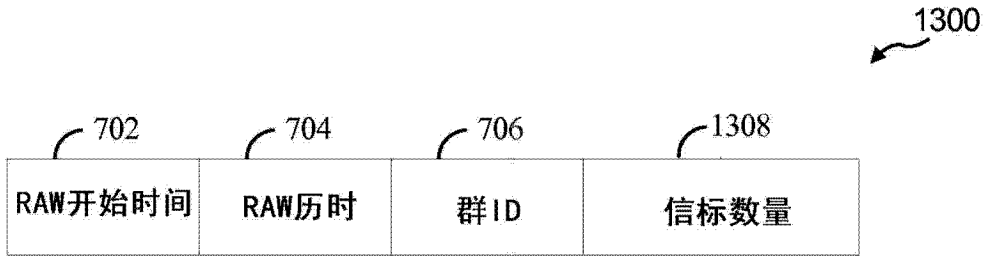

1300
702
704
706
1308
RAW开始时间
RAW历时
群ID
信标数量

图 13

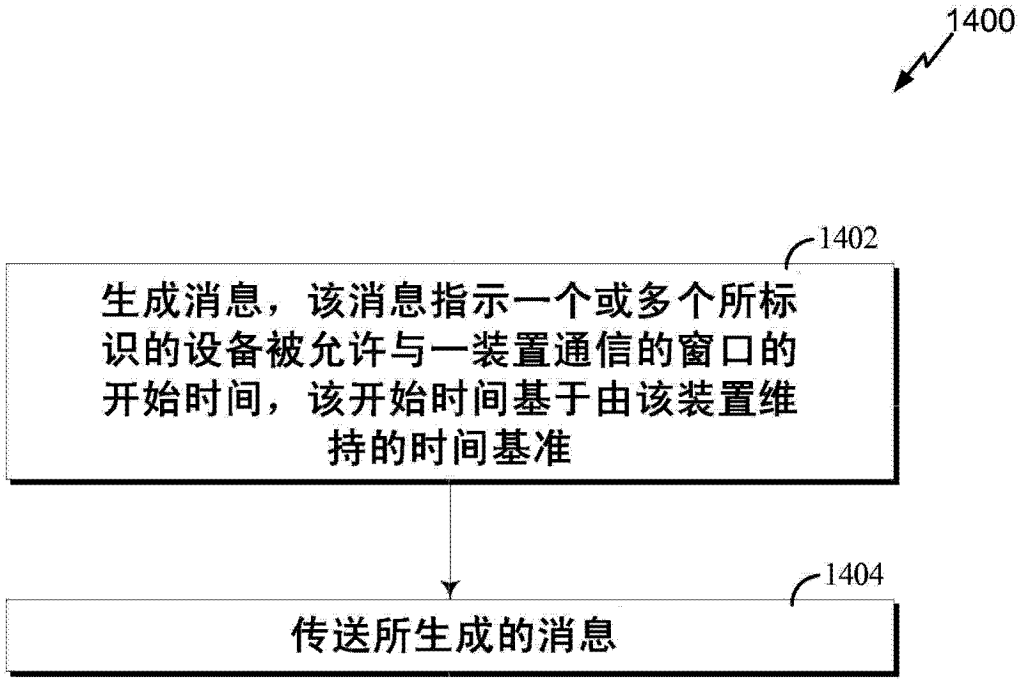

1400
1402
生成消息，该消息指示一个或多个所标识的设备被允许与一装置通信的窗口的开始时间，该开始时间基于由该装置维持的时间基准
1404
传送所生成的消息

图 14

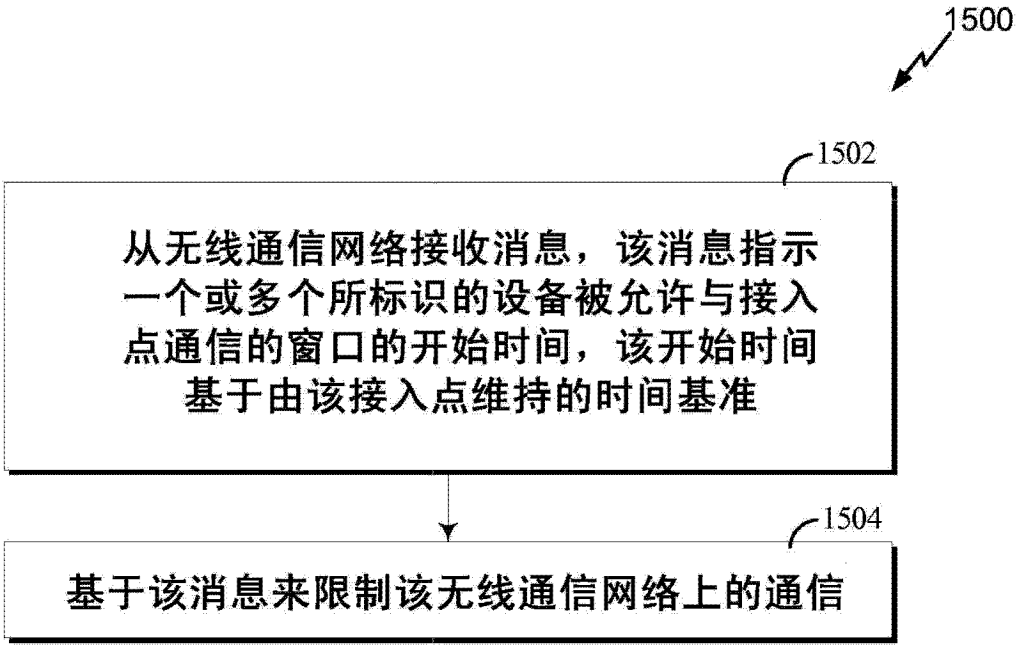

1500
1502
从无线通信网络接收消息，该消息指示一个或多个所标识的设备被允许与接入点通信的窗口的开始时间，该开始时间基于由该接入点维持的时间基准
1504
基于该消息来限制该无线通信网络上的通信

图 15

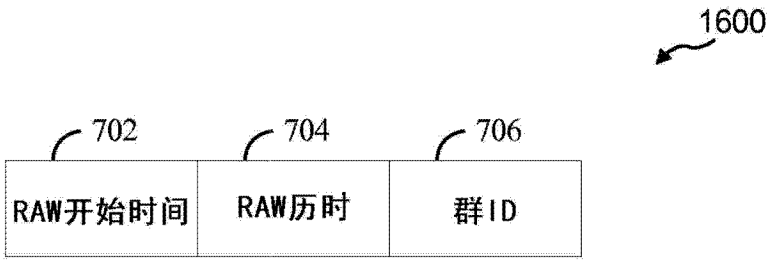

1600
702
704
706
RAW开始时间
RAW历时
群ID

图 16

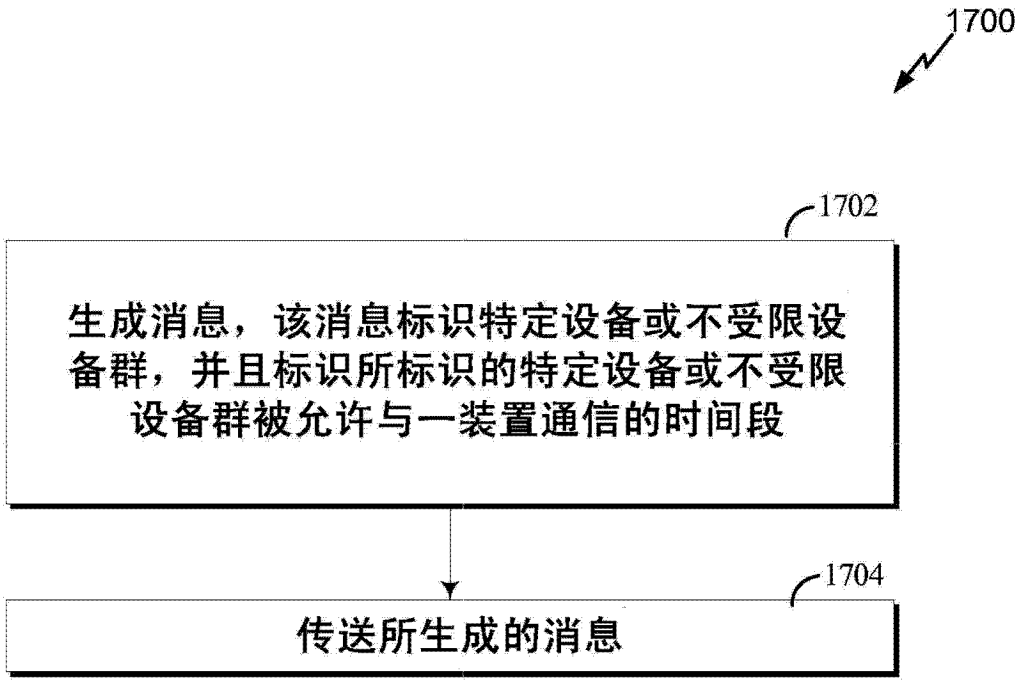

1700
1702
生成消息，该消息标识特定设备或不受限设备群，并且标识所标识的特定设备或不受限设备群被允许与一装置通信的时间段
1704
传送所生成的消息

图 17

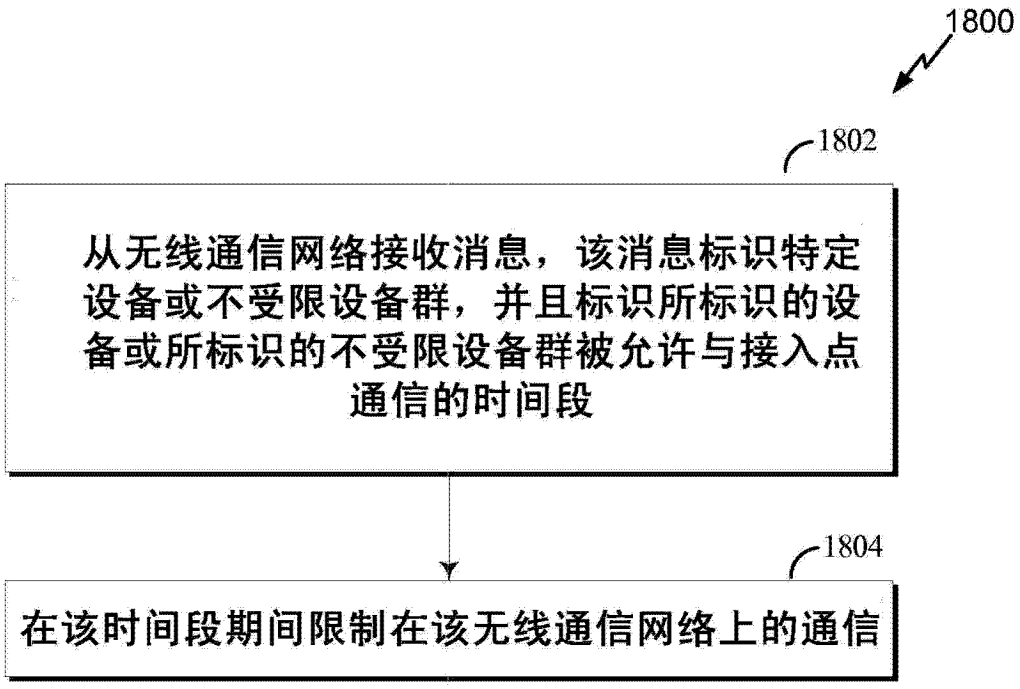

1800
1802
从无线通信网络接收消息，该消息标识特定设备或不受限设备群，并且标识所标识的设备或所标识的不受限设备群被允许与接入点通信的时间段
1804
在该时间段期间限制在该无线通信网络上的通信

图 18


1900
702
704
706
1908
RAW开始时间
RAW历时
群ID
站ID

图 19

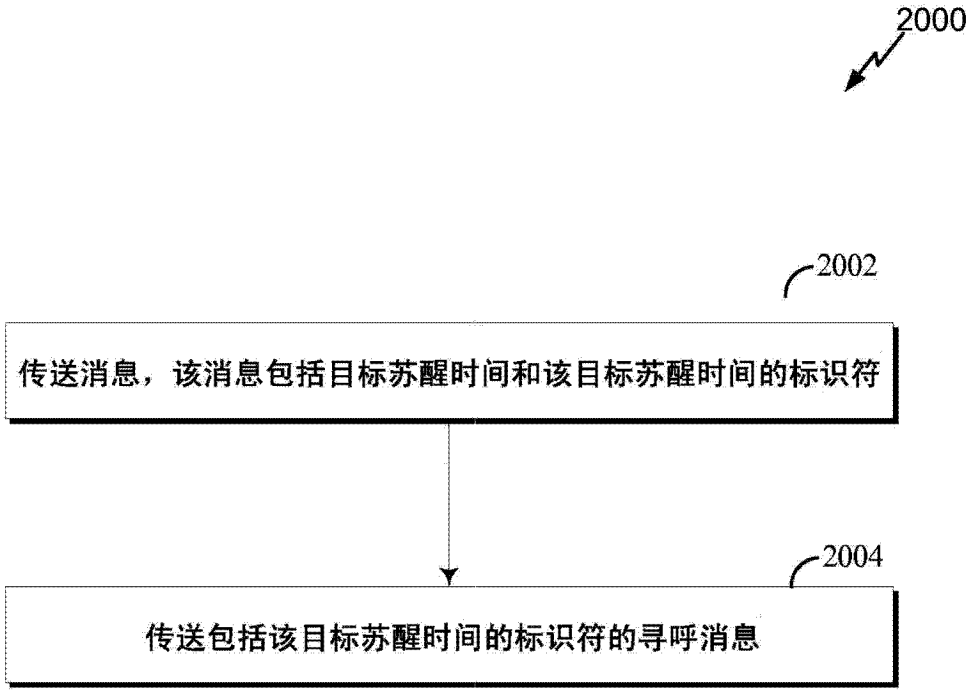

2000
2002
传送消息，该消息包括目标苏醒时间和该目标苏醒时间的标识符
2004
传送包括该目标苏醒时间的标识符的寻呼消息

图 20

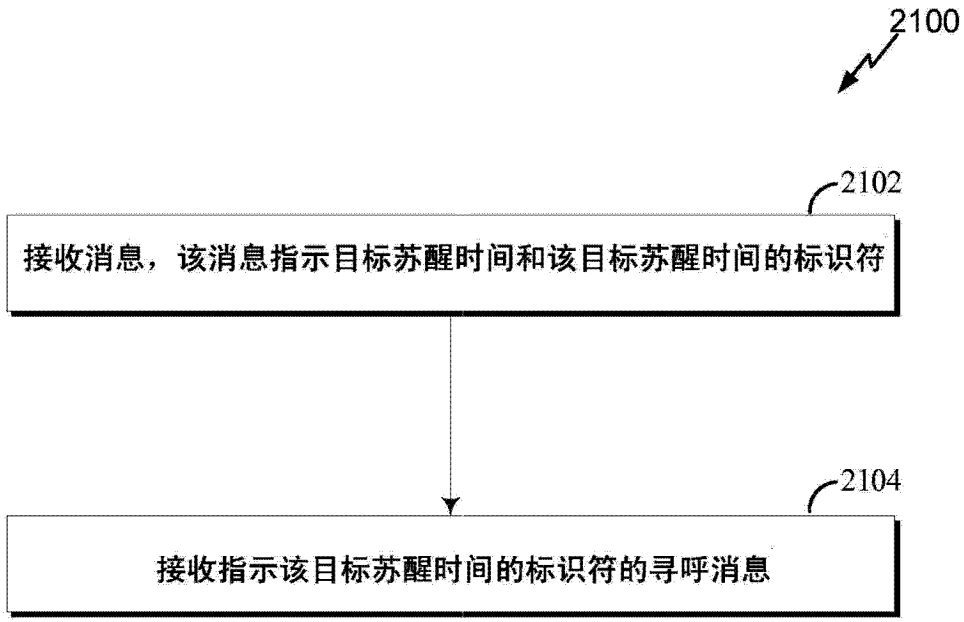

2100
2102
接收消息，该消息指示目标苏醒时间和该目标苏醒时间的标识符
2104
接收指示该目标苏醒时间的标识符的寻呼消息

图 21

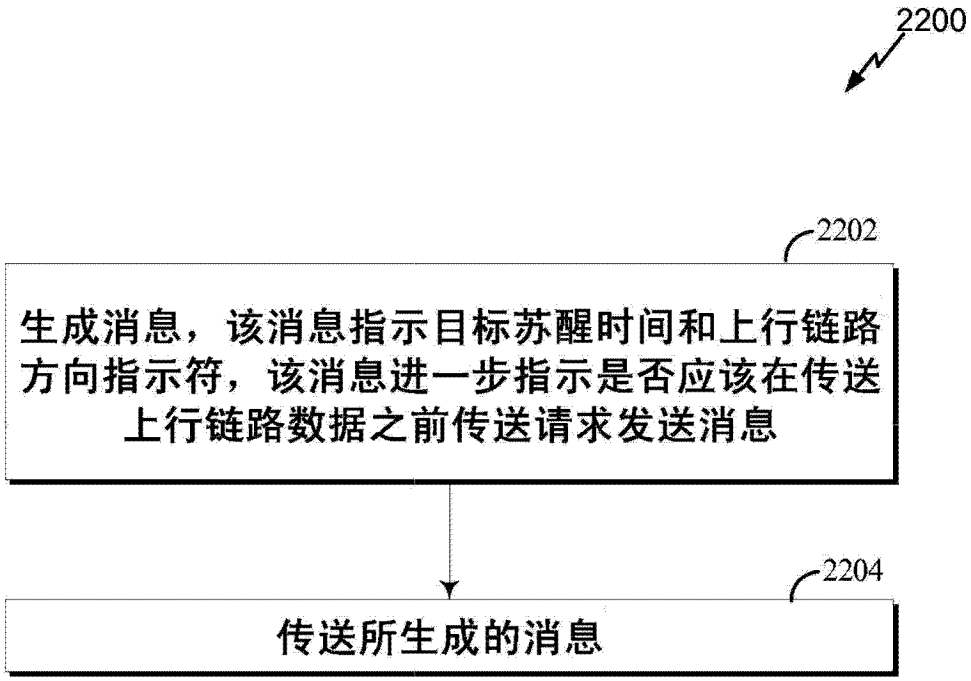

2200
2202
生成消息，该消息指示目标苏醒时间和上行链路方向指示符，该消息进一步指示是否应该在传送上行链路数据之前传送请求发送消息
2204
传送所生成的消息

图 22

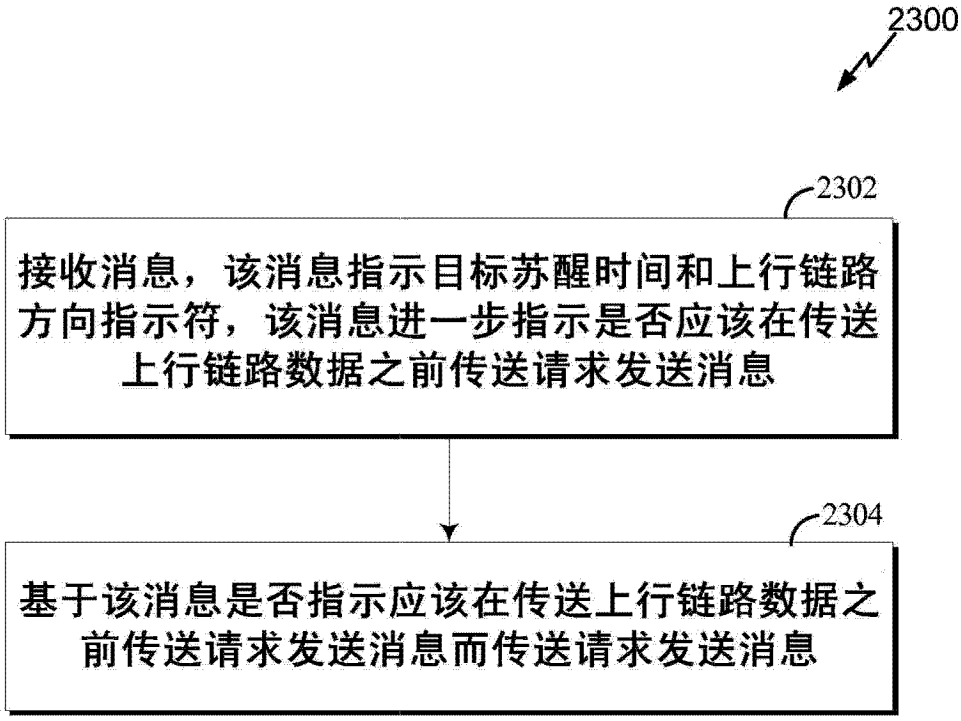

2300
2302
接收消息，该消息指示目标苏醒时间和上行链路方向指示符，该消息进一步指示是否应该在传送上行链路数据之前传送请求发送消息
2304
基于该消息是否指示应该在传送上行链路数据之前传送请求发送消息而传送请求发送消息

图 23