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(54) **METHOD AND DEVICE FOR ENHANCING QUALITY OF SERVICE IN WIRELESS LOCAL AREA NETWORK**

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(57) **ABSTRACT**

The disclosure provides a method and device for enhancing Quality of Service (QoS) in a Wireless Local Area Network (WLAN). The method for enhancing QoS in the WLAN includes the steps of: adding a message category in a wireless access point (S**10**); adding a QoS priority transmission queue according to the added message category and setting queue attributes (S**11**); performing QoS scheduling by using the added transmission queue and performing data transmission (S**12**). The device for enhancing QoS in the WLAN can ensure that a wireless full service is carried out normally according to requirements of users by expanding the message categories in Enhanced Distributed Channel Access (EDCA) QoS, adding a wireless priority queue correspondingly, and using a policy of discarding a message intelligently and the like, thereby enhancing QoS to improve the user experience.

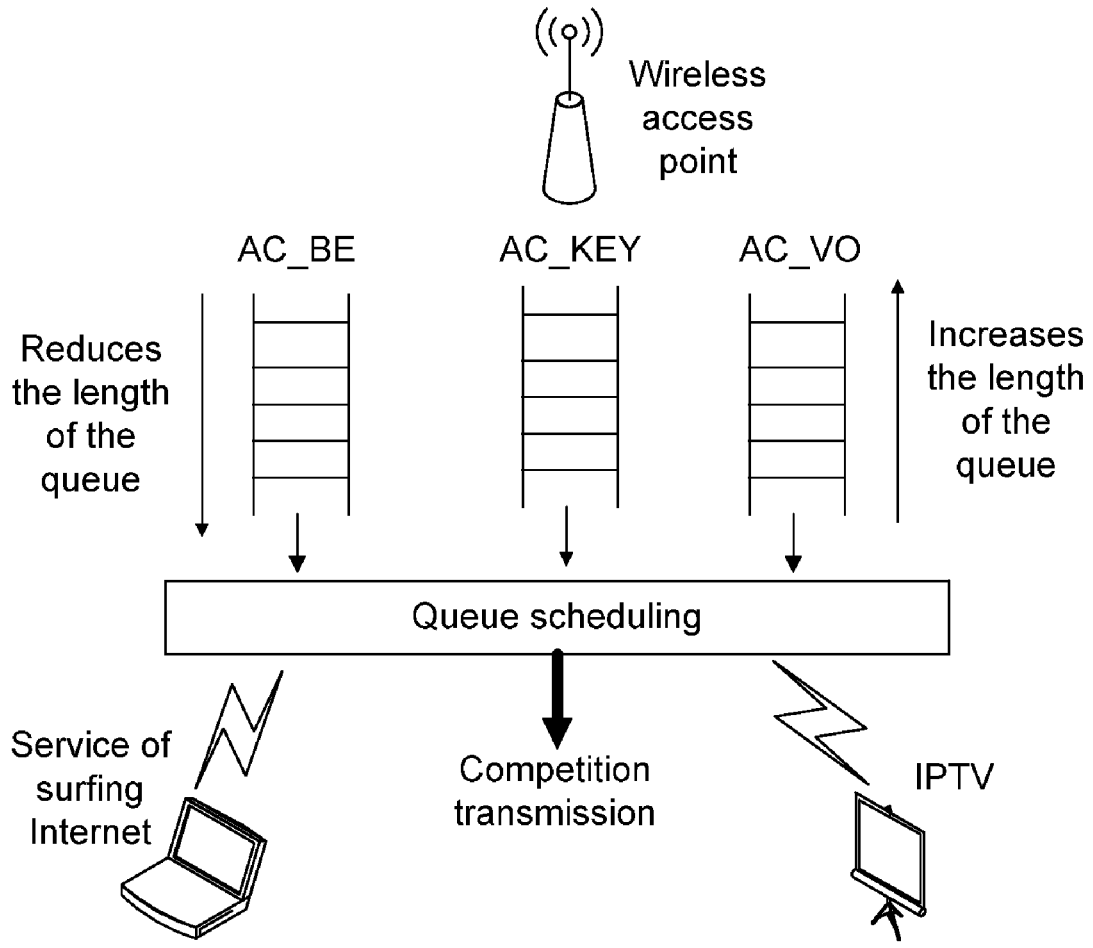


Fig. 1

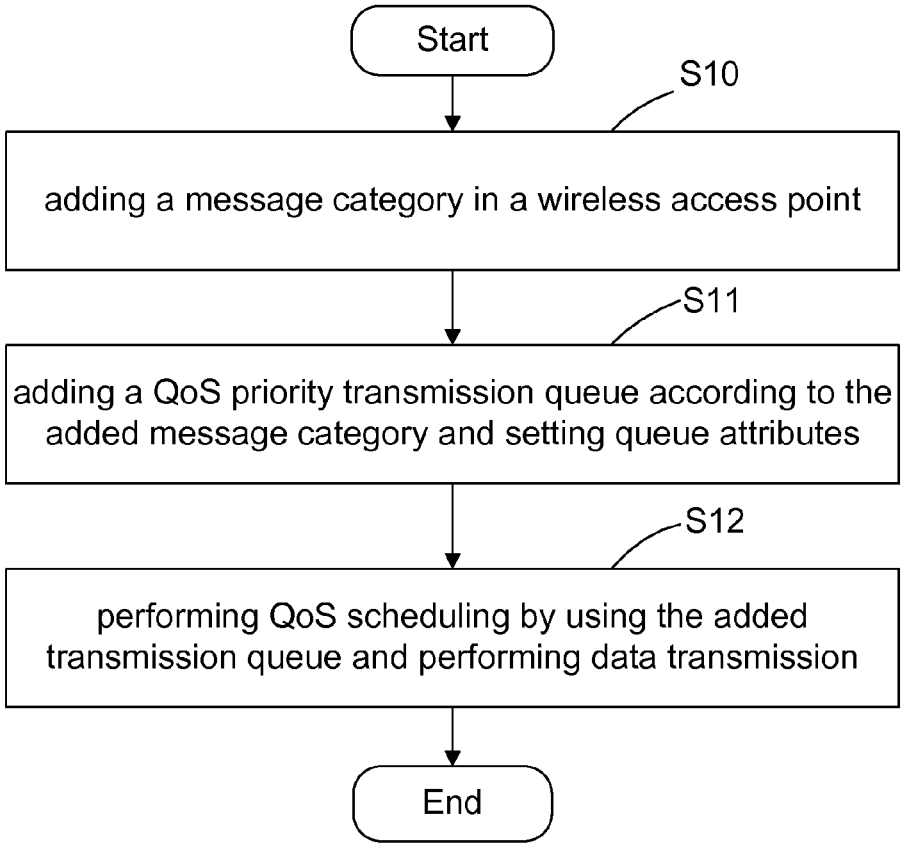

Start
S10
adding a message category in a wireless access point
S11
adding a QoS priority transmission queue according to the added message category and setting queue attributes
S12
performing QoS scheduling by using the added transmission queue and performing data transmission
End

Fig. 2

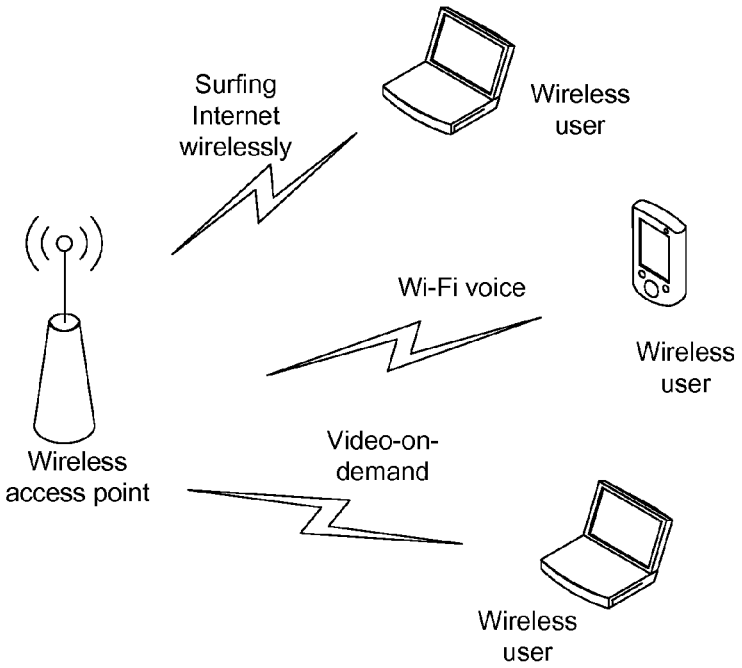

Surfing Internet wirelessly
Wireless user
Wi-Fi voice
Wireless user
Wireless access point
Video-on-demand
Wireless user

Fig. 3

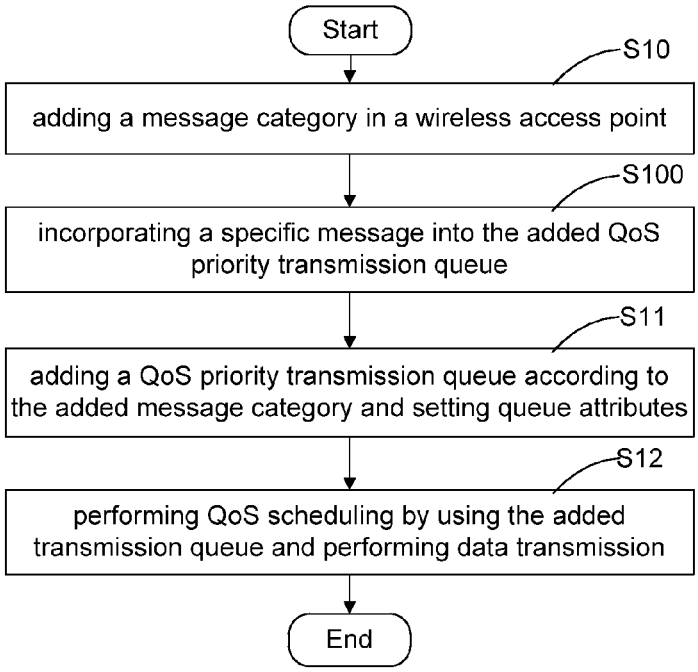

Start
S10
adding a message category in a wireless access point
S100
incorporating a specific message into the added QoS priority transmission queue
S11
adding a QoS priority transmission queue according to the added message category and setting queue attributes
S12
performing QoS scheduling by using the added transmission queue and performing data transmission
End

Fig. 4

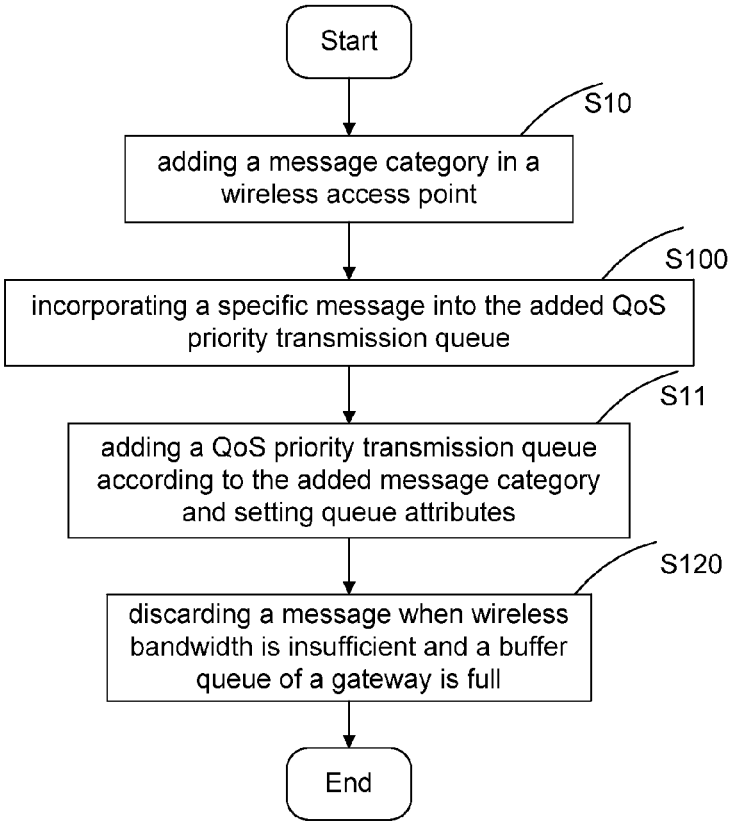

Start
S10
adding a message category in a wireless access point
S100
incorporating a specific message into the added QoS priority transmission queue
S11
adding a QoS priority transmission queue according to the added message category and setting queue attributes
S120
discarding a message when wireless bandwidth is insufficient and a buffer queue of a gateway is full
End

Fig. 5

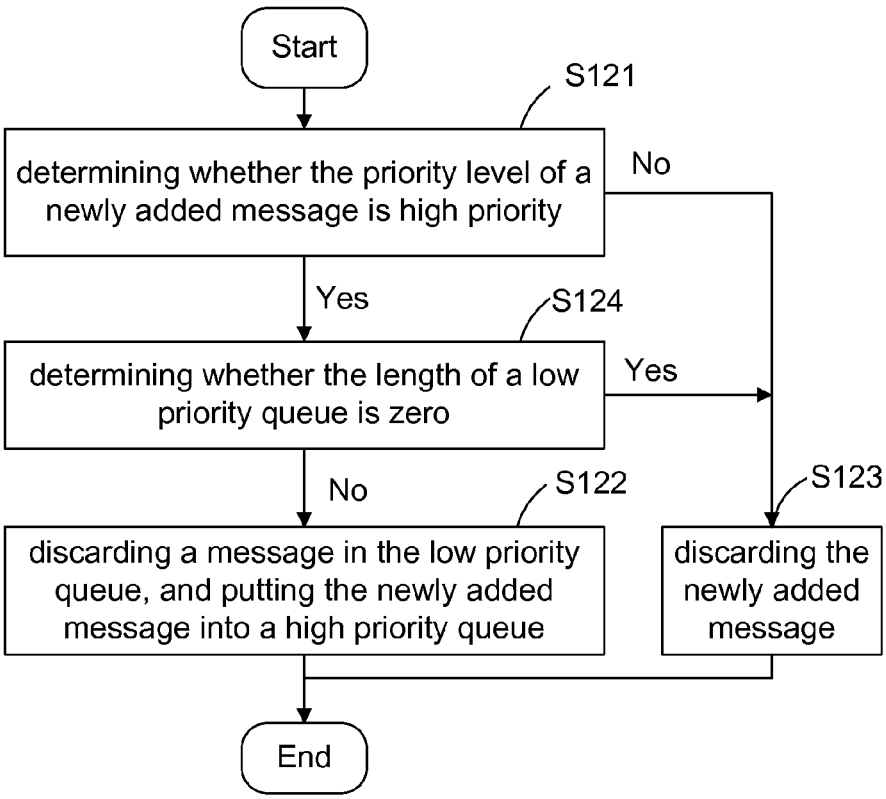

Start
S121
determining whether the priority level of a newly added message is high priority
No
Yes
S124
determining whether the length of a low priority queue is zero
Yes
No
S122
S123
discarding a message in the low priority queue, and putting the newly added message into a high priority queue
discarding the newly added message
End

Fig. 6

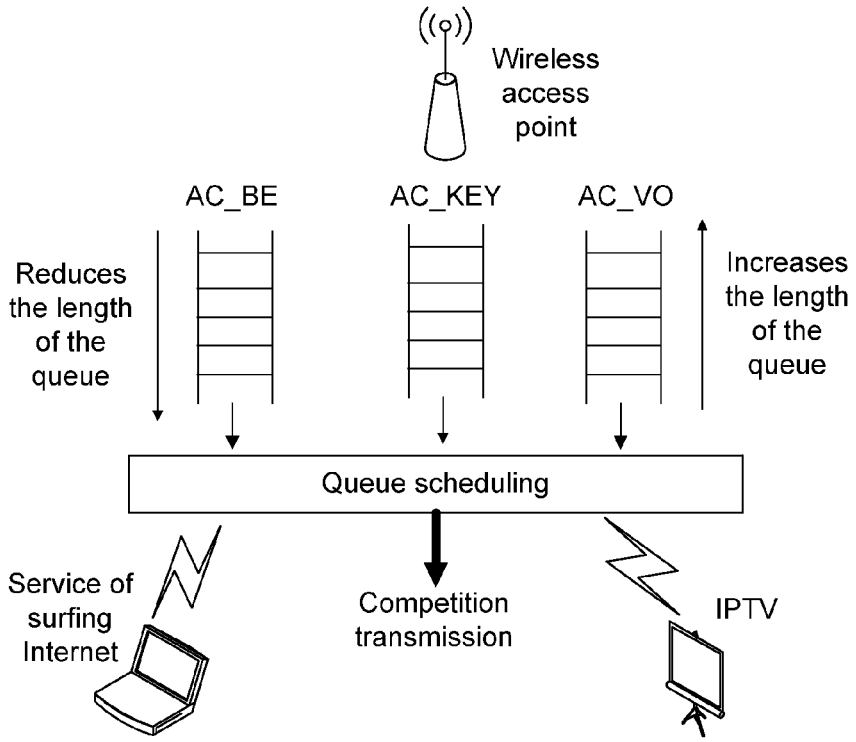

Wireless access point
AC_BE
AC_KEY
AC_VO
Reduces the length of the queue
Increases the length of the queue
Queue scheduling
Service of surfing Internet
Competition transmission
IPTV

Fig. 7

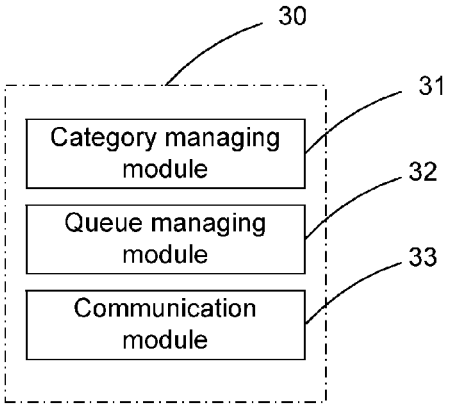


Fig. 8

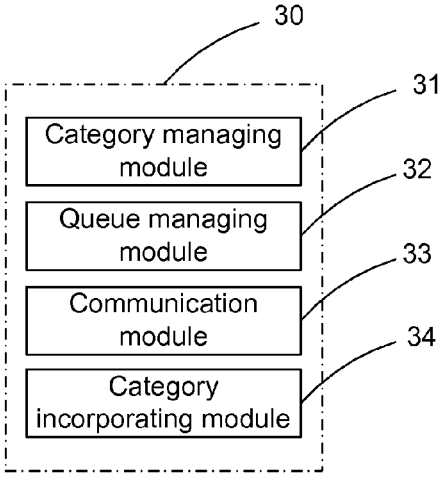
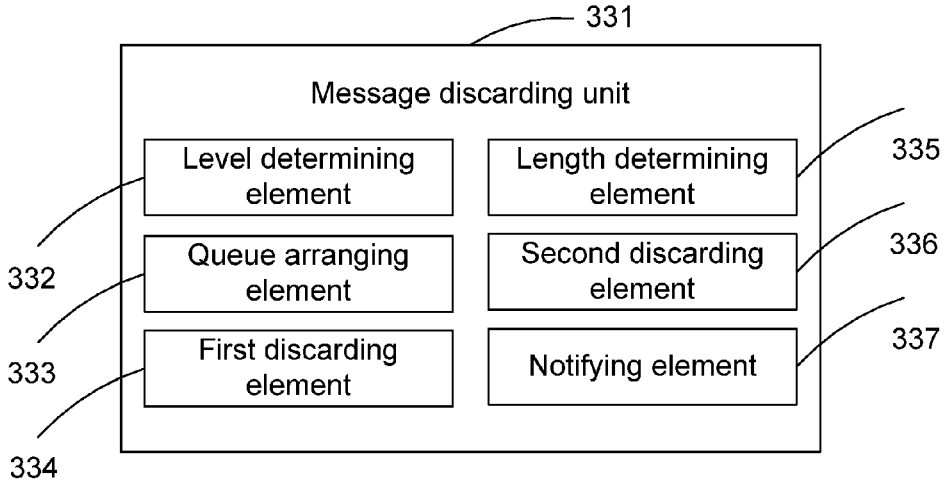


Fig. 9



METHOD AND DEVICE FOR ENHANCING QUALITY OF SERVICE IN WIRELESS LOCAL AREA NETWORK

TECHNICAL FIELD

[0001] The disclosure relates to the field of wireless communications, and in particular to a method and device for enhancing Quality of Service (QoS) in a Wireless Local Area Network (WLAN).

BACKGROUND

[0002] As a way of accessing the network by the user, WLAN has incomparable advantages of simple wiring, convenient movement and the like compared to wired access. With evolution of technology, the bandwidth of the WLAN increases gradually. But as to QoS, only Enhanced Distributed Channel Access (EDCA) QoS in IEEE802.11e can meet the requirements on the transmission of data services, and is in the full service (data, voice and video etc.), the QoS is obviously insufficient.

[0003] EDCA QoS has the following limitations: 1, there are only four message categories, which are respectively AC_BE, AC_BK, AC_VI and AC_VO, and correspondingly priority queue only has four levels, which cannot meet the requirements of full-service scenarios; 2, it is a relative priority in EDCA QoS; in a severe environment, high priority service will be also influenced; for example in home applications, when Internet Protocol Television (IPTV) service and service of surfing Internet are carried out simultaneously, user cares more about the IPTV service, and cannot accept appearance of mosaics or video pause or delay, but can stand the influence of service of surfing Internet relatively. At present, EDCA QoS cannot completely ensure high priority service, for example cannot ensure the preference of the IPTV service and the like.

SUMMARY

[0004] One of the objects of the disclosure is to provide a method and device for enhancing quality of service in a wireless local area network, thereby enhancing the quality of service to improve user experience.

[0005] The disclosure provides a method for enhancing Quality of Service (QoS) in a Wireless Local Area Network (WLAN), including the steps of:

[0006] adding a message category in a wireless access point;

[0007] adding a QoS priority transmission queue according to the added message category and setting queue attributes;

[0008] performing QoS scheduling by using the added transmission queue and performing data transmission.

[0009] Further, after the step of adding the message category in the wireless access point, the method may further include the step of: incorporating a specific message into the added QoS priority transmission queue.

[0010] Further, the step of performing QoS scheduling by using the added transmission queue and performing data transmission may further include the step of: discarding a message when wireless bandwidth is insufficient and a buffer queue of a gateway is full; the step of discarding the message may further include the step of:

[0011] determining whether the priority level of a newly added message is high priority; if so, discarding a message in a low priority queue, and putting the newly added is message into a high priority queue; otherwise, discarding the newly added message.

[0012] Further, when the priority level of the newly added message is high priority, determining whether the length of the low priority queue is zero firstly, if so, discarding the newly added message, otherwise, discarding a message in the low priority queue, and putting the newly added message into the high priority queue.

[0013] Further, the low priority queue is an AC_BK queue and/or an AC_BE queue; and the high priority queue is an AC_VI queue and/or an AC_VO queue.

[0014] Based on the method above, the disclosure provides a device for enhancing Quality of Service (QoS) in a Wireless Local Area Network (WLAN), wherein the device includes:

[0015] a category managing module, which is configured to add a message category in a wireless access point;

[0016] a queue managing module, which is configured to add a QoS priority transmission queue according to the added message category and set queue attributes;

[0017] a communication module, which is configured to perform QoS scheduling by using the added transmission queue and perform data transmission.

[0018] Further, the device may further include: a category incorporating module, which is configured to incorporate a specific message into the added QoS priority transmission queue.

[0019] Further, the communication module may further include:

[0020] a message discarding unit, which is configured to discard a message when wireless bandwidth is insufficient and a buffer queue of a gateway is full.

[0021] Further, the message discarding unit may further include:

[0022] a level determining element, which is configured to determine whether the priority level of a newly added message is a high priority;

[0023] a queue arranging element, which is configured to discard a message in a low priority queue when the priority level of the newly added message is high priority, and put the newly added message with high priority into a high priority queue;

[0024] a first discarding element, which is configured to directly discard the newly added message with low priority when the priority level of the newly added message is low priority.

[0025] Further, the message discarding unit may further include:

[0026] a length determining element, which is configured to determine whether the length of the low priority queue is zero when the priority level of the newly added message is high priority;

[0027] a second discarding element, which is configured to discard the newly added message when the length of the low priority queue is zero;

[0028] a notifying element, which is configured to notify the queue arranging element to perform processing when the length of the low priority queue is not zero.

[0029] The method and device for enhancing QoS in a WLAN of the disclosure can ensure that a wireless full service is carried out normally according to requirements of users by expanding the message categories in EDCA QoS,

and adding a wireless priority queue correspondingly, thereby enhancing QoS to improve user experience.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030] FIG. **1** shows a flowchart illustrating steps of a method for enhancing quality of service in a wireless local area network in an embodiment of the disclosure;

[0031] FIG. **2** shows a schematic diagram illustrating structure of a wireless local area network in an embodiment of the disclosure;

[0032] FIG. **3** shows a flowchart illustrating steps of a method for enhancing quality of service in a wireless local area network in an implementation mode of an embodiment of the disclosure;

[0033] FIG. **4** shows a flowchart illustrating steps of a method for enhancing quality of service in a wireless local area network in another implementation mode of the embodiment of the disclosure;

[0034] FIG. **5** shows a flowchart illustrating step **S120** in an embodiment of the disclosure;

[0035] FIG. **6** shows a schematic diagram illustrating queue scheduling in an embodiment of the disclosure;

[0036] FIG. **7** shows a schematic diagram illustrating structure of a device for enhancing quality of service in a wireless local area network in another embodiment of the disclosure;

[0037] FIG. **8** shows a schematic diagram illustrating structure of a device for enhancing quality of service in a wireless local area network in an implementation mode of another embodiment of the disclosure; and

[0038] FIG. **9** shows a schematic diagram illustrating structure of a message discarding unit in another embodiment of the disclosure.

DETAILED DESCRIPTION

[0039] In view of the limitations of EDCA QoS, the disclosure provides an EDCA QoS-based enhancement technology in conjunction with the practical application of a home wireless gateway. The technology provided in the disclosure can ensure that a wireless full service is carried out normally according to requirements of users by expanding the message categories in EDCA QoS, adding a wireless priority queue correspondingly, and using a policy of discarding a message intelligently and the like, thereby enhancing QoS to improve the user experience.

[0040] Referring to FIG. **1**, the disclosure provides a method for enhancing quality of service in a wireless local area network in an embodiment, including:

[0041] step **S10**: adding a message category in a wireless access point;

[0042] step **S11**: adding a QoS priority transmission queue according to the added message category and setting queue attributes;

[0043] step **S12**: performing QoS scheduling by using the added transmission queue and performing data transmission.

[0044] As shown in FIG. **2**, in the wireless local area network, a plurality of wireless users (STA) may access a wireless Access Point (AP). The plurality of wireless users can access Internet through the wireless access point. Different wireless users can operate different services, such as surfing Internet through wireless access, wireless Internet Protocol Television (IPTV) on-demand/multicast, WirelessFidelity (Wi-Fi) telephone and File Transfer Protocol (FTP) download and the like (refer to FIG. **2**).

[0045] As described in step **S10**, according to IEEE802.11e specification, parameter records of every message category are defined in EDCA parameter set. The format is as shown in Table 1:

TABLE 1

AIFSN	ACM	ACI	Reserved

[0046] wherein length of the ACI is 2 bit, which is defined as shown in Table 2:

TABLE 2

ACI	AC	Description
00	AC_BE	Best effort
01	AC_BK	Background
10	AC_VI	Video
11	AC_VO	Voice

[0047] Based on the above mentioned, the wireless access point can add message category by using the message design of the Media Access Control (MAC) layer of the wireless network.

[0048] The MAC layer can use reserved bit (size of 1 bit) to expand the categories of the message. In such way, the message can be divided into eight categories at most, which can meet the requirements even in the full service application. The wireless priority queues can also be increased correspondingly according to the number of message categories to meet QoS scheduling.

[0049] Message categories expanded by the MAC layer can be user-defined or categorized according to the agreement, as long as the wireless access point and the wireless users can identify the message categories.

[0050] Referring to FIG. **3**, in an implementation mode of the embodiment, after step **S10**, the method further includes:

[0051] step **S100**: incorporating a specific message into the added QoS priority transmission queue.

[0052] As described in step **S100**, the specific message can be defined and set by the user as required. For example, in case of multi-service, some messages are special, such as link keep-alive messages and key management messages and the like. Loss of the messages may result in service interruption, so special processing of the messages can be added in the expanded categories, such as increasing priority level and increasing times of retransmission and other processing. In such way, in a severe environment, special messages may not be lost and the service may not be interrupted. After environment restores, the service can be restored rapidly.

[0053] The link keep-alive message can be Point-to-Point Protocol (PPP) keep-alive message, etc.; and the management message can be Internet Group Management Protocol (IGMP) management message, etc.

[0054] As described in step **S11**, the wireless access point can establish a new transmission queue according to the added message category. The new transmission queue is characterized by strong contention channel ability, short length of the queue, a relatively large number of times of retransmission and the like. Setting queue attributes can include setting attributes, such as the minimum value of competition window

(CWmin), the maximum value of competition window (CWmax), transmission opportunity (TXOP), Arbitration Inter Frame Spacing Number (AIFSN), length of the queue and times of message retransmission.

[0055] As described in step S**12**, the wireless access point performs communication by using the new transmission queue. Even in a severe environment, it can be ensured that the messages in the added message category is transmitted to the counterpart to the greatest extent and ensure that the link is not interrupted, and once the environment restores to normal, normal communication can be restored rapidly to perform data transmission.

[0056] The embodiment is described below with reference to examples in detail.

[0057] Firstly, a new message category AC_KEY is added to the wireless access point, and the PPP keep-alive message, the IGMP management message and the like are incorporated into the AC_KEY.

[0058] Then, a new transmission queue is established corresponding to the message category AC_KEY. The established new transmission queue is characterized by strong contention channel ability, short length of the queue, a relatively large number of times of retransmission and the like.

[0059] Then the established new transmission queue is used for communication. In practical application, even in a severe environment, it can be ensured that the messages in the AC_KEY category is transmitted to the counterpart to the greatest extent and ensure that the link is not interrupted, and once the environment restores to normal, normal communication can be restored rapidly.

[0060] Referring to FIG. **4**, in another implementation mode of the embodiment, step S**12** further includes:

[0061] step S**120**: discarding a message when wireless bandwidth is insufficient and a buffer queue of a gateway is full.

[0062] As described in step S**120**, when wireless bandwidth is insufficient, first discard low priority messages, and only in an emergence, high priority messages are discarded level by level. Smooth transmission of high priority services is ensured at the expense of low priority services.

[0063] Referring to FIG. **5**, step S**120** further includes:

[0064] step S**121**: determining whether a priority level of a newly added message is high priority; if so, discarding a message in a low priority queue, and putting the newly added message into a high priority queue (step S**122**); otherwise, discarding is the newly added message (step S**123**).

[0065] Before step S**122**, the method further includes:

[0066] step S**124**: determining whether the length of the low priority queue is zero; if so, discarding the newly added message (step S**123**); otherwise, executing step S**122**.

[0067] The priority of message category can be determined according to a tos field of an IP message or other user-defined method. The low priority queue can be an AC_BK queue and/or an AC_BE queue and so on; and the high priority queue can be an AC_VI queue and/or an AC_VO queue and so on.

[0068] Discarding of the message is described below with reference to examples in detail.

[0069] Referring to FIG. **6**, for example, two wireless users (terminals) access one wireless gateway, wherein one wireless user wirelessly implements the service of surfing Internet while the other implements the IPTV service; an AC_KEY message category and a transmission queue are expanded over the wireless gateway.

[0070] The newly added message is determined when wireless bandwidth is insufficient and a buffer queue of a gateway is full; if the newly added message is a low priority message category such as an AC_BK category, then the message is discarded directly; if the newly added message is a high priority message category such as an AC_VO category, the length of the AC_BK queue is reduced by one firstly, and the message in the queue is discarded directly, then the length of the AC_VO queue is increased and the newly added message is put into the queue. Before the message in the AC_BK queue is discarded in the above manner, it is determined whether the length of the AC_BK queue is 0 firstly, if so, stops increasing the length of the AC_VO queue, and begins to discard the newly added message.

[0071] When wireless bandwidth begins to mitigate, the length of the AC_VO queue is reduced gradually, then the length of the AC_BK queue can be increased gradually, and low priority services restore to normal.

[0072] Referring to FIG. **7**, the disclosure provides a device **30** for enhancing QoS in a WLAN of another embodiment, including:

[0073] a category managing module **31**, which is configured to add a message category in a wireless access point;

[0074] a queue managing module **32**, which is configured to add a QoS priority transmission queue according to the added message category and set queue is attributes;

[0075] a communication module **33**, which is configured to perform QoS scheduling by using the added transmission queue and perform data transmission.

[0076] Based on the above mentioned, the category managing module **31** can use message design of a Media Access Control (MAC) layer of a wireless network to add message category in the wireless access point.

[0077] The MAC layer can use a reserved bit (size of 1 bit) to expand the message categories. In such way, the message can be divided into eight categories at most, which can meet the requirements even in the full service application. The wireless priority queues can also be increased correspondingly according to the number of message categories to meet QoS scheduling. Message categories expanded by the MAC layer can be user-defined or categorized according to agreement, as long as the wireless access point and the wireless users can identify the message categories.

[0078] Referring to FIG. **8**, in an implementation mode of the embodiment, the device **30** further includes a category incorporating module **34**, which is configured to incorporate a specific message into the added QoS priority transmission queue.

[0079] The category incorporating module **34**, in case of multi-service, can incorporate special messages such as link keep-alive messages and/or key management messages and the like into the added message category. The specific message can include a PPP keep-alive message and/or an IGMP management message and the like.

[0080] Loss of the messages may result in service interruption, so special processing of the messages can be added, through the category incorporating module **34**, in the expanded categories, such as increasing priority level and increasing times of retransmission. In such way, in a severe

environment, special messages may not be lost and the service may not be interrupted. After the environment restores, the service can be restored rapidly.

[0081] The queue managing module **32** can establish a new transmission queue according to the added message category. The new transmission queue is characterized by strong contention channel ability, short length of the queue, a relatively large number of times of retransmission and the like.

[0082] The communication module **33** can use the new transmission queue for communication. Even in a severe environment, it can be ensured that the is messages in the added message category is transmitted to the counterpart to the greatest extent and ensure that the link is not interrupted, and once the environment restores to normal, normal communication can be restored rapidly.

[0083] Referring to FIG. **9**, in another implementation mode of the embodiment, the communication module **33** further includes a message discarding unit **331**, which is configured to discard a message when wireless bandwidth is insufficient and a buffer queue of a gateway is full.

[0084] The message discarding unit **331** can first discard low priority messages when wireless bandwidth is insufficient and a buffer queue of a gateway is full, and only in an emergence, discards high priority messages level by level. Smooth transmission of high priority services is ensured at the expense of low priority services.

[0085] The message discarding unit **331** further includes a level determining element **332**, a queue arranging element **333** and a first discarding element **334**, wherein

[0086] the level determining element **332** is configured to determine whether the priority level of a newly added message is high priority;

[0087] the queue arranging element **333** is configured to discard a message in a low priority queue when the priority level of the newly added message is high priority, and put the newly added message with high priority into a high priority queue; and

[0088] the first discarding element **334** is configured to directly discard the newly added message with low priority when the priority level of the newly added message is low priority.

[0089] The message discarding unit **331** further includes a length determining element **335**, a second discarding element **336** and a notifying element **337**, wherein the length determining element **335** is configured to determine whether the length of the low priority queue is zero when the priority level of the newly added message is high priority; the second discarding element **336** is configured to discard the newly added message according to determination when the length of the low priority queue is zero; and the notifying element **337** is configured to notify the queue arranging element **333** to process according to determination when the length of the low priority queue is not zero.

[0090] Discarding of the message is described below with reference to examples in detail.

[0091] For example, two wireless users (terminals) access one wireless gateway, wherein one wireless user wirelessly implements service of surfing Internet while the is other implements IPTV service; an AC_KEY message category and a transmission queue are expanded over the wireless gateway.

[0092] The newly added message can be determined by the level determining element **332** when wireless bandwidth is insufficient and a buffer queue of a gateway is full; if the newly added message is a low priority message category such as an AC_BK category, then the message is discarded directly by the first discarding element **334**; if the newly added message is a high priority message category such as an AC_VO category, the length of the AC_BK queue is reduced by one through the queue arranging element **333**, the message in the queue is discarded directly, then the length of the AC_VO queue is increased and the newly added message is put into the AC_VO queue. Before the message in the AC_BK queue is discarded in the above manner, the length determining element **335** is configured to determine whether the length of the AC_BK queue is 0; if so, the AC_VO queue stops increasing, and the second discarding element **336** is configured to begin to discard the newly added message; otherwise, the notifying element **337** is configured to notify the queue arranging element **333** to process.

[0093] When wireless bandwidth begins to mitigate, the length of the AC_VO queue is reduced gradually, the AC_BK queue can be increased gradually, and low priority services restore to normal.

[0094] The above are only preferred embodiments of the disclosure and not intended to limit the patent scope of the disclosure. Those equivalent structures or equivalent process transformations made according to the content of the specification and the drawings of the disclosure, or direct or indirect use thereof in other related technical fields, shall similarly fall within the protection scope of the patent.

1. A method for enhancing Quality of Service (QoS) in a Wireless Local Area Network (WLAN), comprising:

adding a message category in a wireless access point;

adding a QoS priority transmission queue according to the added message category and setting queue attributes;

performing QoS scheduling by using the added transmission queue and performing data transmission.

2. The method according to claim **1**, after the step of adding the message category in the wireless access point, further comprising:

incorporating a specific message into the added QoS priority transmission queue.

3. The method according to claim **1**, wherein the step of performing QoS scheduling by using the added transmission queue and performing data transmission further comprises the step of:

discarding a message when wireless bandwidth is insufficient and a buffer queue of a gateway is full.

4. The method according to claim **3**, wherein the step of discarding the message further comprises the step of:

determining whether the priority level of a newly added message is high priority; if so, discarding a message in a low priority queue, and putting the newly added message into a high priority queue; otherwise, discarding the newly added message.

5. The method according to claim **4**, wherein before the step of discarding the message in the low priority queue, and putting the newly added message into the high priority queue, further comprises the step of:

determining whether the length of the low priority queue is zero; if so, discarding the newly added message; otherwise, discarding a message in the low priority queue, and putting the newly added message into the high priority queue.

6. The method according to claim 4, wherein the low priority queue is an AC_BK queue and/or an AC_BE queue; and the high priority queue is an AC_VI queue and/or an AC_VO queue.

7. A device for enhancing Quality of Service (QoS) in a Wireless Local Area Network (WLAN), comprising:

a category managing module, which is configured to add a message category in a wireless access point;

a queue managing module, which is configured to add a QoS priority transmission queue according to the added message category and set queue attributes;

a communication module, which is configured to perform QoS scheduling by using the added transmission queue and perform data transmission.

8. The device according to claim 7, further comprising:

a category incorporating module, which is configured to incorporate a specific message into the added QoS priority transmission queue.

9. The device according to claim 7, wherein the communication module further comprises:

a message discarding unit, which is configured to discard a message when wireless bandwidth is insufficient and a buffer queue of a gateway is full.

10. The device according to claim 9, wherein the message discarding unit further comprises:

a level determining element, which is configured to determine whether the priority level of a newly added message is high priority;

a queue arranging element, which is configured to discard a message in a low priority queue when the priority level of the newly added message is high priority, and put the newly added message with high priority into a high priority queue;

a first discarding element, which is configured to directly discard the newly added message with low priority when the priority level of the newly added message is low priority.

11. The device according to claim 10, wherein the message discarding unit further comprises:

a length determining element, which is configured to determine whether the length of the low priority queue is zero when the priority level of the newly added message is high priority;

a second discarding element, which is configured to discard the newly added message when the length of the low priority queue is zero;

a notifying element, which is configured to notify the queue arranging element to perform processing when the length of the low priority queue is not zero.

12. The method according to claim 2, wherein the step of performing QoS scheduling by using the added transmission queue and performing data transmission further comprises the step of:

discarding a message when wireless bandwidth is insufficient and a buffer queue of a gateway is full.

13. The method according to claim 12, wherein the step of discarding the message further comprises the step of:

determining whether the priority level of a newly added message is high priority; if so, discarding a message in a low priority queue, and putting the newly added message into a high priority queue; otherwise, discarding the newly added message.

14. The method according to claim 13, wherein before the step of discarding the message in the low priority queue, and putting the newly added message into the high priority queue, further comprises the step of:

determining whether the length of the low priority queue is zero; if so, discarding the newly added message; otherwise, discarding a message in the low priority queue, and putting the newly added message into the high priority queue.

15. The method according to claim 5, wherein the low priority queue is an AC_BK queue and/or an AC_BE queue; and the high priority queue is an AC_VI queue and/or an AC_VO queue.

16. The method according to claim 13, wherein the low priority queue is an AC_BK queue and/or an AC_BE queue; and the high priority queue is an AC_VI queue and/or an AC_VO queue.

17. The method according to claim 14, wherein the low priority queue is an AC_BK queue and/or an AC_BE queue; and the high priority queue is an AC_VI queue and/or an AC_VO queue.

18. The device according to claim 8, wherein the communication module further comprises:

a message discarding unit, which is configured to discard a message when wireless bandwidth is insufficient and a buffer queue of a gateway is full.

19. The device according to claim 18, wherein the message discarding unit further comprises:

a level determining element, which is configured to determine whether the priority level of a newly added message is high priority;

a queue arranging element, which is configured to discard a message in a low priority queue when the priority level of the newly added message is high priority, and put the newly added message with high priority into a high priority queue;

a first discarding element, which is configured to directly discard the newly added message with low priority when the priority level of the newly added message is low priority.

20. The device according to claim 19, wherein the message discarding unit further comprises:

a length determining element, which is configured to determine whether the length of the low priority queue is zero when the priority level of the newly added message is high priority;

a second discarding element, which is configured to discard the newly added message when the length of the low priority queue is zero;

a notifying element, which is configured to notify the queue arranging element to perform processing when the length of the low priority queue is not zero.

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