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The Access Method for a Collision Prevent from the Wireless Network

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무선네트워크에서 충돌예방을 위한 접근방법

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요 약

본 논문은 유무선 네트워크 환경에서 백오프 알고리즘을 적용하여 채널에 접근 충돌을 줄이는 방법을 제안한다. IEEE 802.16 환경에서 더블 백오프 사이즈가 열악한 환경에서도 동작점이 처음과 마지막 서비스가 동일하게 사용할 수 있도록 하였다. 데이터 처리량의 증가, 지연의 편차 감소 그리고 랜덤액세스 프로토콜의 과부하 조건에서 성능 감소율 향상을 위해 IEEE 802.16 환경에 적응 할 수 있는 알고리즘을 제시하였다. 컴퓨터 시뮬레이션 결과 본 논문에서 제시한 알고리즘이 기존네트워크 보다 처리속도가 향상되었다. 또한 낮은 패킷의 포화상태에서도 손실이 적음을 확인 할 수 있었고, 기존네트워크 보다 포화 상태가 연장이 되는 것을 알 수 있었다.

Abstract

In this paper propose a method to reduce data for collision resolution. It is to reduce a damage of the back off algorithm to apply in both wire and wireless networks. Double back off size can be work in the first and the last movement point service as a same time in IEEE 802.16. It propose of the algorithm to be suited to IEEE 802.16 for increasing network access percentage in increase a data treat, delay error range and random access over fuller condition. In the result of the computer simulation, the proposal algorism give a increasing speed more than under the this paper. From this computer simulation result, we can get the confirmation of the small loss in saturated and saturated could be a longer in last network.

▸ Keyword : 핸드오버(handover), 무선네트워크(Wireless Network), 휴대인터넷표준화(IEEE 802.16), 백오프알고리즘(BEB)

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Ⅰ. Introduction

The rapidly advancing internet communication technology makes ubiquitous computing feasible where mobile users con have access to location independent information and computing resources. Multimedia networking is another emerging technological trend of the 2000s and there is an increasing demand or supporting multimedia traffic in the wireless LANs. Besides, MN(Mobile Node) offers mobility in networks [1,2].

A major technical challenge in wireless communication is the selection of suitable multiple access control scheme to efficiently arbitrate wireless devices on a common air interface. A variety of MAC(Medium Access Contril) schemes have been proposed, e.g. The multiple access schemes such as Slotted ALOHA(Additive Links Online Hawaii Area) and CSMA/CA(Carrier Sense Multiple Access/Collision Acknowledge), and the demand assignment schemes such as PRMA(Packet Reserve Multiple Access), DQRUMA(Distributed Queuing Request Update Multiple Access), and RAP(Random Addressed Polling)[3].

One of the most important components in MAC design is back off algorithm which is needed when collision occurs either in data transmission or in bandwidth reservation. The BEB(Binary Exponential Back off) algorithm is the most widely used in wireless networks such as cellular systems and wireless LANs[4].

It is important that do to minimize delay of service that MN feels using fast hand off function to secure mobility for transfer MN. Must consider about several items for offer of such persistent service. Item that must consider first while MN achieves handoff process without being serviced, it is problem about abandoned packet. If handoff process has been prolonged, can produce qualitative problem of service by increase of have abolished packet without being serviced at handoff process. Therefore, handoff process quickly could achieve problem awareness about method and solvent by analysis of problem need. Delay time that happen at handoff procedure greatly channel search delay time and authentication procedure delay time and, is consisted of reassociation procedure delay time[5].

The paper is organized as follows. The operation of BEB algorithm and its drawbacks will be described in Section Ⅱ. Section Ⅲ presents our deterministic algorithm. Experimental results are presented in Section Ⅳ. Finally, we conclude the paper in Section Ⅴ.

Ⅱ. The Binary Exponential Algorithm

The BEB algorithm used in wireless network operates in the following way. If a packet has been transmitted unsuccessfully i times, the packet will be retransmitted again k slots later, where k is a random number uniformly distributed over the interval of [0, $2^{3+i}-1$]. If a packet is transmitted successfully or is expired and dropped, i is reset to 0. The philosophy behind the BEB algorithm is that, for a given packet, a higher number of unsuccessful retransmissions imply that more stations are competing for the available bandwidth, and, as a result, a larger back off window should be adopted to reduce the probability of collision [6,7].

The existing IEEE 802.11 WLAN does not offer handover. However, the current one offers handover to the mobile in order to reduce disconnection caused by frequent movement of cells. If the mobile moves to another cell beyond the present cell area, it will disconnect AP(Access Point) which is connected.

As the Fig. 2 shows, the handover process of mobile is composed of channel probe, authentication and reassociation. Firstly, a mobile disconnects the existing AP by the movement of itself. And then, AP searches all available channels to connect the new AP. If a mobile senses there is more than one response message from AP, it selects the highest reception degree of strength among the response messages. After previous process is completed, In the process of authentication, the decision on whether to connect a mobile to the network is made by using the selected

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channel. If a mobile is permitted to connect the network, reassociation is processed. And, the mobile transmits in the AP which is new a reassociation request message, received this message the new AP refers to the address field of the existing AP which exists inside combination request message. After that, a mobile sends the message of reconnection to the new AP and the new AP refers to the address field in the existing AP where there is a request message of combination[8].

If the new AP is in existence, it request old AP to the mobile about information of security and don't receiving data during hand over. Next, the new AP requests the old AP to transmit if there are any data on such as security during the handover. Regarding this requested old AP send information about the mobile to new AP with the IAPP (Inter-Access Point Protocol). This cause, hand over is completed. The process of handover is completed by old AP's sending related information to the new AP through IAAP(International Association for Analytical Psychology) after receiving the request. In the 3 steps of handover, the ratio of handover latency shows as below. Authentication accounts for 90% and reassociation 10%.

Under high loads, there are always stations challenging another competition which has lost in the previous competition as well as stations newly joining the competition. At this time, the new joiners are given shorter CW's(Continuous Wave) while the backlogged stations are assigned longer CW's. So, the slots positioned earlier in CW have a much higher probability to be chosen under high loads in the BEB algorithm. This is undesirable because the slots that have been chosen are more likely to be chosen again. Further, the BEB may generate a number of collisions at high traffic intensities, as a result, a long contention interval is required to determine the winner. This results in decrease of performance such as throughput and the packet delay[9,10].

In this paper, we propose a deterministic back off algorithm to reduce contention interval as much as possible for accessing the channel without collision in the back off process[11].

$$W_i = (i+1)\cdot K \quad i \in (0, m) \qquad (1)$$

The transition probabilities of Markov chain are

Let $b_{i,k}$ be the stationary distribution of the Markov chain, then we have

$$b_{i,0} = p^i \cdot b_{0,0} \qquad 0 \le i \le m \qquad (2)$$

from the following recursive relationship between the consecutive distributions :

$$b_{i,0} = p \cdot b_{i-1,0} \qquad 0 < i \le m \qquad (3)$$

Because the chain is regular, we have

$$b_{i,k} = \frac{W_i - k}{W_i} \cdot \begin{cases} (1-p)\sum_{j=0}^{m} b_{j,0} + b_{m,0} & i = 0 \\ p \cdot b_{i-1,0} & 0 < i \le m \end{cases} \qquad (4)$$

Let P_t denote the probability that there are at least one transmission in a given slot time. Then, since n stations contend to access the medium and each station transmits with probability ϖ, is given by

$$P_t = 1 - (1-\varpi)^n \qquad (5)$$

Let P_S denote the probability of successful transmission, which means the probability that a station is transmitting and the remaining $n-1$ stations remain silent. Then, we have

$$P_s = \frac{n\varpi(1-\varpi)^{n-1}}{P_t} = \frac{n\varpi(1-\varpi)^{n-1}}{1-(1-\varpi)^n} \qquad (6)$$

Finally, we can express channel utilization S by dividing the time needed to transmit payload information

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transmitted in a slot time with the average length of a slot time :

$$S = \frac{E[Payload\ transmission\ time]}{E[total\ time]} = \frac{P_s P_t T_P}{(1-P_t)\delta + P_s P_t T_F + (1-P_s) P_t T_F} \quad (7)$$

where T_F is a frame transmission time, and T_P is a constant payload transmission time.

III. Proposed Scheme

In our algorithm, each station is initially given back off time based on its ID during the registration or authentication procedure by the BS(Base Station) in the cellular network or the AP in the wireless LAN. In other words, the back off time is not randomly chosen as in the BEB, but is given a fixed value by BS or AP when each station enters the network. Once, a station is assigned the back off time, it starts a counter called CC(Countdown Counter). The CC is decremented, beginning from the initial back off time, by one every time an empty slot is sensed, and tries transmission when it reaches 0 as in the BEB. The station whose CC has reached 0 is given a new back off time by BS or AP using a beacon messages over the downlink. In our scheme, the station which is given the smallest back off time has the highest priority to access channel. To guarantee fairness for accessing the channel among stations in the network, each station decrements its back off time by one for every frame. In this way, all stations share the channel by handing over the prior right among each other.

As the Fig. 1 shows, a proposed method is based on IEEE 802.11 WLAN network. After a mobile completes handover, it reports valid information on channel to the new connected AP and the new AP sends this information to the old AP.

Old AP makes the NCT(Neighbor Channel Table) based on received hand over information from new AP. The period of making the NCT is called learning time. The process of learning movement information on mobile needed to make NCT is described as below.

1. The mobile, which has finished hand-over to connect new AP, sends the learned neighbor AP's channel information to the new AP.
2. This AP sends neighbor channel information to the old AP with IAPP.
3. The old AP that makes a NCT based on the mobile hand-over, and then informs to the mobiles often that are in its service area.

In the Fig. 1, the NCT is composed of three columns. One is neighbor ID in AP. Another is using AP the channel which each AP uses. The other is Next Scan Channel information. A next scan channel column is made based on information on probe response frame which a mobile implementing handover receives during the channel scanning process

Neighbor Channel Table

Channel	BSSID	Next Scan Channel
1	00:40:96:47:e6:ec	
6	01:4a:89:b3:e6:5c	0
	00:23:58:a7:e2:34	11
	02:a3:46:38:00:49	11
11	00:28:87:45:a6:12	6
	00:a7:b4:5a:3a:45	6
	00:a7:b4:5a:25:35	6

(a) Neighbor Channel Table

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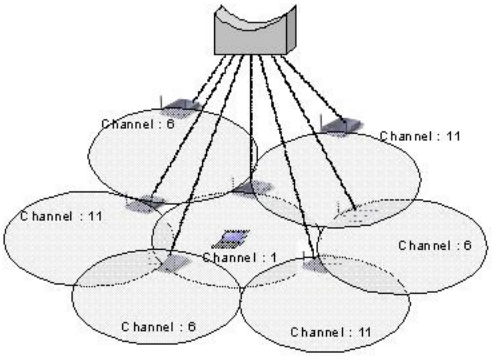

(b) IEEE 802.16 WLAN Network.

Fig. 1. Neighbor Channel Table and IEEE 802.16 WLAN Network.

In this paper, proposed fast hand over method is shown as below.

Algorithm :

For all channel i where any Leaning Channel Table
Broadcast probe request at channel
while True **do**
start probe timer
read probe responses
if Medium is idle until MinChannelTime expires
then
Broadcast probe request at next channel
continue
else if current channel hit in Neighbor Channel Table
then
Broadcast probe request at NextScanChannel index Channel
continue
else if NextScanChannel index channel hitting or non hitting
then
break
end if
end while
end for

The next scan channel column as the service of neighboring APs is overlapped each other. A mobile will be able to implement channel search into next scan channel column if it receives the prove response frame from the AP which is the same as BSSID(Basic Synchronized Subset Identification) items in NCT during the handover. It is because it is highly likely that a mobile is situated on the area of AP which receives probe response frame or overlapped area of neighboring AP.

Ⅳ. Simulation

As the Fig. 2 shows, simulation model is made to compare latency caused by the existing handover method with latency caused by a proposed ACS(Advanced Communications Services) method. In the Fig. 2. AP_ID is marked to distinguish each channel from used channels. Furthermore, NS-2 is used as the simulation program. Based on the program, IEEE 802.11 WLAN is set for the simulation.

Cells used in the simulation model are composed of 7 cells. Each mobile moves periodically every 500 ms from the range of AP0 to AP6. The radius of each cell is 100 m and parameters used during the handover are set just as the table 1.

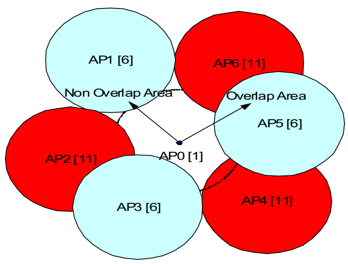

Fig. 2. System Model.

Table 1. Simulation Parameter.

Parameter	Value
MinChannelTime	3ms
MaxChannelTime	30ms
Slot Time	20μs
DIFS Time	54μs
SIFS Time	16μs
Channel Switching Time	5μs
DATA Rate	11Mbps

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The whole simulation time is 70 seconds. In addition, the learning time needed to make NCT is 40 seconds. Handover of a mobile uses a previous full scanning method for only during the learning time. During that learning time, AP makes NCT based on movement which each mobile experience.

In Fig. 3, simulation show for compares latency of three method hand over. One is proposed ACT(Advanced CMOS Thermometer), another is full scanning method and the other is selective scanning method.

As the Fig. 3 shows, simulation uses ACT, full scanning and selective scanning in order to compare latency used by each method. During the learning time, full scanning method is used to search the channel in order to compare the existing method to proposed method. Therefore, as the Fig. 3 shows, the result is the same during the learning time. However, it demonstrates that during the handover latency time is reduced dramatically in the 2 methods except full scanning method. The reason why latency time is reduced dramatically through a selective scanning method is that the channel used in simulation is the same as the channel selected in advance. Therefore, only related channels are scanned.

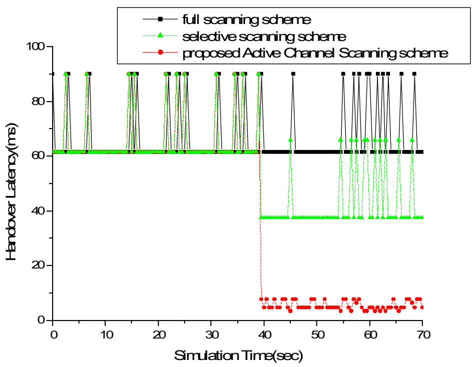

Fig. 3. Comparison of Latency used by Each Method Considering Time.

A mobile will use the ACS method to receive message from AP. If the results are the same, a mobile will search the channel which is selected in a next Scan Channel column. If the Next Scan Channel column is 0, a mobile only receives message from alone AP. Consequently, channel scanning method quickly ends.

As the table 2 indicates, the mobile used by a proposed method reduces latency time and the number of scanning channels after it implements handover through the existing full scanning, selective scanning and a proposed ACS.

Table 2. Handover Latency and the number of Scanning Channels.

Algorithms	*Delay Time(ms)*	*Scanning Channel number*
full-scanning	65.8	11
select-scanning	42.3	3
ACT-scanning	5.88	2.4

A method in the simulation where neighboring APs use 3 channels. Fist of all, compared to latency time used by the full scanning, latency time used by the selective scanning and proposed Active Scanning reduces by 34% and 91.1% respectively.

Moreover, the number of scanning channels is 2.4. It reduces greatly compared to 11 in the full scanning method and 3 in the selective scanning.

As the Fig. 4 shows, on average, the time required to scan the channel is changed according to the change of methods such as the full scanning, selective scanning, and proposed Active Channel Scanning. First, full scanning does not reduce latency time much because it scans all channels. Secondly, the selective scanning method increases latency to follow the AP using the channel. It is mainly because it tends to scan the rest channels along with selected channels as the number of channels which neighboring APs use increases.

Therefore, latency time which a terminal spends during the handover increases continuously. Finally, in the proposed ACT method, latency time is neededmuch less than that of mentioned two methods because a mobile scans the channels which neighboring APs use and ends scanning early after considering the

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overlapped area of AP. However, the average of handover time increases as the number of channels which a mobile has to scan increases. However, handover time of the proposed ACT method is needed much less than that of other existing methods.

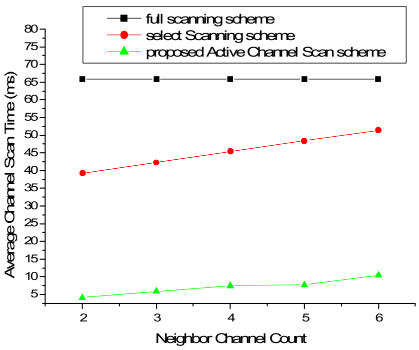

Fig. 4. Neighbor AP increment channel compare with each method.

As the table 3 shows, when the number of the channels which neighboring APs use is 2, the average of scanning channel time in the proposed ACS and full scanning method reduces by 40.3% and 93.8% respectively compared to that of the full scanning method. As the number of channels that neighboring APs use increases, so does the performance.

Table 3. A reduce in handover latency(%).

Neighbor Channel Count	2	3	4	5	6
select-scanning	40.3	35.7	31.1	26.6	22.0
ACT-scanning	93.8	91.1	88.7	88.3	84.2

Fig. 5 shows the mean packet delay measured from the start of packet generation to the acknowledgement of its proper reception. Since the BEB algorithm doubles back off window size for every collision without considering anything, the station may sometimes experience a long delay before accessing the channel to transmit its packets. However, our algorithm can reduce the delay by using a deterministic back off times in the saturation state.

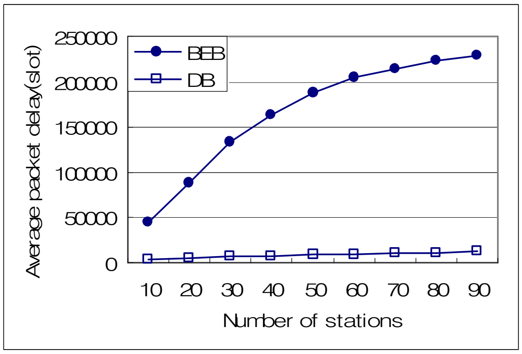

Fig. 5. Average packet delay versus number of stations.

Ⅴ. Conclusion

In this paper, a dynamic contention periods based on the collision group(BEB) algorithm is proposed for collision resolution in the IEEE 802.16 broadband wireless access network. The BEB algorithm determines the contention periods according to the a number of collided slot and collided requests to the base station. The BEB algorithm is useful to improve the performance of throughput and system delay characteristic than binary back-off algorithm. It is to reduce a damage of the back off algorithm to apply in both wire and wireless networks. In our analytical model, we assumed that each priority class used nonoverlapped contention period. We have shown that the EDCF(Economic Development Common Frame) priority scheme is quite effective to support controlled QoS(Quality of Service). Our model was validated via computer simulations and a sound agreement between the numerical results by both was observed.

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