METHOD, DEVICE, AND SYSTEM FOR JOINING NEIGHBOR AWARENESS NETWORK DEVICE CLUSTER

~~CROSS-REFERENCE TO RELATED APPLICATION~~

~~[0001] This application claims priority to Chinese Patent Application No. 201310351937.9, filed with the Chinese Patent Office on August 13, 2013, which is incorporated herein by reference in its entirety.~~

TECHNICAL FIELD

[0002] The present invention relates to the field of wireless technologies, and in particular, to a method, device, and system for joining a neighbor awareness network device cluster (Neighbor Awareness Network Cluster).

BACKGROUND

[0003] A Wi-Fi (Wireless Fidelity, ~~wireless fidelity~~) technology is a short-distance wireless communications technology, and is already widely used due to its advantages such as a free spectrum and a high transmission rate. For example, in a scenario in which an AP (Access Point, access point) is disposed at an airport, or in a restaurant or a conference room, a Wi-Fi device accesses a network by using the AP. For another example, in a scenario in which no AP is disposed, Wi-Fi devices directly communicate with each other to implement data sharing between the Wi-Fi devices and use of various services, that is, communication is implemented between the Wi-Fi devices.

[0004] For the scenario in which no AP is disposed, the Wi-Fi Alliance (Wi-Fi Alliance) puts forward a NAN (Neighbor Awareness Network, neighbor awareness network) technology to implement synchronization and service discovery between

the Wi-Fi devices and then achieve an objective of implementing communication between the Wi-Fi devices.

[0005] FIG. 1 is a schematic diagram of a DW (Discovery Window~~, discovery time window~~) of a neighbor awareness network device cluster on a sixth channel of 2.4 G~~h~~Hz frequency band~~ frequency band~~. As can be seen from FIG. 1, in a same neighbor awareness network device cluster, time duration of a DW is fixed, and a time interval between any two neighboring DWs is fixed. In a DW, both a Master (master device) and a Non-Master Sync (non-master synchronization device) that are in the neighbor awareness network device cluster may contend for sending a Sync Beacon (synchronization beacon frame) to implement device synchronization in a network; however, at other time beyond the DW, the Master sends a Discovery Beacon (discovery beacon frame) to announce existence of the neighbor awareness network device cluster.

[0006] As can be known from the description of the neighbor awareness network technology, multiple Wi-Fi devices may join a neighbor awareness network device cluster, and implement synchronization between the Wi-Fi devices and service search and discovery in a DW of the neighbor awareness network device cluster. Because the time duration of a DW is shorter than the time interval between two neighboring DWs, and a Wi-Fi device needs to, only within the very short time duration of the DW, listen on a working channel and perform service discovery, the Wi-Fi device may perform service search and discovery continuously in a low power consumption mode.

[0007] When a Wi-Fi device scans a working channel of a neighbor awareness network and discovers multiple neighbor awareness network device clusters, the Wi-Fi device may join each neighbor awareness network device cluster, and implement synchronization and service search and discovery in each neighbor awareness network device cluster. That is, the Wi-Fi device needs to perform channel listening in a DW of each neighbor awareness network device cluster, participate in an election of a synchronization device, and be synchronized to the ~~discovery time window~~discovery window of the neighbor awareness network device cluster to perform service discovery, thereby implementing service search and discovery.

[0008] Assuming that the Wi-Fi device joins two neighbor awareness network device clusters (which may be separately called neighbor awareness network device cluster-A and neighbor awareness network device cluster-B), FIG. 2 shows a schematic diagram of composition of a neighbor awareness network in which the Wi-Fi device joins the neighbor awareness network device cluster-A and the neighbor awareness network device cluster-B, and FIG. 3 shows a schematic diagram of the neighbor awareness network device cluster-A and the neighbor awareness network device cluster-B that have a same working channel but unaligned DWs. The Wi-Fi device not only needs to, in an DW of the neighbor awareness network device cluster-A, listen on a channel, participate in an election of a synchronization device, and be synchronized to the ~~discovery time window~~discovery window of the neighbor awareness network device cluster to perform service discovery, but also needs to, in an DW of the neighbor awareness network device cluster-B, listen on a channel, participate in an election of a synchronization device, and be synchronized to the ~~discovery time window~~discovery window of the neighbor awareness network device cluster to perform service discovery. In a case in which service discovery needs to be performed continuously (possibly because no desired service is discovered for a long time or it is necessary to participate all the time in implementing service provisioning to the outside), the actual working time spent by the Wi-Fi device in joining multiple neighbor awareness network device clusters to perform service search and discovery is apparently longer compared with when the Wi-Fi device needs to join only one neighbor awareness network device cluster, and therefore, a relative power consumption of the Wi-Fi device is relatively high. In addition, on the working channel of the neighbor awareness network, DW resources of both the neighbor awareness network device cluster-A and the neighbor awareness network device cluster-B are occupied, and remaining available resources on the working channel are reduced, resulting in a problem of a relatively high resource usage of the working channel.

[0009] In conclusion, when the Wi-Fi device detects multiple neighbor awareness network device clusters and separately joins each neighbor awareness

network, actual working time spent by the Wi-Fi device in service search and discovery is prolonged, power consumption of the Wi-Fi device is increased, and available resources on the working channel are reduced. Therefore, currently it is urgent to find a solution that can maintain a low power consumption of the Wi-Fi device without excessively occupying available resources of the working channel of the neighbor awareness network in a case in which the Wi-Fi device detects multiple neighbor awareness network device clusters.

SUMMARY

[0010] ~~Embodiments of the~~ The present invention provides a method, device, and system for joining a neighbor awareness network device cluster, which are used to solve problems of a high power consumption of a device and reduction of available resources on a working channel in the prior art.

[0011] In a first aspect, a method for joining a neighbor awareness network device cluster is provided. The method includes:

when discovering a second neighbor awareness network device cluster, acquiring, by a wireless device in a first neighbor awareness network device cluster, attribute information of the second neighbor awareness network device cluster;

comparing, by the wireless device, the attribute information of the second neighbor awareness network device cluster with attribute information of the first neighbor awareness network device cluster to determine whether it is necessary to join the second neighbor awareness network device cluster; and

when determining that it is necessary to join the second neighbor awareness network device cluster, sending, by the wireless device, an event message in the first neighbor awareness network device cluster, leaving the first neighbor awareness network device cluster, and joining the second neighbor awareness network device cluster, where the event message is about joining the second neighbor awareness network device cluster and includes the attribute information of the second neighbor awareness network device cluster, so that other wireless devices

in the first neighbor awareness network device cluster that receive the event message are capable of joining the second neighbor awareness network device cluster according to the attribute information of the second neighbor awareness network device cluster.

[0012] According to the first aspect, in a first possible implementation manner of the first aspect, the discovering, by a wireless device, a second neighbor awareness network device cluster and acquiring attribute information of the second neighbor awareness network device cluster specifically include:

when a cluster identifier included in a received beacon frame or service frame of a neighbor awareness network is different from a locally recorded cluster identifier of the first neighbor awareness network device cluster, determining, by the wireless device, that the second neighbor awareness network device cluster is discovered; and

acquiring, by the wireless device, the attribute information of the second neighbor awareness network device cluster from the received beacon frame or service frame of the neighbor awareness network.

[0013] According to the first aspect or the first possible implementation manner of the first aspect, in a second possible implementation manner of the first aspect, the attribute information of the second neighbor awareness network device cluster includes at least one type of the following information:

a cluster identifier of the second neighbor awareness network device cluster, the number of wireless devices included in the second neighbor awareness network device cluster, an anchor master rank in the second neighbor awareness network device cluster, a hop count from the wireless device to an anchor master device in the second neighbor awareness network device cluster, and transmission time of a beacon frame of the anchor master device in the second neighbor awareness network device cluster.

[0014] According to the first aspect, or the first possible implementation manner or second possible implementation manner of the first aspect, in a third possible implementation manner of the first aspect, the determining, by the wireless device, whether it is necessary to join the

second neighbor awareness network device cluster specifically includes:

comparing, by the wireless device, the cluster identifier of the second neighbor awareness network device cluster with the locally recorded cluster identifier of the first neighbor awareness network device cluster, and determining, according to a preset determination rule, whether it is necessary to join the second neighbor awareness network device cluster.

[0015] According to the first aspect, or the first possible implementation manner, second possible implementation manner, or third possible implementation manner of the first aspect, in a fourth possible implementation manner of the first aspect, the joining, by other wireless devices in the first neighbor awareness network device cluster that receive the event message, the second neighbor awareness network device cluster specifically includes:

comparing, by the other wireless devices in the first neighbor awareness network device cluster that receive the event message, the cluster identifier of the second neighbor awareness network device cluster that is included in the event message with the locally recorded cluster identifier of the first neighbor awareness network device cluster, and when determining, according to the preset determination rule, that it is necessary to join the second neighbor awareness network device cluster, leaving the first neighbor awareness network device cluster, and joining the second neighbor awareness network device cluster.

[0016] According to the third possible implementation manner or fourth possible implementation manner of the first aspect, in a fifth possible implementation manner of the first aspect, the determination rule is specifically: when the cluster identifier of the second neighbor awareness network device cluster is greater than the cluster identifier of the first neighbor awareness network device cluster, it is necessary to join the second neighbor awareness network device cluster; or

the determination rule is specifically: when the cluster identifier of the second neighbor awareness network device cluster is less than the cluster identifier of the first neighbor awareness network device cluster, it is necessary to join the second neighbor awareness network device cluster.

[0017] According to the first aspect, or the first possible implementation manner, second possible implementation manner, third possible implementation manner, fourth possible implementation manner, or fifth possible implementation manner of the first aspect, in a sixth possible implementation manner of the first aspect, the leaving, by the wireless device, the first neighbor awareness network device cluster specifically includes:

not participating, by the wireless device, in contending for serving as a synchronization device in the first neighbor awareness network device cluster any longer; and

the joining, by the wireless device, the second neighbor awareness network device cluster specifically includes:

participating, by the wireless device, in contending for serving as a synchronization device in the second neighbor awareness network device cluster, and being synchronized to a ~~discovery time window~~discovery window of the second neighbor awareness network device cluster to perform service discovery.

[0018] According to the first aspect, or the first possible implementation manner, second possible implementation manner, third possible implementation manner, fourth possible implementation manner, fifth possible implementation manner, or sixth possible implementation manner of the first aspect, in a seventh possible implementation manner of the first aspect, the event message is a beacon frame or a service frame of a neighbor awareness network, where the beacon frame or the service frame includes the attribute information of the second neighbor awareness network device cluster; or

the event message is a beacon frame or a service frame of a neighbor awareness network, where the beacon frame or the service frame includes merging indication information, and the merging indication information is used to instruct wireless devices in the first neighbor awareness network device cluster that receive the event message to join the second neighbor awareness network device cluster specified by the merging indication information.

[0019] According to the seventh possible implementation manner of the first

aspect, in an eighth possible implementation manner of the first aspect, the including, by the wireless device, the attribute information of the second neighbor awareness network device cluster in the beacon frame or the service frame of the neighbor awareness network specifically includes:

carrying, by the wireless device, the cluster identifier of the second neighbor awareness network device cluster in a destination address field of the beacon frame of the neighbor awareness network, and carrying the attribute information of the second neighbor awareness network device cluster in an attribute information field of the neighbor awareness network; or

carrying, by the wireless device, the cluster identifier of the second neighbor awareness network device cluster in a destination address field of the service frame of the neighbor awareness network, and carrying the attribute information of the second neighbor awareness network device cluster in a frame body.

[0020] According to the first aspect, or the first possible implementation manner, second possible implementation manner, third possible implementation manner, fourth possible implementation manner, fifth possible implementation manner, sixth possible implementation manner, seventh possible implementation manner, or eighth possible implementation manner of the first aspect, in a ninth possible implementation manner of the first aspect, the method further includes:

determining, by the other wireless devices in the first neighbor awareness network device cluster that receive the event message, according to received signal strength of the event message and the number of received event messages, whether to send, in the first neighbor awareness network device cluster, an event message about joining the second neighbor awareness network device cluster, where the event message includes the attribute information of the second neighbor awareness network device cluster.

[0021] According to the ninth possible implementation manner of the first aspect, in a tenth possible implementation manner of the first aspect, the other wireless devices in the first neighbor awareness network device cluster that receive the event message use

awareness network device cluster, and joining the second neighbor awareness network device cluster.

[0023] According to the second aspect, in a first possible implementation manner of the second aspect, the discovering, by a wireless device, a second neighbor awareness network device cluster and acquiring attribute information of the second neighbor awareness network device cluster specifically include:

when a cluster identifier included in a received beacon frame or service frame of a neighbor awareness network is different from a locally recorded cluster identifier of the first neighbor awareness network device cluster, determining, by the wireless device, that the second neighbor awareness network device cluster is discovered; and

acquiring, by the wireless device, the attribute information of the second neighbor awareness network device cluster from the received beacon frame or service frame of the neighbor awareness network.

[0024] According to the second aspect or the first possible implementation manner of the second aspect, in a second possible implementation manner of the second aspect, the attribute information of the second neighbor awareness network device cluster includes at least one type of the following information:

a cluster identifier of the second neighbor awareness network device cluster, the number of wireless devices included in the second neighbor awareness network device cluster, an anchor master rank in the second neighbor awareness network device cluster, a hop count from the wireless device to an anchor master device in the second neighbor awareness network device cluster, and transmission time of a beacon frame of the anchor master device in the second neighbor awareness network device cluster.

[0025] According to the second possible implementation manner of the second aspect, in a third possible implementation manner of the second aspect, the determining, by the wireless device, whether it is necessary to join the second neighbor awareness network device cluster specifically includes:

comparing, by the wireless device, the cluster identifier of the second

neighbor awareness network device cluster with the locally recorded cluster identifier of the first neighbor awareness network device cluster, and determining, according to a preset determination rule, whether it is necessary to join the second neighbor awareness network device cluster.

[0026] According to the third possible implementation manner of the second aspect, in a fourth possible implementation manner of the second aspect, the determination rule is specifically: when the cluster identifier of the second neighbor awareness network device cluster is greater than the cluster identifier of the first neighbor awareness network device cluster, it is necessary to join the second neighbor awareness network device cluster; or

the determination rule is specifically: when the cluster identifier of the second neighbor awareness network device cluster is less than the cluster identifier of the first neighbor awareness network device cluster, it is necessary to join the second neighbor awareness network device cluster.

[0027] According to the second aspect, or the first possible implementation manner, second possible implementation manner, third possible implementation manner, or fourth possible implementation manner of the second aspect, in a fifth possible implementation manner of the second aspect, the leaving, by the wireless device, the first neighbor awareness network device cluster specifically includes:

not participating, by the wireless device, in contending for serving as a synchronization device in the first neighbor awareness network device cluster any longer; and

the joining, by the wireless device, the second neighbor awareness network device cluster specifically includes:

participating, by the wireless device, in contending for serving as a synchronization device in the second neighbor awareness network device cluster, and being synchronized to a ~~discovery time window~~discovery window of the second neighbor awareness network device cluster to perform service discovery.

[0028] In a third aspect, a method for joining a neighbor awareness network device cluster is provided and includes:

when discovering multiple neighbor awareness network device clusters, creating, by a wireless device, a new neighbor awareness network device cluster; and

sending, separately in the multiple neighbor awareness network device clusters by the wireless device, an event message about joining the new neighbor awareness network device cluster, so that other wireless devices that are in the multiple neighbor awareness network device clusters and receive the event message join the new neighbor awareness network device cluster according to the event message, where the event message includes attribute information of the new neighbor awareness network device cluster.

[0029] According to the third aspect, in a first possible implementation manner of the third aspect, a cluster identifier of the new neighbor awareness network device cluster created by the wireless device and cluster identifiers of the multiple neighbor awareness network device clusters meet a preset condition.

[0030] According to the first possible implementation manner of the third aspect, in a second possible implementation manner of the third aspect, the preset condition is specifically: the cluster identifier of the new neighbor awareness network device cluster created by the wireless device is greater than a cluster identifier of any one of the multiple neighbor awareness network device clusters; or

the preset condition is specifically: the cluster identifier of the new neighbor awareness network device cluster created by the wireless device is less than a cluster identifier of any one of the multiple neighbor awareness network device clusters.

[0031] According to the third aspect, or the first possible implementation manner, second possible implementation manner, or third possible implementation manner of the third aspect, in a fourth possible implementation manner of the third aspect, transmission time of a beacon frame of an anchor master device in the new neighbor awareness network device cluster created by the wireless device is the same as transmission time of a beacon frame of an anchor master device in one of the multiple neighbor awareness network device clusters.

[0032] In a fourth aspect, a wireless device for joining a neighbor awareness

network device cluster is provided, where the wireless device in a first neighbor awareness network device cluster includes:

a discovery module, configured to discover a neighbor awareness network device cluster;

an attribute information acquiring module, configured to acquire attribute information of the second neighbor awareness network device cluster when the discovery module discovers a second neighbor awareness network device cluster;

a determining module, configured to compare the attribute information of the second neighbor awareness network device cluster with attribute information of the first neighbor awareness network device cluster to determine whether it is necessary to join the second neighbor awareness network device cluster;

a message sending module, configured to send an event message in the first neighbor awareness network device cluster when the determining module determines that it is necessary to join the second neighbor awareness network device cluster, where the event message is about joining the second neighbor awareness network device cluster and includes the attribute information of the second neighbor awareness network device cluster, so that other wireless devices in the first neighbor awareness network device cluster that receive the event message are capable of joining the second neighbor awareness network device cluster according to the attribute information of the second neighbor awareness network device cluster;

a leaving module, configured to leave the first neighbor awareness network device cluster when the determining module determines that it is necessary to join the second neighbor awareness network device cluster; and

a joining module, configured to join the second neighbor awareness network device cluster when the determining module determines that it is necessary to join the second neighbor awareness network device cluster.

[0033] According to the fourth aspect, in a first possible implementation manner of the fourth aspect,

the discovery module is specifically configured to determine, when a cluster identifier included in a received beacon frame or service frame of a neighbor awareness network is different from a locally recorded cluster identifier of the first

neighbor awareness network device cluster, that the second neighbor awareness network device cluster is discovered; and

the attribute information acquiring module is specifically configured to acquire the attribute information of the second neighbor awareness network device cluster from the received beacon frame or service frame of the neighbor awareness network.

[0034] According to the fourth aspect or the first possible implementation manner of the fourth aspect, in a second possible implementation manner of the fourth aspect, the attribute information of the second neighbor awareness network device cluster includes at least one type of the following information:

a cluster identifier of the second neighbor awareness network device cluster, the number of wireless devices included in the second neighbor awareness network device cluster, an anchor master rank in the second neighbor awareness network device cluster, a hop count from the wireless device to an anchor master device in the second neighbor awareness network device cluster, and transmission time of a beacon frame of the anchor master device in the second neighbor awareness network device cluster.

[0035] According to the fourth aspect, or the first possible implementation manner or second possible implementation manner of the fourth aspect, in a third possible implementation manner of the fourth aspect,

the determining module is specifically configured to compare the cluster identifier of the second neighbor awareness network device cluster with the locally recorded cluster identifier of the first neighbor awareness network device cluster, and determine, according to a preset determination rule, whether it is necessary to join the second neighbor awareness network device cluster.

[0036] According to the third possible implementation manner of the fourth aspect, in a fourth possible implementation manner of the fourth aspect, the determination rule is specifically: when the cluster identifier of the second neighbor awareness network device cluster is greater than the cluster identifier of the first neighbor awareness network device cluster, it is necessary to join the second neighbor awareness

network device cluster; or

the determination rule is specifically: when the cluster identifier of the second neighbor awareness network device cluster is less than the cluster identifier of the first neighbor awareness network device cluster, it is necessary to join the second neighbor awareness network device cluster.

[0037] According to the fourth aspect, or the first possible implementation manner, second possible implementation manner, or third possible implementation manner of the fourth aspect, in a fourth possible implementation manner of the fourth aspect,

the leaving module is specifically configured not to participate in contending for serving as a synchronization device in the first neighbor awareness network device cluster any longer; and

the joining module is specifically configured to participate in contending for serving as a synchronization device in the second neighbor awareness network device cluster, and be synchronized to a ~~discovery time window~~discovery window of the second neighbor awareness network device cluster to perform service discovery.

[0038] According to the fourth aspect, or the first possible implementation manner, second possible implementation manner, third possible implementation manner, or fourth possible implementation manner of the fourth aspect, in a fifth possible implementation manner of the fourth aspect, the event message is a beacon frame or a service frame of a neighbor awareness network, where the beacon frame or the service frame includes the attribute information of the second neighbor awareness network device cluster; or

the event message is a beacon frame or a service frame of a neighbor awareness network, where the beacon frame or the service frame includes merging indication information, and the merging indication information is used to instruct wireless devices in the first neighbor awareness network device cluster that receive the event message to join the second neighbor awareness network device cluster specified by the merging indication information.

[0039] According to the fifth possible implementation manner of the fourth aspect, in a sixth possible implementation manner of the fourth aspect,

of the second neighbor awareness network device cluster, so that other wireless devices in the first neighbor awareness network device cluster that receive the event message are capable of joining the second neighbor awareness network device cluster according to the attribute information of the second neighbor awareness network device cluster.

[0041] According to the fifth aspect, in a first possible implementation manner of the fifth aspect,

the wireless interface is specifically configured to scan a beacon frame or a service frame of a neighbor awareness network; and

the discovering a second neighbor awareness network device cluster according to a scanning result of the wireless interface, and acquiring attribute information of the second neighbor awareness network device cluster are specifically: when a CID included in a received beacon frame or service frame of a neighbor awareness network is different from a locally recorded CID of the first neighbor awareness network device cluster, determining that the second neighbor awareness network device cluster is discovered; and acquiring the attribute information of the second neighbor awareness network device cluster from the received beacon frame or service frame of the neighbor awareness network.

[0042] According to the fifth aspect or the first possible implementation manner of the fifth aspect, in a second possible implementation manner of the fifth aspect,

the attribute information of the second neighbor awareness network device cluster includes at least one type of the following information:

a CID of the second neighbor awareness network device cluster, the number of wireless devices included in the second neighbor awareness network device cluster, an anchor master rank in the second neighbor awareness network device cluster, a hop count from the wireless device to an anchor master device in the second neighbor awareness network device cluster, and transmission time of a beacon frame of the anchor master device in the second neighbor awareness network device cluster.

[0043] According to the second possible implementation manner of the fifth aspect, in a third possible implementation manner of the fifth aspect,

the comparing the attribute information of the second neighbor awareness network device cluster with attribute information of the first neighbor awareness network device cluster to determine whether it is necessary to join the second neighbor awareness network device cluster are specifically: comparing the CID of the second neighbor awareness network device cluster with the locally recorded CID of the first neighbor awareness network device cluster, and determining, according to a preset determination rule, whether it is necessary to join the second neighbor awareness network device cluster.

[0044] According to the third possible implementation manner of the fifth aspect, in a fourth possible implementation manner of the fifth aspect,

the determination rule is specifically: when the CID of the second neighbor awareness network device cluster is greater than the CID of the first neighbor awareness network device cluster, it is necessary to join the second neighbor awareness network device cluster; or

the determination rule is specifically: when the CID of the second neighbor awareness network device cluster is less than the CID of the first neighbor awareness network device cluster, it is necessary to join the second neighbor awareness network device cluster.

[0045] According to the fifth aspect, or the first possible implementation manner, second possible implementation manner, third possible implementation manner, or fourth possible implementation manner of the fifth aspect, in a fifth possible implementation manner of the fifth aspect,

the leaving the first neighbor awareness network device cluster is specifically: not participating in contending for serving as a synchronization device in the first neighbor awareness network device cluster any longer; and the joining the second neighbor awareness network device cluster is specifically: participating in contending for serving as a synchronization device in the second neighbor awareness network device cluster, and being synchronized to a ~~discovery time window~~discovery window of the second neighbor awareness network device cluster to perform service discovery.

[0046] According to the fifth aspect, or the first possible implementation manner, second possible implementation manner, third possible implementation manner,

fourth possible implementation manner, or fifth possible implementation manner of the fifth aspect, in a sixth possible implementation manner of the fifth aspect,

the event message is a beacon frame or a service frame of a neighbor awareness network, where the beacon frame or the service frame includes the attribute information of the second neighbor awareness network device cluster; or

the event message is a beacon frame or a service frame of a neighbor awareness network, where the beacon frame or the service frame includes merging indication information, and the merging indication information is used to instruct wireless devices in the first neighbor awareness network device cluster that receive the event message to join the second neighbor awareness network device cluster specified by the merging indication information.

[0047] According to the sixth possible implementation manner of the fifth aspect, in a seventh possible implementation manner of the fifth aspect,

the sending, in the first neighbor awareness network device cluster, an event message about joining the second neighbor awareness network device cluster, is specifically: carrying the CID of the second neighbor awareness network device cluster in a destination address field of the beacon frame of the neighbor awareness network, carrying the attribute information of the second neighbor awareness network device cluster in an attribute information field of the neighbor awareness network, and controlling the wireless interface to send the frame as an event message in the first neighbor awareness network device cluster; or

carrying the CID of the second neighbor awareness network device cluster in a destination address field of the service frame of the neighbor awareness network, carrying the attribute information of the second neighbor awareness network device cluster in a frame body, and controlling the wireless interface to send the frame as an event message in the first neighbor awareness network device cluster.

[0048] In a sixth aspect, a wireless device for joining a neighbor awareness network device cluster is provided, where the wireless device in a first neighbor awareness network device cluster includes:

a receiving module, configured to receive an event message about joining a second neighbor awareness network device cluster, where the event message is sent by other wireless devices and includes attribute information of the second neighbor awareness network device cluster; and

a joining module, configured to join the second neighbor awareness network device cluster according to the attribute information of the second neighbor awareness network device cluster.

[0049] According to the sixth aspect, in a first possible implementation manner of the sixth aspect, the wireless device further includes:

a determining module, configured to compare a cluster identifier of the second neighbor awareness network device cluster that is included in the event message with a locally recorded cluster identifier of the first neighbor awareness network device cluster, and determine, according to a preset determination rule, whether it is necessary to join the second neighbor awareness network device cluster; and

a leaving module, configured to leave the first neighbor awareness network device cluster when the determining module determines that it is necessary to join the second neighbor awareness network device cluster; where

the joining module is specifically configured to join the second neighbor awareness network device cluster when the determining module determines that it is necessary to join the second neighbor awareness network device cluster.

[0050] According to the first possible implementation manner of the sixth aspect, in a second possible implementation manner of the sixth aspect, the determination rule is specifically: when the cluster identifier of the second neighbor awareness network device cluster is greater than the cluster identifier of the first neighbor awareness network device cluster, it is necessary to join the second neighbor awareness network device cluster; or

the determination rule is specifically: when the cluster identifier of the second neighbor awareness network device cluster is less than the cluster identifier of the first neighbor awareness network device cluster, it is necessary to join the

second neighbor awareness network device cluster.

[0051] According to the sixth aspect, or the first implementation manner or second implementation manner of the sixth aspect, in a third possible implementation manner of the sixth aspect, the wireless device further includes:

a message sending module, configured to determine, according to received signal strength of the event message and the number of received event messages, in the first neighbor awareness network device cluster, whether to send an event message about joining the second neighbor awareness network device cluster, and when determining sending the event message, in the first neighbor awareness network device cluster, send the event message about joining the second neighbor awareness network device cluster.

[0052] According to the third implementation manner of the sixth aspect, in a fourth possible implementation manner of the sixth aspect,

the message sending module is specifically configured to: determine whether the received signal strength of the event message is higher than a first threshold, and if the received signal strength of the event message is higher than the first threshold, in the first neighbor awareness network device cluster, not send the event message about joining the second neighbor awareness network device cluster; or if the received signal strength of the event message is lower than or equal to the first threshold, determine the number of received event messages whose received signal strength is higher than a second threshold, and if the number reaches the threshold, in the first neighbor awareness network device cluster, not send the event message about joining the second neighbor awareness network device cluster, or if the number does not reach the threshold, in the first neighbor awareness network device cluster, send the event message about joining the second neighbor awareness network device cluster; where the first threshold is higher than the second threshold.

[0053] In a seventh aspect, a wireless device for joining a neighbor awareness network device cluster is provided, where the wireless device in a first neighbor awareness network device cluster includes:

a wireless interface, configured to receive an event message about joining

a second neighbor awareness network device cluster, where the event message is sent by other wireless devices and includes attribute information of the second neighbor awareness network device cluster; and

a processor, configured to join the second neighbor awareness network device cluster according to the attribute information of the second neighbor awareness network device cluster.

[0054] According to the seventh aspect, in a first possible implementation manner of the seventh aspect,

the processor is specifically configured to compare a CID of the second neighbor awareness network device cluster that is included in the event message with a locally recorded CID of the first neighbor awareness network device cluster, and determine, according to a preset determination rule, whether it is necessary to join the second neighbor awareness network device cluster; and when a determination result is that it is necessary to join the second neighbor awareness network device cluster, leave the first neighbor awareness network device cluster, and join the second neighbor awareness network device cluster.

[0055] According to the first possible implementation manner of the seventh aspect, in a second possible implementation manner of the seventh aspect, the determination rule is specifically: when the CID of the second neighbor awareness network device cluster is greater than the CID of the first neighbor awareness network device cluster, it is necessary to join the second neighbor awareness network device cluster; or

the determination rule is specifically: when the CID of the second neighbor awareness network device cluster is less than the CID of the first neighbor awareness network device cluster, it is necessary to join the second neighbor awareness network device cluster.

[0056] According to the seventh aspect, or the first possible implementation manner or second possible implementation manner of the seventh aspect, in a third possible implementation manner of the seventh aspect,

the processor is further configured to determine, according to received signal strength of the event message and the number of received event messages,

whether to send, in the first neighbor awareness network device cluster, an event message about joining the second neighbor awareness network device cluster.

[0057] According to the third possible implementation manner of the seventh aspect, in a fourth possible implementation manner of the seventh aspect,

the determining, according to received signal strength of the event message and the number of received event messages, whether to send, in the first neighbor awareness network device cluster, an event message about joining the second neighbor awareness network device cluster is specifically: determining whether the received signal strength of the event message is higher than a first threshold; and if the received signal strength of the event message is higher than the first threshold, in the first neighbor awareness network device cluster, not sending the event message about joining the second neighbor awareness network device cluster; or if the received signal strength of the event message is lower than or equal to the first threshold, determining the number of received event messages whose received signal strength is higher than a second threshold, and if the number reaches the threshold, in the first neighbor awareness network device cluster, not sending the event message about joining the second neighbor awareness network device cluster, or if the number does not reach the threshold, in the first neighbor awareness network device cluster, sending the event message about joining the second neighbor awareness network device cluster; where the first threshold is higher than the second threshold.

[0058] In an eighth aspect, a wireless device for joining a neighbor awareness network device cluster is provided, where the wireless device in a first neighbor awareness network device cluster includes:

a discovery module, configured to discover a neighbor awareness network device cluster;

an attribute information acquiring module, configured to acquire attribute information of the second neighbor awareness network device cluster when the discovery module discovers a second neighbor awareness network device cluster;

a determining module, configured to compare the attribute information of

the second neighbor awareness network device cluster with attribute information of the first neighbor awareness network device cluster to determine whether it is necessary to join the second neighbor awareness network device cluster;

a leaving module, configured to leave the first neighbor awareness network device cluster when the determining module determines that it is necessary to join the second neighbor awareness network device cluster; and

a joining module, configured to join the second neighbor awareness network device cluster when the determining module determines that it is necessary to join the second neighbor awareness network device cluster.

[0059] According to the eighth aspect, in a first possible implementation manner of the eighth aspect,

the discovery module is specifically configured to determine, when a cluster identifier included in a received beacon frame or service frame of a neighbor awareness network is different from a locally recorded cluster identifier of the first neighbor awareness network device cluster, that the second neighbor awareness network device cluster is discovered; and

the attribute information acquiring module is specifically configured to acquire the attribute information of the second neighbor awareness network device cluster from the received beacon frame or service frame of the neighbor awareness network.

[0060] According to the eighth aspect or the first possible implementation manner of the eighth aspect, in a second possible implementation manner of the eighth aspect, the attribute information of the second neighbor awareness network device cluster includes at least one type of the following information:

a cluster identifier of the second neighbor awareness network device cluster, the number of wireless devices included in the second neighbor awareness network device cluster, an anchor master rank in the second neighbor awareness network device cluster, a hop count from the wireless device to an anchor master device in the second neighbor awareness network device cluster, and transmission time of a beacon frame of the anchor master device in the second neighbor awareness network device cluster.

[0061] According to the second possible implementation manner of the eighth aspect, in a third possible implementation manner of the eighth aspect,

the determining module is specifically configured to compare the cluster identifier of the second neighbor awareness network device cluster with the locally recorded cluster identifier of the first neighbor awareness network device cluster, and determine, according to a preset determination rule, whether it is necessary to join the second neighbor awareness network device cluster.

[0062] According to the third possible implementation manner of the eighth aspect, in a fourth possible implementation manner of the eighth aspect, the determination rule is specifically: when the cluster identifier of the second neighbor awareness network device cluster is greater than the cluster identifier of the first neighbor awareness network device cluster, it is necessary to join the second neighbor awareness network device cluster; or

the determination rule is specifically: when the cluster identifier of the second neighbor awareness network device cluster is less than the cluster identifier of the first neighbor awareness network device cluster, it is necessary to join the second neighbor awareness network device cluster.

[0063] According to the eighth aspect, or the first possible implementation manner, second possible implementation manner, third possible implementation manner, or fourth possible implementation manner of the eighth aspect, in a fifth possible implementation manner of the eighth aspect,

the leaving module is specifically configured not to participate in contending for serving as a synchronization device in the first neighbor awareness network device cluster any longer; and

the joining module is specifically configured to participate in contending for serving as a synchronization device in the second neighbor awareness network device cluster, and be synchronized to a ~~discovery time window~~discovery window of the second neighbor awareness network device cluster to perform service discovery.

[0064] In a ninth aspect, a wireless device for joining a neighbor awareness network device cluster is provided, where the wireless device in a first neighbor

awareness network device cluster includes:

a wireless interface, configured to scan a neighbor awareness network device cluster; and

a processor, configured to discover a second neighbor awareness network device cluster according to a scanning result of the wireless interface, and acquire attribute information of the second neighbor awareness network device cluster; compare the attribute information of the second neighbor awareness network device cluster with attribute information of the first neighbor awareness network device cluster to determine whether it is necessary to join the second neighbor awareness network device cluster; and when a determination result is that it is necessary to join the second neighbor awareness network device cluster, leave the first neighbor awareness network device cluster, and join the second neighbor awareness network device cluster.

[0065] According to the ninth aspect, in a first possible implementation manner of the ninth aspect,

the wireless interface is specifically configured to scan a beacon frame or a service frame of a neighbor awareness network; and

the discovering a second neighbor awareness network device cluster according to a scanning result of the wireless interface, and acquiring attribute information of the second neighbor awareness network device cluster are specifically: when a CID included in a beacon frame or a service frame of a neighbor awareness network that is scanned by the wireless interface is different from a locally recorded CID of the first neighbor awareness network device cluster, determining that the second neighbor awareness network device cluster is discovered; and acquiring the attribute information of the second neighbor awareness network device cluster from the received beacon frame or service frame of the neighbor awareness network.

[0066] According to the ninth aspect or the first possible implementation manner of the ninth aspect, in a second possible implementation manner of the ninth aspect, the attribute information of the second neighbor awareness network device cluster includes at least one type of the following information:

a CID of the second neighbor awareness network device cluster, the

number of wireless devices included in the second neighbor awareness network device cluster, an anchor master rank in the second neighbor awareness network device cluster, a hop count from the wireless device to an anchor master device in the second neighbor awareness network device cluster, and transmission time of a beacon frame of the anchor master device in the second neighbor awareness network device cluster.

[0067] According to the second possible implementation manner of the ninth aspect, in a third possible implementation manner of the ninth aspect,

the comparing the attribute information of the second neighbor awareness network device cluster with attribute information of the first neighbor awareness network device cluster to determine whether it is necessary to join the second neighbor awareness network device cluster are specifically: comparing the CID of the second neighbor awareness network device cluster with the locally recorded CID of the first neighbor awareness network device cluster, and determining, according to a preset determination rule, whether it is necessary to join the second neighbor awareness network device cluster.

[0068] According to the third possible implementation manner of the ninth aspect, in a fourth possible implementation manner of the ninth aspect,

the determination rule is specifically: when the CID of the second neighbor awareness network device cluster is greater than the CID of the first neighbor awareness network device cluster, it is necessary to join the second neighbor awareness network device cluster; or

the determination rule is specifically: when the CID of the second neighbor awareness network device cluster is less than the CID of the first neighbor awareness network device cluster, it is necessary to join the second neighbor awareness network device cluster.

[0069] According to the ninth aspect, or the first possible implementation manner, second possible implementation manner, or third possible implementation manner of the ninth aspect, in a fourth possible implementation manner of the ninth aspect,

the leaving the first neighbor awareness network device cluster is

specifically: not participating in contending for serving as a synchronization device in the first neighbor awareness network device cluster any longer; and the joining the second neighbor awareness network device cluster is specifically: participating in contending for serving as a synchronization device in the second neighbor awareness network device cluster, and being synchronized to a ~~discovery time window~~discovery window of the second neighbor awareness network device cluster to perform service discovery.

[0070] In a tenth aspect, a wireless device for joining a neighbor awareness network device cluster is provided, where the wireless device includes:

a discovery module, configured to discover a neighbor awareness network device cluster;

a creating module, configured to create a new neighbor awareness network device cluster when the discovery module discovers multiple neighbor awareness network device clusters; and

a message sending module, configured to send, separately in the multiple neighbor awareness network device clusters, an event message about joining the new neighbor awareness network device cluster, where the event message includes attribute information of the new neighbor awareness network device cluster, so that other wireless devices that are in the multiple neighbor awareness network device clusters and receive the event message join the new neighbor awareness network device cluster according to the event message.

[0071] According to the tenth aspect, in a first possible implementation manner of the tenth aspect, a cluster identifier of the new neighbor awareness network device cluster and cluster identifiers of the multiple neighbor awareness network device clusters meet a preset condition.

[0072] According to the first possible implementation manner of the tenth aspect, in a second possible implementation manner of the tenth aspect,

the preset condition is specifically: the cluster identifier of the new neighbor awareness network device cluster created by the wireless device is greater than a cluster identifier of any one of the multiple neighbor awareness network device clusters; or

the preset condition is specifically: the cluster identifier of the new neighbor awareness network device cluster created by the wireless device is less than a cluster identifier of any one of the multiple neighbor awareness network device clusters.

[0073] According to the tenth aspect, or the first possible implementation manner or second possible implementation manner of the tenth aspect, in a third possible implementation manner of the tenth aspect,

transmission time of a beacon frame of an anchor master device in the created new neighbor awareness network device cluster is the same as transmission time of a beacon frame of an anchor master device in one of the multiple neighbor awareness network device clusters.

[0074] In an eleventh aspect, a wireless device for joining a neighbor awareness network device cluster is provided and includes:

a wireless interface, configured to scan a neighbor awareness network device cluster; and

a processor, configured to create a new neighbor awareness network device cluster when discovering multiple neighbor awareness network device clusters according to the scanning of the wireless interface; and send, separately in the multiple neighbor awareness network device clusters, an event message about joining the new neighbor awareness network device cluster, where the event message includes attribute information of the new neighbor awareness network device cluster, so that other wireless devices that are in the multiple neighbor awareness network device clusters and receive the event message join the new neighbor awareness network device cluster according to the event message.

[0075] In a twelfth aspect, a system for joining a neighbor awareness network device cluster is provided and includes multiple wireless devices, where:

a wireless device in a first neighbor awareness network device cluster is configured to acquire attribute information of the second neighbor awareness network device cluster when discovering a second neighbor awareness network device cluster; compare the attribute information of the second neighbor awareness

network device cluster with attribute information of the first neighbor awareness network device cluster to determine whether it is necessary to join the second neighbor awareness network device cluster; and when determining that it is necessary to join the second neighbor awareness network device cluster, in the first neighbor awareness network device cluster, send an event message about joining the second neighbor awareness network device cluster, leave the first neighbor awareness network device cluster, and join the second neighbor awareness network device cluster, where the event message includes the attribute information of the second neighbor awareness network device cluster; and

other wireless devices in the first neighbor awareness network device cluster that receive the event message are configured to join the second neighbor awareness network device cluster according to the attribute information of the second neighbor awareness network device cluster.

[0076] In a thirteenth aspect, a system for joining a neighbor awareness network device cluster is provided and includes:

a wireless device, configured to create a new neighbor awareness network device cluster when discovering multiple neighbor awareness network device clusters, and send, separately in the multiple neighbor awareness network device clusters, an event message about joining the new neighbor awareness network device cluster, where the event message includes attribute information of the new neighbor awareness network device cluster; and

other wireless devices that are in the multiple neighbor awareness network device clusters and receive the event message, configured to join the new neighbor awareness network device cluster according to the event message.

[0077] ~~This application~~The present invention has the following beneficial effects:

[0078] In the solutions of ~~embodiments of~~ the present invention, a wireless device moves between multiple neighbor awareness network device clusters according to a rule, and does not belong to the multiple neighbor awareness network device clusters at the same time; the wireless device contends for serving as a synchronization device and performs service discovery in a DW both only in a

neighbor awareness network device cluster that the wireless device joins. Therefore, the actual working time spent by the wireless device in synchronization and service search and discovery is relatively short, and power consumption of the wireless device is also relatively low. Meanwhile, as time progresses, wireless devices in a neighbor awareness network device cluster may be merged into another neighbor awareness network device cluster, and a case in which DWs of some neighbor awareness network device clusters on a working channel are no longer occupied occurs. Therefore, available resources on the working channel are increased, and correct service search and discovery can be ensured.

BRIEF DESCRIPTION OF DRAWINGS

[0079] To describe the technical solutions ~~in the embodiments~~ of the present invention more clearly, in the following ~~briefly introduces the~~ accompanying drawings ~~required for~~ are briefly introduced describing ~~the~~ embodiments of the present invention. Apparently, the accompanying drawings in the following description show merely some embodiments of the present invention~~, and a person of ordinary skill in the art may still derive other drawings from these accompanying drawings without creative efforts~~.

[0080] FIG. 1 is a schematic diagram of a DW of a neighbor awareness network device cluster on a sixth channel of 2.4 Ghz according to the prior art;

[0081] FIG. 2 is a schematic diagram of composition of a neighbor awareness network according to the prior art;

[0082] FIG. 3 is a schematic diagram of two neighbor awareness network device clusters that have a same working channel but unaligned DWs according to the prior art;

[0083] FIG. 4 is a schematic diagram of steps of a method for joining a neighbor awareness network device cluster according to Embodiment 1 of the present invention;

[0084] FIG. 5 is a schematic diagram of composition of a neighbor awareness network according to Embodiment 1 of the present invention;

[0085] FIG. 6 is a schematic diagram of steps of a method for joining a neighbor awareness network device cluster according to Embodiment 2 of the present invention;

[0086] FIG. 7 is a schematic diagram of composition of a neighbor awareness network according to Embodiment 2 of the present invention;

[0087] FIG. 8 is a schematic diagram of steps of a method for joining a neighbor awareness network device cluster according to Embodiment 3 of the present invention;

[0088] FIG. 9 is a schematic diagram of composition of a neighbor awareness network according to Embodiment 3 of the present invention;

[0089] FIG. 10 (a) and FIG. 10 (b) are schematic structural diagrams of a wireless device according to Embodiment 4 of the present invention;

[0090] FIG. 11 is a schematic structural diagram of a wireless device according to Embodiment 5 of the present invention;

[0091] FIG. 12 is a schematic structural diagram of a wireless device according to Embodiment 6 of the present invention; and

[0092] FIG. 13 is a schematic structural diagram of a wireless device according to Embodiment 8 of the present invention.

DESCRIPTION OF EMBODIMENTS

[0093] To make the objectives, technical solutions, and advantages of the present invention clearer, the following further describes the present invention in detail with reference to the accompanying drawings. Apparently, the described embodiments are merely a part rather than all of the embodiments of the present invention. ~~All other embodiments obtained by a person of ordinary skill in the art based on the embodiments of the present invention without creative efforts shall fall within the protection scope of the present invention.~~

[0094] To reduce actual working time spent by a wireless device in service search and discovery and reduce power consumption of the wireless device without

by the wireless device in synchronization and service search and discovery is relatively short, and power consumption of the wireless device is also relatively low. Meanwhile, as time progresses, other wireless devices in the first neighbor awareness network device cluster may also leave the first neighbor awareness network device cluster and join the second neighbor awareness network device cluster according to operations similar to the above; when all wireless devices in the first neighbor awareness network device cluster ~~leave and join~~leave the first neighbor awareness network device cluster and join the second neighbor awareness network device cluster (that is, the first neighbor awareness network device cluster is merged into the second neighbor awareness network device cluster), a DW of the first neighbor awareness network device cluster on the working channel is no longer occupied. Therefore, available resources on the working channel are increased, and correct service search and discovery can be ensured.

[0097] The neighbor awareness network device cluster involved in the embodiment of the present invention is a relatively loose wireless network established by direct communication between multiple wireless devices, and the neighbor awareness network device cluster has a cluster identifier (CID) for indicating the cluster.

[0098] Wireless devices in the neighbor awareness network device cluster may be classified by functions into:

Anchor Master (anchor master device), having the largest AMR (Anchor Master Rank, anchor master rank), and providing a TSF (time ~~clock~~ synchronization function);

Master, sending a Sync Beacon carrying cluster attribute information, such as anchor master device information, to implement device synchronization in the network; and further sending a Discovery Beacon to announce existence of a neighbor awareness network device cluster;

Non-Master Sync, configured to send a Sync Beacon carrying cluster attribute information such as anchor master device information, to implement device synchronization in the network; and

Non-Master Non-Sync (non-master non-synchronization device), not

sending a beacon frame.

[0099] The attribute information of the neighbor awareness network device cluster includes: a CID, the number of wireless devices included in the neighbor awareness network device cluster, an anchor master rank in the neighbor awareness network device cluster, a hop count from the wireless device to an anchor master device, transmission time of a beacon frame of an anchor master device, and so on. The Master and Non-Master Sync may be called synchronization devices because they both send a Sync Beacon to perform synchronization.

[00100] The neighbor awareness network device cluster synchronizes, by using a beacon frame, a wireless device in the cluster to a DW and a cluster working channel that are specified by the cluster, and the wireless device in the cluster sends a service discovery frame in the DW to implement service discovery between devices in the cluster.

[00101] A neighbor awareness network technology defines a working channel (for example, a sixth channel of 2.4 GhHz or a channel of 5 GHz). On a working channel of a neighbor awareness network, the wireless device may actively create a neighbor awareness network device cluster, or the wireless device discovers an existing neighbor awareness network device cluster nearby by scanning the working channel of the neighbor awareness network, and joins the neighbor awareness network device cluster.

[00102] It should be noted that the wireless device involved in the embodiment of the present invention may be a Wi-Fi device, or a Bluetooth device, and so on.

[00103] The following describes the solution of the present invention in detail with reference to specific embodiments.

Embodiment 1

[00104] As shown in FIG. 4, which is a schematic diagram of steps of a method for joining a neighbor awareness network device cluster in Embodiment 1 of the present invention, the method includes the following steps:

awareness network device cluster, for example, wireless device_5, wireless device_6, and wireless device_7 may also leave the first neighbor awareness network device cluster and join the second neighbor awareness network device cluster.

[00134] When all wireless devices in the first neighbor awareness network device cluster ~~leave and join~~leave the first neighbor awareness network device cluster and join the second neighbor awareness network device cluster (that is, the first neighbor awareness network device cluster is merged into the second neighbor awareness network device cluster), the DW of the first neighbor awareness network device cluster on the working channel is not occupied. Therefore, available resources on the working channel are increased, and service search and discovery can be ensured.

[00135] In the solution of Embodiment 1, in the process in which any wireless device in the first neighbor awareness network device cluster leaves the first neighbor awareness network device cluster and joins the second neighbor awareness network device cluster, other wireless devices in the first neighbor awareness network device cluster are not actively notified. Each wireless device itself performs scanning and discovery, and selects, according to a rule, to join a neighbor awareness network device cluster. This solution has relatively low requirements for capabilities of the wireless devices, and is simple and easy to implement.

[00136] Considering that in the solution of Embodiment 1, the process in which the first neighbor awareness network device cluster is merged into the second neighbor awareness network device cluster is relatively slow, to improve efficiency of the wireless device' moving between multiple neighbor awareness network device clusters, on the basis of Embodiment 1, Embodiment 2 of the present invention further proposes that a wireless device leaving the first neighbor awareness network device cluster should send, in the first neighbor awareness network device cluster, an event message about joining the second neighbor awareness network device cluster, so that wireless devices in the first neighbor awareness network device cluster that receive the event message are capable of joining the second neighbor awareness network device cluster quickly, and that efficiency of merging the first neighbor

network device cluster.

[00147] The other wireless devices receiving the event message may acquire the attribute information of the second neighbor awareness network device cluster from the received event message, and the other wireless devices may determine, according to the manner described in step 203 or step 103, whether it is necessary to join the second neighbor awareness network device cluster, for example, determine, according to the CID, scale, and so on, whether it is necessary to join the second neighbor awareness network device cluster.

[00148] When determining that it is necessary to join the second neighbor awareness network device cluster, the other wireless devices leave the first neighbor awareness network device cluster and join the second neighbor awareness network device cluster. Embodiment 2 does not limit a sequence of the other wireless devices' leaving the first neighbor awareness network device cluster and joining the second neighbor awareness network device cluster.

[00149] Further, in another embodiment, step 207 may be included: The other wireless devices determine, according to a received signal strength indicator (RSSI) of the event message and the number of received event messages, whether to send, in the first neighbor awareness network device cluster, an event message about joining the second neighbor awareness network device cluster.

[00150] When the other wireless devices determine joining the second neighbor awareness network device cluster, a sequence between the other wireless devices' joining the second neighbor awareness network device cluster and continuing to propagate the event message in the first neighbor awareness network device cluster is not limited. For a sequence between the three processes of the other wireless devices' leaving the first neighbor awareness network device cluster, joining the second neighbor awareness network device cluster, and continuing to propagate the event message in the first neighbor awareness network device cluster, reference may be made to the related description in step 205.

[00151] When the other wireless devices determine leaving the first neighbor awareness network device cluster and joining the second neighbor awareness

Duration: a duration field;

A1: an address 1, which is an ID of a neighbor awareness network device cluster that is defined by the Wi-Fi Alliance;

A2: an address 2, which is an address of a sender;

A3: an address 3, which is a cluster identifier of the neighbor awareness network device cluster, namely, a CID field, used to indicate a neighbor awareness network device cluster to which the wireless device belongs;

SeqCtrol: sequence control;

Time Stamp: a timestamp of a beacon frame;

Beacon Interval: a time interval of the beacon frame;

Capability: capability information;

NAN IE: an attribute information field of a neighbor awareness network, carrying attribute information of the neighbor awareness network device cluster; and

FCS: frame check sequence.

[00160] The wireless device makes the following modifications to the conventional Sync Beacon generated for the first neighbor awareness network device cluster, to obtain an event message sent in the first neighbor awareness network device cluster:

(1) carrying the CID of the second neighbor awareness network device cluster in the destination address field (namely, the A3 field), where the CID is used to indicate to the other wireless devices receiving the event message that the event message is used for propagating the second neighbor awareness network device cluster; and

(2) carrying the attribute information of the second neighbor awareness network device cluster in the attribute information field of the neighbor awareness network, so that a wireless device receiving the event message modifies locally recorded attribute information of the first neighbor awareness network device cluster to the attribute information of the second neighbor awareness network device cluster.

[00161] By modifying the foregoing two parts, the wireless device receiving the event message may first determine, according to the CID, whether to join the second

neighbor awareness network device cluster, and after determining joining the second neighbor awareness network device cluster, update the locally recorded attribute information of the neighbor awareness network device cluster.

[00162] The Sync Beacon is used as an example for description above. The processing manner for an event ~~information~~ message that is a Discovery Beacon including the attribute information of the second neighbor awareness network device cluster is the same as the processing manner for the Sync Beacon.

[00163] A Service Discovery Frame including the attribute information of the second neighbor awareness network device cluster is used as an example of the event message. The event message sent in the first neighbor awareness network device cluster by the wireless device is a Service Discovery Frame generated for the first neighbor awareness network device cluster. Table 2 is a frame structure of a conventional Service Discovery Frame.

Table 2

2	2	6	6	6	2	4	0-2320	4
Frame Control	**Duration**	**A1**	**A2**	**A3**	**Seq. Ctrl**	**HT Ctrl**	**Frame Body**	**FCS**

[00164] Definitions of a format for a frame body (Frame Body) part is listed in Table 3:

Table 3

Field	**Size (Octets)**	**Value (Hex)**	**Description**
Category	1	0x04	IEEE 802.11 Public Action Frame
Action Field	1	0x09	IEEE 802.11 Public Action Frame Vendor Specific

Field	Size (Octets)	Value (Hex)	Description
OUI	3	0x50-6F-9A	WFA specific OUI
OUI Type	1	TBD by WFA	Identifying the type and version of the NAN
NAN Attributes	Variable	Variable	One or more NAN Attributes

where:

Category: a type of a ~~public~~ Public Action ~~frame~~Frame;

Action Field: an action field, a type of which is defined by a vendor;

OUI: an organization identifier, specified by the Wi-Fi Alliance;

OUI Type: an organization type; and

NAN Attributes: an attribute information field of a neighbor awareness network.

[00165] The wireless device makes the following modifications to the conventional Service Discovery Frame generated for the first neighbor awareness network device cluster, to obtain an event message sent in the first neighbor awareness network device cluster:

(1) carrying the CID of the second neighbor awareness network device cluster in the destination address field (namely, the A3 field), where the CID is used to indicate to the other wireless devices receiving the event message that the event message is used for propagating the second neighbor awareness network device cluster; and

(2) carrying the attribute information of the second neighbor awareness network device cluster in the attribute information field of the neighbor awareness network in the frame body, so that a wireless device receiving the event message modifies locally recorded attribute information of the first neighbor awareness network device cluster to the attribute information of the second neighbor awareness

device that has joined a neighbor awareness network device cluster, or may also be a wireless device that has not joined any neighbor awareness network device cluster) discovers multiple neighbor awareness network device clusters by means of scanning, the wireless device may also not join any one of the neighbor awareness network device clusters, but actively create a new neighbor awareness network device cluster, requiring that discovered other neighbor awareness network device clusters be merged into the created new neighbor awareness network device cluster. In this case, when discovering multiple neighbor awareness network device clusters, the wireless device joins only the new neighbor awareness network device cluster created by the wireless device itself. Therefore, it is ensured that actual working time spent by the wireless device in synchronization and service search and discovery is relatively short, and that power consumption is relatively low. Meanwhile, as time progresses, other wireless devices in each neighbor awareness network device cluster that are discovered by the wireless device may also join the created new neighbor awareness network device cluster, so that DWs of the discovered multiple neighbor awareness network device clusters on the working channel are released, available resources on the working channel are increased, and service search and discovery can be ensured. Embodiment 3 is used for description as follows.

Embodiment 3

[00175] As shown in FIG. 8, which is a schematic diagram of steps of a method of Embodiment 3 of the present invention, the method includes the following steps:

[00176] Step 301: A wireless device creates a new neighbor awareness network device cluster when discovering multiple neighbor awareness network device clusters.

[00177] In step 301, the wireless device may be a wireless device that has not joined any neighbor awareness network device cluster. When discovering multiple neighbor awareness network device clusters in a process of discovering a neighbor awareness network device cluster, the wireless device may not join any one of the

specifically configured to participate in contending for serving as a synchronization device in the second neighbor awareness network device cluster, and be synchronized to a ~~discovery time window~~discovery window of the second neighbor awareness network device cluster to perform service discovery.

[00203] The wireless device in Embodiment 4 has a function of implementing each step in Embodiment 1, which is not repeated herein.

[00204] Embodiment 4 of the present invention further describes a wireless device for joining a neighbor awareness network device cluster, which is of a same inventive concept as Embodiment 1. As shown in FIG. 10 (b), the wireless device in a first neighbor awareness network device cluster includes: a wireless interface 21 and a processor 22.

[00205] The wireless interface 21 is configured to scan a neighbor awareness network device cluster.

[00206] The processor 22 is configured to discover a second neighbor awareness network device cluster according to a scanning result of the wireless interface 21, and acquire attribute information of the second neighbor awareness network device cluster; compare the attribute information of the second neighbor awareness network device cluster with attribute information of the first neighbor awareness network device cluster to determine whether it is necessary to join the second neighbor awareness network device cluster; and when a determination result is that it is necessary to join the second neighbor awareness network device cluster, leave the first neighbor awareness network device cluster, and join the second neighbor awareness network device cluster.

[00207] Preferably, the wireless interface 21 is specifically configured to scan a beacon frame or a service frame of a neighbor awareness network; and

the discovering a second neighbor awareness network device cluster according to a scanning result of the wireless interface 21, and acquiring attribute information of the second neighbor awareness network device cluster are specifically: when a CID included in a beacon frame or a service frame of a neighbor awareness network that is scanned by the wireless interface 21 is different from a locally

[00211] Preferably, the leaving the first neighbor awareness network device cluster is specifically: not participating in contending for serving as a synchronization device in the first neighbor awareness network device cluster any longer; and the joining the second neighbor awareness network device cluster is specifically: participating in contending for serving as a synchronization device in the second neighbor awareness network device cluster, and being synchronized to a ~~discovery time window~~discovery window of the second neighbor awareness network device cluster to perform service discovery.

[00212] The processor 22 further has a capability of controlling each interface and other functional components in the wireless device to perform the foregoing operations.

[00213] The wireless device in Embodiment 4 has a function of implementing each step in Embodiment 1, which is not repeated herein.

Embodiment 5

[00214] Embodiment 5 of the present invention describes a wireless device for joining a neighbor awareness network device cluster, which is of a same inventive concept as Embodiment 2. As shown in FIG. 11, the wireless device in a first neighbor awareness network device cluster includes a discovery module 31, an attribute information acquiring module 32, a determining module 33, a message sending module 34, a leaving module 35, and a joining module 36.

[00215] The discovery module 31 is configured to discover a neighbor awareness network device cluster. In the solution of Embodiment 5, the discovery module 31 may discover a second neighbor awareness network device cluster according to a manner the same as step 201 in Embodiment 2.

[00216] The attribute information acquiring module 32 is configured to acquire attribute information of the second neighbor awareness network device cluster when the discovery module 31 discovers a second neighbor awareness network device cluster. In the solution of Embodiment 5, the attribute information acquiring module 32 may

participate in contending for serving as a synchronization device in the first neighbor awareness network device cluster any longer; and the joining module 36 is specifically configured to participate in contending for serving as a synchronization device in the second neighbor awareness network device cluster, and be synchronized to a ~~discovery time window~~discovery window of the second neighbor awareness network device cluster to perform service discovery.

[00226] Preferably, the event message is a beacon frame or a service frame of a neighbor awareness network, where the beacon frame or the service frame includes the attribute information of the second neighbor awareness network device cluster; or

the event message is a beacon frame or a service frame of a neighbor awareness network, where the beacon frame or the service frame includes merging indication information, and the merging indication information is used to instruct wireless devices in the first neighbor awareness network device cluster that receive the event message to join the second neighbor awareness network device cluster specified by the merging indication information.

[00227] The message sending module 34 is specifically configured to: when the determining module 33 determines that it is necessary to join the second neighbor awareness network device cluster, carry the cluster identifier of the second neighbor awareness network device cluster in a destination address field of the beacon frame of the neighbor awareness network, carry the attribute information of the second neighbor awareness network device cluster in an attribute information field of the neighbor awareness network, and send the beacon frame as an event message in the first neighbor awareness network device cluster; or

carry the cluster identifier of the second neighbor awareness network device cluster in a destination address field of the service frame of the neighbor awareness network, carry the attribute information of the second neighbor awareness network device cluster in a frame body, and send the service frame as an event message in the first neighbor awareness network device cluster.

[00228] The wireless device in Embodiment 5 has a function of implementing

step 201 to step 205 in Embodiment 2, which is not repeated herein.

[00229] Embodiment 5 of the present invention further describes a wireless device for joining a neighbor awareness network device cluster, which is of a same inventive concept as Embodiment 2. The wireless device in a first neighbor awareness network device cluster includes: a wireless interface and a processor.

[00230] The wireless interface is configured to scan a neighbor awareness network device cluster.

[00231] The processor is configured to discover a second neighbor awareness network device cluster according to a scanning result of the wireless interface, and acquire attribute information of the second neighbor awareness network device cluster; compare the attribute information of the second neighbor awareness network device cluster with attribute information of the first neighbor awareness network device cluster to determine whether it is necessary to join the second neighbor awareness network device cluster; and when a determination result is that it is necessary to join the second neighbor awareness network device cluster, control the wireless interface to send, in the first neighbor awareness network device cluster, an event message about joining the second neighbor awareness network device cluster, leave the first neighbor awareness network device cluster, and join the second neighbor awareness network device cluster, where the event message includes the attribute information of the second neighbor awareness network device cluster, so that other wireless devices in the first neighbor awareness network device cluster that receive the event message are capable of joining the second neighbor awareness network device cluster according to the attribute information of the second neighbor awareness network device cluster.

[00232] Preferably, the wireless interface is specifically configured to scan a beacon frame or a service frame of a neighbor awareness network; and

the discovering a second neighbor awareness network device cluster according to a scanning result of the wireless interface, and acquiring attribute information of the second neighbor awareness network device cluster are specifically: when a CID included in a received beacon frame or service frame of a neighbor awareness

[00236] Preferably, the leaving the first neighbor awareness network device cluster is specifically: not participating in contending for serving as a synchronization device in the first neighbor awareness network device cluster any longer; and the joining the second neighbor awareness network device cluster is specifically: participating in contending for serving as a synchronization device in the second neighbor awareness network device cluster, and being synchronized to a ~~discovery time window~~discovery window of the second neighbor awareness network device cluster to perform service discovery.

[00237] Preferably, the event message is a beacon frame or a service frame of a neighbor awareness network, where the beacon frame or the service frame includes the attribute information of the second neighbor awareness network device cluster; or

the event message is a beacon frame or a service frame of a neighbor awareness network, where the beacon frame or the service frame includes merging indication information, and the merging indication information is used to instruct wireless devices in the first neighbor awareness network device cluster that receive the event message to join the second neighbor awareness network device cluster specified by the merging indication information.

[00238] The sending, in the first neighbor awareness network device cluster, an event message about joining the second neighbor awareness network device cluster is specifically: carrying the CID of the second neighbor awareness network device cluster in a destination address field of the beacon frame of the neighbor awareness network, carrying the attribute information of the second neighbor awareness network device cluster in an attribute information field of the neighbor awareness network, and controlling the wireless interface to send the frame as an event message in the first neighbor awareness network device cluster; or

carrying the CID of the second neighbor awareness network device cluster in a destination address field of the service frame of the neighbor awareness network, carrying the attribute information of the second neighbor awareness network device cluster in a frame body, and controlling the wireless interface to send

a determining module 43, configured to compare a cluster identifier of the second neighbor awareness network device cluster that is included in the event message with a locally recorded cluster identifier of the first neighbor awareness network device cluster, and determine, according to a preset determination rule, whether it is necessary to join the second neighbor awareness network device cluster; and

a leaving module 44, configured to leave the first neighbor awareness network device cluster when the determining module 43 determines that it is necessary to join the second neighbor awareness network device cluster; where

the joining module 42 is specifically configured to join the second neighbor awareness network device cluster when the determining module 43 determines that it is necessary to join the second neighbor awareness network device cluster.

[00247] The determination rule is specifically: when the CID of the second neighbor awareness network device cluster is greater than the CID of the first neighbor awareness network device cluster, it is necessary to join the second neighbor awareness network device cluster; or

the determination rule is specifically: when the CID of the second neighbor awareness network device cluster is less than the CID of the first neighbor awareness network device cluster, it is necessary to join the second neighbor awareness network device cluster.

[00248] Preferably, the wireless device further includes:

a message sending module 45, configured to determine, according to received signal strength of the event message and the number of received event messages, whether to send, in the first neighbor awareness network device cluster, an event message about joining the second neighbor awareness network device cluster, and when determining sending the event message, in the first neighbor awareness network device cluster, send the event message about joining the second neighbor awareness network device cluster.

[00249] Preferably, the message sending module 45 is specifically configured to: determine whether the received signal strength of the event message is higher than a

device cluster, where the event message includes the attribute information of the second neighbor awareness network device cluster.

[00263] Other wireless devices in the first neighbor awareness network device cluster that receive the event message are configured to join the second neighbor awareness network device cluster according to the attribute information of the second neighbor awareness network device cluster.

[00264] The wireless device sending the event message and the wireless device receiving the event message further have functions of implementing each step in Embodiment 2, which is not repeated herein.

[00265] Using a schematic diagram of composition of a neighbor awareness network in FIG. 7 as an example, wireless device_1 is a wireless device in the system, which actively discovers a second neighbor awareness network device cluster and sends, in the first neighbor awareness network device cluster, an event message about joining the second neighbor awareness network device cluster, when the wireless device determines it is necessary to join the second neighbor awareness network device cluster. Wireless device_5 to wireless device_10 are wireless devices that passively receive the event message and join the second neighbor awareness network device cluster according to the event message.

Embodiment 8

[00266] Embodiment 8 of the present invention describes a wireless device for joining a neighbor awareness network device cluster, which is of a same inventive concept as Embodiment 3. As shown in FIG. 13, the wireless device includes a discovery module 51, ~~and~~ a creating module 52 and a message sending module 53.

[00267] The discovery module 51 is configured to discover a neighbor awareness network device cluster.

[00268] The creating module 52 is configured to create a new neighbor awareness network device cluster when the discovery module 51 discovers multiple neighbor awareness network device clusters.

computing device. As defined herein, the computer readable media does not include non-persistent computer readable media (transitory media), for example, a modulated data signal and a carrier wave.

[00289] ~~Although some preferred embodiments of the present application have been described, a person skilled in the art can make changes and modifications to these embodiments once learning the basic inventive concept. Therefore, the following claims are intended to be explained as to cover the preferred embodiments and all changes and modifications falling within the scope of the present application.~~

[00290] ~~It is apparent that a person skilled in the art can make various modifications and variations to the application~~the present invention ~~without departing from the spirit and scope of the application~~the present invention~~.~~ ~~The application~~The present invention ~~is intended to cover these modifications and variations provided that they fall in the scope of protection defined by the following claims or their equivalents.~~

CLAIMS

What is claimed is:

1. A method for joining a neighbor awareness network device cluster, wherein the method comprises:

when discovering a second neighbor awareness network device cluster, acquiring, by a wireless device in a first neighbor awareness network device cluster, attribute information of the second neighbor awareness network device cluster;

comparing, by the wireless device, the attribute information of the second neighbor awareness network device cluster with attribute information of the first neighbor awareness network device cluster to determine whether it is necessary to join the second neighbor awareness network device cluster; and

when determining that it is necessary to join the second neighbor awareness network device cluster, sending, by the wireless device, an event message in the first neighbor awareness network device cluster, leaving the first neighbor awareness network device cluster, and joining the second neighbor awareness network device cluster, wherein the event message is about joining the second neighbor awareness network device cluster and comprises the attribute information of the second neighbor awareness network device cluster, so that other wireless devices in the first neighbor awareness network device cluster that receive the event message are capable of joining the second neighbor awareness network device cluster according to the attribute information of the second neighbor awareness network device cluster.

2. The method according to claim 1, wherein the discovering, by the wireless device, a second neighbor awareness network device cluster and acquiring attribute information of the second neighbor awareness network device cluster specifically comprise:

when a cluster identifier comprised in a received beacon frame or service frame of a neighbor awareness network is different from a locally recorded cluster identifier of the first neighbor awareness network device cluster, determining, by the

wireless device, that the second neighbor awareness network device cluster is discovered; and

acquiring, by the wireless device, the attribute information of the second neighbor awareness network device cluster from the received beacon frame or service frame of the neighbor awareness network.

3. The method according to claim 1 or 2, wherein the attribute information of the second neighbor awareness network device cluster comprises at least one type of the following information:

a cluster identifier of the second neighbor awareness network device cluster, the number of wireless devices comprised in the second neighbor awareness network device cluster, an anchor master rank in the second neighbor awareness network device cluster, a hop count from the wireless device to an anchor master device in the second neighbor awareness network device cluster, and transmission time of a beacon frame of the anchor master device in the second neighbor awareness network device cluster.

4. The method according to any one of claims 1 to 3, wherein the determining, by the wireless device, whether it is necessary to join the second neighbor awareness network device cluster specifically comprises:

comparing, by the wireless device, the cluster identifier of the second neighbor awareness network device cluster with the locally recorded cluster identifier of the first neighbor awareness network device cluster, and determining, according to a preset determination rule, whether it is necessary to join the second neighbor awareness network device cluster.

5. The method according to any one of claims 1 to 4, wherein the joining, by other wireless devices in the first neighbor awareness network device cluster that receive the event message, the second neighbor awareness network device cluster specifically comprises:

comparing, by the other wireless devices in the first neighbor awareness network device cluster that receive the event message, the cluster identifier of the second neighbor awareness network device cluster that is comprised in the event

message with the locally recorded cluster identifier of the first neighbor awareness network device cluster, and when determining, according to the preset determination rule, that it is necessary to join the second neighbor awareness network device cluster, leaving the first neighbor awareness network device cluster, and joining the second neighbor awareness network device cluster.

6. The method according to claim 4 or 5, wherein the determination rule is specifically: when the cluster identifier of the second neighbor awareness network device cluster is greater than the cluster identifier of the first neighbor awareness network device cluster, it is necessary to join the second neighbor awareness network device cluster; or

the determination rule is specifically: when the cluster identifier of the second neighbor awareness network device cluster is less than the cluster identifier of the first neighbor awareness network device cluster, it is necessary to join the second neighbor awareness network device cluster.

7. The method according to any one of claims 1 to 6, wherein the leaving, by the wireless device, the first neighbor awareness network device cluster specifically comprises:

stopping participating, by the wireless device, in contending for serving as a synchronization device in the first neighbor awareness network device cluster and

the joining, by the wireless device, the second neighbor awareness network device cluster specifically comprises:

participating, by the wireless device, in contending for serving as a synchronization device in the second neighbor awareness network device cluster, and being synchronized to a discovery time window of the second neighbor awareness network device cluster to perform service discovery.

8. The method according to any one of claims 1 to 7, wherein: the event message is a beacon frame or a service frame of a neighbor awareness network, wherein the beacon frame or the service frame comprises the attribute information of the second neighbor awareness network device cluster; or

the event message is a beacon frame or a service frame of a neighbor awareness

network, wherein the beacon frame or the service frame comprises merging indication information, and the merging indication information is used to instruct wireless devices in the first neighbor awareness network device cluster that receive the event message to join the second neighbor awareness network device cluster specified by the merging indication information.

9. The method according to claim 8, wherein the comprising, by the wireless device, the attribute information of the second neighbor awareness network device cluster in the beacon frame or the service frame of the neighbor awareness network specifically comprises:

carrying, by the wireless device, the cluster identifier of the second neighbor awareness network device cluster in a destination address field of the beacon frame of the neighbor awareness network, and carrying the attribute information of the second neighbor awareness network device cluster in an attribute information field of the neighbor awareness network; or

carrying, by the wireless device, the cluster identifier of the second neighbor awareness network device cluster in a destination address field of the service frame of the neighbor awareness network, and carrying the attribute information of the second neighbor awareness network device cluster in a frame body.

10. The method according to any one of claims 1 to 9, wherein the method further comprises:

determining, by the other wireless devices in the first neighbor awareness network device cluster that receive the event message, according to received signal strength of the event message and the number of received event messages, whether to send, in the first neighbor awareness network device cluster, an event message about joining the second neighbor awareness network device cluster, wherein the event message comprises the attribute information of the second neighbor awareness network device cluster.

11. The method according to claim 10, wherein the other wireless devices in the first neighbor awareness network device cluster that receive the event message use the following manner to determine whether to send, in the first neighbor awareness

network device cluster, the event message about joining the second neighbor awareness network device cluster:

determining, by the other wireless devices in the first neighbor awareness network device cluster that receive the event message, whether the received signal strength of the event message is higher than a first threshold; and

if yes, in the first neighbor awareness network device cluster, skipping sending the event message about joining the second neighbor awareness network device cluster; or

otherwise, determining the number of received event messages whose received signal strength is higher than a second threshold, and if the number reaches the threshold, in the first neighbor awareness network device cluster, skipping sending the event message about joining the second neighbor awareness network device cluster, or if the number does not reach the threshold, in the first neighbor awareness network device cluster, sending the event message about joining the second neighbor awareness network device cluster; wherein

the first threshold is higher than the second threshold.

12. A method for joining a neighbor awareness network device cluster, wherein the method comprises:

when discovering a second neighbor awareness network device cluster, acquiring, by a wireless device in a first neighbor awareness network device cluster, attribute information of the second neighbor awareness network device cluster;

comparing, by the wireless device, the attribute information of the second neighbor awareness network device cluster with attribute information of the first neighbor awareness network device cluster to determine whether it is necessary to join the second neighbor awareness network device cluster; and

when determining that it is necessary to join the second neighbor awareness network device cluster, leaving, by the wireless device, the first neighbor awareness network device cluster, and joining the second neighbor awareness network device cluster.

13. The method according to claim 12, wherein the discovering, by the wireless

device, a second neighbor awareness network device cluster and acquiring attribute information of the second neighbor awareness network device cluster specifically comprise:

when a cluster identifier comprised in a received beacon frame or service frame of a neighbor awareness network is different from a locally recorded cluster identifier of the first neighbor awareness network device cluster, determining, by the wireless device, that the second neighbor awareness network device cluster is discovered; and

acquiring, by the wireless device, the attribute information of the second neighbor awareness network device cluster from the received beacon frame or service frame of the neighbor awareness network.

14. The method according to claim 12 or 13, wherein the attribute information of the second neighbor awareness network device cluster comprises at least one type of the following information:

a cluster identifier of the second neighbor awareness network device cluster, the number of wireless devices comprised in the second neighbor awareness network device cluster, an anchor master rank in the second neighbor awareness network device cluster, a hop count from the wireless device to an anchor master device in the second neighbor awareness network device cluster, and transmission time of a beacon frame of the anchor master device in the second neighbor awareness network device cluster.

15. The method according to claim 14, wherein the determining, by the wireless device, whether it is necessary to join the second neighbor awareness network device cluster specifically comprises:

comparing, by the wireless device, the cluster identifier of the second neighbor awareness network device cluster with the locally recorded cluster identifier of the first neighbor awareness network device cluster, and determining, according to a preset determination rule, whether it is necessary to join the second neighbor awareness network device cluster.

16. The method according to claim 15, wherein the determination rule is

specifically: when the cluster identifier of the second neighbor awareness network device cluster is greater than the cluster identifier of the first neighbor awareness network device cluster, it is necessary to join the second neighbor awareness network device cluster; or

the determination rule is specifically: when the cluster identifier of the second neighbor awareness network device cluster is less than the cluster identifier of the first neighbor awareness network device cluster, it is necessary to join the second neighbor awareness network device cluster.

17. The method according to any one of claims 12 to 16, wherein the leaving, by the wireless device, the first neighbor awareness network device cluster specifically comprises:

stopping participating, by the wireless device, in contending for serving as a synchronization device in the first neighbor awareness network device cluster; and

the joining, by the wireless device, the second neighbor awareness network device cluster specifically comprises:

participating, by the wireless device, in contending for serving as a synchronization device in the second neighbor awareness network device cluster, and being synchronized to a discovery time window of the second neighbor awareness network device cluster to perform service discovery.

18. A method for joining a neighbor awareness network device cluster, wherein the method comprises:

when discovering multiple neighbor awareness network device clusters, creating, by a wireless device, a new neighbor awareness network device cluster; and

sending, separately in the multiple neighbor awareness network device clusters by the wireless device, an event message about joining the new neighbor awareness network device cluster, so that other wireless devices that are in the multiple neighbor awareness network device clusters and receive the event message join the new neighbor awareness network device cluster according to the event message, wherein the event message comprises attribute information of the new neighbor awareness network device cluster.

19. The method according to claim 18, wherein a cluster identifier of the new neighbor awareness network device cluster created by the wireless device and cluster identifiers of the multiple neighbor awareness network device clusters meet a preset condition.

20. The method according to claim 19, wherein the preset condition is specifically: the cluster identifier of the new neighbor awareness network device cluster created by the wireless device is greater than a cluster identifier of any one of the multiple neighbor awareness network device clusters; or

the preset condition is specifically: the cluster identifier of the new neighbor awareness network device cluster created by the wireless device is less than a cluster identifier of any one of the multiple neighbor awareness network device clusters.

21. The method according to any one of claims 18 to 20, wherein transmission time of a beacon frame of an anchor master device in the new neighbor awareness network device cluster created by the wireless device is the same as transmission time of a beacon frame of an anchor master device in one of the multiple neighbor awareness network device clusters.

22. A wireless device for joining a neighbor awareness network device cluster, wherein the wireless device in a first neighbor awareness network device cluster comprises:

a discovery module, configured to discover a neighbor awareness network device cluster;

an attribute information acquiring module, configured to acquire attribute information of the second neighbor awareness network device cluster when the discovery module discovers a second neighbor awareness network device cluster;

a determining module, configured to compare the attribute information of the second neighbor awareness network device cluster with attribute information of the first neighbor awareness network device cluster to determine whether it is necessary to join the second neighbor awareness network device cluster;

a message sending module, configured to send an event message in the first neighbor awareness network device cluster when the determining module determines

that it is necessary to join the second neighbor awareness network device cluster, wherein the event message is about joining the second neighbor awareness network device cluster and comprises the attribute information of the second neighbor awareness network device cluster, so that other wireless devices in the first neighbor awareness network device cluster that receive the event message are capable of joining the second neighbor awareness network device cluster according to the attribute information of the second neighbor awareness network device cluster;

a leaving module, configured to leave the first neighbor awareness network device cluster when the determining module determines that it is necessary to join the second neighbor awareness network device cluster; and

a joining module, configured to join the second neighbor awareness network device cluster when the determining module determines that it is necessary to join the second neighbor awareness network device cluster.

23. The wireless device according to claim 22, wherein:

the discovery module is specifically configured to determine, when a cluster identifier comprised in a received beacon frame or service frame of a neighbor awareness network is different from a locally recorded cluster identifier of the first neighbor awareness network device cluster, that the second neighbor awareness network device cluster is discovered; and

the attribute information acquiring module is specifically configured to acquire the attribute information of the second neighbor awareness network device cluster from the received beacon frame or service frame of the neighbor awareness network.

24. The wireless device according to claim 22 or 23, wherein the attribute information of the second neighbor awareness network device cluster comprises at least one type of the following information:

a cluster identifier of the second neighbor awareness network device cluster, the number of wireless devices comprised in the second neighbor awareness network device cluster, an anchor master rank in the second neighbor awareness network device cluster, a hop count from the wireless device to an anchor master device in the second neighbor awareness network device cluster, and transmission time of a

beacon frame of the anchor master device in the second neighbor awareness network device cluster.

25. The wireless device according to any one of claims 22 to 24, wherein:

the determining module is specifically configured to compare the cluster identifier of the second neighbor awareness network device cluster with the locally recorded cluster identifier of the first neighbor awareness network device cluster, and determine, according to a preset determination rule, whether it is necessary to join the second neighbor awareness network device cluster.

26. The wireless device according to claim 25, wherein the determination rule is specifically: when the cluster identifier of the second neighbor awareness network device cluster is greater than the cluster identifier of the first neighbor awareness network device cluster, it is necessary to join the second neighbor awareness network device cluster; or

the determination rule is specifically: when the cluster identifier of the second neighbor awareness network device cluster is less than the cluster identifier of the first neighbor awareness network device cluster, it is necessary to join the second neighbor awareness network device cluster.

27. The wireless device according to any one of claims 22 to 26, wherein:

the leaving module is specifically configured to stop participating in contending for serving as a synchronization device in the first neighbor awareness network device cluster; and

the joining module is specifically configured to participate in contending for serving as a synchronization device in the second neighbor awareness network device cluster, and be synchronized to a discovery time window of the second neighbor awareness network device cluster to perform service discovery.

28. The wireless device according to any one of claims 22 to 27, wherein: the event message is a beacon frame or a service frame of a neighbor awareness network, wherein the beacon frame or the service frame comprises the attribute information of the second neighbor awareness network device cluster; or

the event message is a beacon frame or a service frame of a neighbor awareness

network, wherein the beacon frame or the service frame comprises merging indication information, and the merging indication information is used to instruct wireless devices in the first neighbor awareness network device cluster that receive the event message to join the second neighbor awareness network device cluster specified by the merging indication information.

29. The wireless device according to claim 28, wherein:

the message sending module is specifically configured to: when the determining module determines that it is necessary to join the second neighbor awareness network device cluster, carry the cluster identifier of the second neighbor awareness network device cluster in a destination address field of the beacon frame of the neighbor awareness network, carry the attribute information of the second neighbor awareness network device cluster in an attribute information field of the neighbor awareness network, and send the beacon frame as an event message in the first neighbor awareness network device cluster; or

carry the cluster identifier of the second neighbor awareness network device cluster in a destination address field of the service frame of the neighbor awareness network, carry the attribute information of the second neighbor awareness network device cluster in a frame body, and send the service frame as an event message in the first neighbor awareness network device cluster.

30. A wireless device for joining a neighbor awareness network device cluster, wherein the wireless device in a first neighbor awareness network device cluster comprises:

a receiving module, configured to receive an event message about joining a second neighbor awareness network device cluster, wherein the event message is sent by other wireless devices and comprises attribute information of the second neighbor awareness network device cluster; and

a joining module, configured to join the second neighbor awareness network device cluster according to the attribute information of the second neighbor awareness network device cluster.

31. The wireless device according to claim 30, further comprising:

a determining module, configured to compare a cluster identifier of the second neighbor awareness network device cluster that is comprised in the event message with a locally recorded cluster identifier of the first neighbor awareness network device cluster, and determine, according to a preset determination rule, whether it is necessary to join the second neighbor awareness network device cluster; and

a leaving module, configured to leave the first neighbor awareness network device cluster when the determining module determines that it is necessary to join the second neighbor awareness network device cluster; wherein

the joining module is specifically configured to join the second neighbor awareness network device cluster when the determining module determines that it is necessary to join the second neighbor awareness network device cluster.

32. The wireless device according to claim 31, wherein the determination rule is specifically: when the cluster identifier of the second neighbor awareness network device cluster is greater than the cluster identifier of the first neighbor awareness network device cluster, it is necessary to join the second neighbor awareness network device cluster; or

the determination rule is specifically: when the cluster identifier of the second neighbor awareness network device cluster is less than the cluster identifier of the first neighbor awareness network device cluster, it is necessary to join the second neighbor awareness network device cluster.

33. The wireless device according to any one of claims 30 to 32, further comprising:

a message sending module, configured to determine, according to received signal strength of the event message and the number of received event messages, whether to send in the first neighbor awareness network device cluster, an event message about joining the second neighbor awareness network device cluster, and when determining so, in the first neighbor awareness network device cluster, send the event message about joining the second neighbor awareness network device cluster.

34. The wireless device according to claim 33, wherein:

the message sending module is specifically configured to: determine whether the received signal strength of the event message is higher than a first threshold, and if yes, in the first neighbor awareness network device cluster, skip sending the event message about joining the second neighbor awareness network device cluster; otherwise, determine the number of received event messages whose received signal strength is higher than a second threshold, and if the number reaches the threshold, in the first neighbor awareness network device cluster, skip sending the event message about joining the second neighbor awareness network device cluster, or if the number does not reach the threshold, in the first neighbor awareness network device cluster, send the event message about joining the second neighbor awareness network device cluster; wherein the first threshold is higher than the second threshold.

35. A wireless device for joining a neighbor awareness network device cluster, wherein the wireless device in a first neighbor awareness network device cluster comprises:

a discovery module, configured to discover a neighbor awareness network device cluster;

an attribute information acquiring module, configured to acquire attribute information of the second neighbor awareness network device cluster when the discovery module discovers a second neighbor awareness network device cluster;

a determining module, configured to compare the attribute information of the second neighbor awareness network device cluster with attribute information of the first neighbor awareness network device cluster to determine whether it is necessary to join the second neighbor awareness network device cluster;

a leaving module, configured to leave the first neighbor awareness network device cluster when the determining module determines that it is necessary to join the second neighbor awareness network device cluster; and

a joining module, configured to join the second neighbor awareness network device cluster when the determining module determines that it is necessary to join the second neighbor awareness network device cluster.

36. The wireless device according to claim 35, wherein:

the discovery module is specifically configured to determine, when a cluster identifier comprised in a received beacon frame or service frame of a neighbor awareness network is different from a locally recorded cluster identifier of the first neighbor awareness network device cluster, that the second neighbor awareness network device cluster is discovered; and

the attribute information acquiring module is specifically configured to acquire the attribute information of the second neighbor awareness network device cluster from the received beacon frame or service frame of the neighbor awareness network.

37. The wireless device according to claim 35 or 36, wherein the attribute information of the second neighbor awareness network device cluster comprises at least one type of the following information:

a cluster identifier of the second neighbor awareness network device cluster, the number of wireless devices comprised in the second neighbor awareness network device cluster, an anchor master rank in the second neighbor awareness network device cluster, a hop count from the wireless device to an anchor master device in the second neighbor awareness network device cluster, and transmission time of a beacon frame of the anchor master device in the second neighbor awareness network device cluster.

38. The wireless device according to any one of claims 35 to 37, wherein:

the determining module is specifically configured to compare the cluster identifier of the second neighbor awareness network device cluster with the locally recorded cluster identifier of the first neighbor awareness network device cluster, and determine, according to a preset determination rule, whether it is necessary to join the second neighbor awareness network device cluster.

39. The wireless device according to claim 38, wherein the determination rule is specifically: when the cluster identifier of the second neighbor awareness network device cluster is greater than the cluster identifier of the first neighbor awareness network device cluster, it is necessary to join the second neighbor awareness network device cluster; or

the determination rule is specifically: when the cluster identifier of the second neighbor awareness network device cluster is less than the cluster identifier of the first neighbor awareness network device cluster, it is necessary to join the second neighbor awareness network device cluster.

40. The wireless device according to any one of claims 35 to 39, wherein:

the leaving module is specifically configured to stop participating in contending for serving as a synchronization device in the first neighbor awareness network device cluster; and

the joining module is specifically configured to participate in contending for serving as a synchronization device in the second neighbor awareness network device cluster, and be synchronized to a discovery time window of the second neighbor awareness network device cluster to perform service discovery.

41. A wireless device for joining a neighbor awareness network device cluster, wherein the wireless device comprises:

a discovery module, configured to discover a neighbor awareness network device cluster;

a creating module, configured to create a new neighbor awareness network device cluster when the discovery module discovers multiple neighbor awareness network device clusters; and

a message sending module, configured to send, separately in the multiple neighbor awareness network device clusters, an event message about joining the new neighbor awareness network device cluster, wherein the event message comprises attribute information of the new neighbor awareness network device cluster, so that other wireless devices that are in the multiple neighbor awareness network device clusters and receive the event message join the new neighbor awareness network device cluster according to the event message.

42. The wireless device according to claim 41, wherein a cluster identifier of the new neighbor awareness network device cluster and cluster identifiers of the multiple neighbor awareness network device clusters meet a preset condition.

43. The wireless device according to claim 42, wherein the preset condition is

specifically: the cluster identifier of the new neighbor awareness network device cluster created by the wireless device is greater than a cluster identifier of any one of the multiple neighbor awareness network device clusters; or

the preset condition is specifically: the cluster identifier of the new neighbor awareness network device cluster created by the wireless device is less than a cluster identifier of any one of the multiple neighbor awareness network device clusters.

44. The wireless device according to any one of claims 41 to 43, wherein transmission time of a beacon frame of an anchor master device in the created new neighbor awareness network device cluster is the same as transmission time of a beacon frame of an anchor master device in one of the multiple neighbor awareness network device clusters.

45. A system for joining a neighbor awareness network device cluster, comprising multiple wireless devices, wherein:

a wireless device in a first neighbor awareness network device cluster is configured to acquire attribute information of the second neighbor awareness network device cluster when discovering a second neighbor awareness network device cluster; compare the attribute information of the second neighbor awareness network device cluster with attribute information of the first neighbor awareness network device cluster to determine whether it is necessary to join the second neighbor awareness network device cluster; and when determining that it is necessary to join the second neighbor awareness network device cluster, in the first neighbor awareness network device cluster, send an event message about joining the second neighbor awareness network device cluster, leave the first neighbor awareness network device cluster, and join the second neighbor awareness network device cluster, wherein the event message comprises the attribute information of the second neighbor awareness network device cluster; and

other wireless devices in the first neighbor awareness network device cluster that receive the event message are configured to join the second neighbor awareness network device cluster according to the attribute information of the second neighbor awareness network device cluster.

46. A system for joining a neighbor awareness network device cluster, comprising:

a wireless device, configured to create a new neighbor awareness network device cluster when discovering multiple neighbor awareness network device clusters, and send, separately in the multiple neighbor awareness network device clusters, an event message about joining the new neighbor awareness network device cluster, wherein the event message comprises attribute information of the new neighbor awareness network device cluster; and

other wireless devices that are in the multiple neighbor awareness network device clusters and receive the event message, configured to join the new neighbor awareness network device cluster according to the event message.

CLAIMS

1. A method performed by a wireless network device in a first Neighbor Awareness Network device cluster (NAN cluster) to join a second NAN cluster, wherein each of the first and second NAN clusters is a Wi-Fi NAN cluster of Wi-Fi Alliance and comprises a plurality of wireless network devices, the method comprising:

discovering the second NAN cluster;

determining to join the second NAN cluster based on discovery information obtained regarding the second NAN cluster;

sending an event message to other wireless network devices in the first NAN cluster, wherein the event message indicates that the wireless network device is joining the second NAN cluster, and comprises a cluster ID (CID) of the second NAN cluster;

joining the second NAN cluster; and

after sending the event message, leaving the first NAN cluster.

2. The method according to claim 1, wherein the attribute information of the second NAN cluster comprises at least one of the following types of information:

a number of wireless network devices in the second NAN cluster, an anchor master rank in the second NAN cluster, a hop count from the wireless network device to an anchor master device in the second NAN cluster, and a transmission time of a beacon frame of the anchor master device in the second NAN cluster.

3. The method according to any one of claim 1 or 2, wherein the step of determining comprises:

calculating, by the wireless network device, a first score based on multiple pieces of attribute information of the first NAN cluster, and a second score based on multiple pieces of attribute information of the second NAN cluster;

comparing the first score and the second score;

determining to join the second NAN cluster when the second score is greater

than the first score.

4. The method according to any one of claims 1 to 3, wherein the event message is a beacon frame or a service frame and comprises the CID and the attribute information of the second NAN cluster; or

the event message is a beacon frame or a service frame and comprises the CID of the second NAN cluster and merging indication information for instructing the other wireless network devices in the first NAN cluster that receive the event message to join the second NAN cluster.

5. The method according to claim 4, wherein the event message is:

a beacon frame comprising the CID of the second NAN cluster in a destination address field of the beacon frame, and the attribute information of the second NAN cluster in an NAN attribute information field of the beacon frame;

or

a service frame comprising the CID of the second NAN cluster in a destination address field of the service frame, and the attribute information of the second NAN cluster in a frame body of the service frame.

6. The method according to any one of claims 1 to 5, wherein the step of discovering comprises:

receiving a beacon frame or service frame including the CID and attribute information of the second NAN cluster.

7. A wireless network device comprising:

a memory storing computer executable instructions for the wireless network device in a first Neighbor Awareness Network device cluster (NAN cluster) to join a second NAN cluster, wherein each of the first and second NAN clusters is a Wi-Fi NAN cluster of Wi-Fi Alliance and comprises a plurality of wireless network devices;

a processor is configured to execute the computer executable instructions to perform operations of:

discovering the second NAN cluster;

determining to join the second neighbor awareness network device cluster based on discovery information obtained regarding the second NAN cluster;

sending an event message to other wireless network devices in the first NAN cluster, wherein the event message indicates that the wireless network device is joining the second NAN cluster and comprises a cluster ID (CID) of the second NAN cluster;

joining the second NAN cluster; and

after sending the event message, leaving the first NAN cluster.

8. The wireless device according to claim 7, wherein the attribute information of the second NAN Cluster comprises at least one of the following types of information:

a number of wireless devices comprised in the second NAN cluster, an anchor master rank in the second NAN cluster, a hop count from the wireless device to an anchor master device in the second NAN cluster, and a transmission time of a beacon frame of the anchor master device in the second NAN cluster.

9. The wireless device according to any one of claim 7 or 8, wherein the operation of determining comprises: calculating a first score based on multiple pieces of attribute information of the first NAN cluster, and a second score based on multiple pieces of attribute information of the second NAN cluster;

comparing the first score and the second score;

determining to join the second NAN cluster when the second score is greater than the first score.

10. The wireless device according to any one of claims 7 to 9, wherein: the event message is:

a beacon frame or a service frame comprising the CID and the attribute information of the second NAN cluster; or

a beacon frame or a service frame comprising the CID of the second NAN cluster and merging indication information for instructing other wireless network

devices in the first NAN cluster to join the second NAN cluster.

11. The wireless device according to claim 10, wherein the operation of sending comprises:

placing the CID of the second NAN cluster in a destination address field of a beacon frame and placing attribute information of the second NAN Cluster in an attribute information field of the beacon frame, and sending the beacon frame as the event message; or

placing the cluster ID of the second NAN Cluster in a destination address field of a service frame and placing attribute information of the second NAN Cluster in a frame body of the service frame, and sending the service frame as the event message.

12. The wireless device according to any one of claims 7 to 11, wherein the operation of discovering comprises:

receiving a beacon frame or service frame;

comparing a cluster ID (CID) in the received beacon frame or service frame to a locally recorded CID of the first NAN Cluster;

determining that the second NAN cluster is discovered when the CID in the received beacon frame or service frame is different from the CID of the first NAN cluster; and

obtaining attribute information of the second NAN cluster from the received beacon frame or service frame.