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TRANSMISSION CAPACITY REPROCESSING IN IEEE 802.16 NETWORKS

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ABSTRACT

A base station schedules a stand-by subscriber station for each subscriber station with uplink (UL) transmission opportunities. The base station then transmits a list of each of the stand-by subscriber stations over the network. The stand-by subscriber stations then check to see if there is any unused bandwidth reserved for the corresponding subscriber station. In this study, we suggest a method for recycling wasted bandwidth without altering the current bandwidth reservation, which we call bandwidth recycling. The proposed plan's goal is to give other SSs access to the accessible, underutilised bandwidth. Three scheduling strategies are suggested to increase throughput by examining parameters influencing recycling performance..Before sending any data, the subscriber station (SS) must request the requisite amount of bandwidth from the base station (BS) in order to guarantee QoS-assured services. The SS often retains the allocated bandwidth to support variable bit rate (VBR) applications in order to maintain the QoS-guaranteed services. As a result, the reserved bandwidth transmitted data may exceed the transmitted data and may not always be used in its entirety. Despite the amount of bandwidth set asideThe IEEE 802.16 network emphasises connections. It offers the benefit of enhanced network resource control to deliver QoS-guaranteed services. Our research goal is twofold: to increase bandwidth consumption while keeping the same QoS assured services. To keep the same QoS-guaranteed services, the current bandwidth reservation is left alone. use the unused bandwidth to increase bandwidth usage. That was a development of the first version. It allowed for non-line-of-sight (NLOS) operation and covered frequency ranges between 2 and 11 GHZ. Instead of using towers or 802.16a's three physical layers, OFDM, OFDMA, and single carrier, NLOS operation allowed base stations to be mounted on roofs of homes or buildings.It also added support for mesh topology and new MAC features. Moreover, 802.16a offered the perfect wireless backhaul technology to link commercial 802.11 hotspots and 802.11 WLAN to the Internet.As soon as it happens, we suggested bandwidth recycling to reuse any unused bandwidth. Each complimentary station keeps an eye on the whole UL transmission interval of the TS to which it corresponds and is on alert for any chances to recycle any unused bandwidth. Three more algorithms have been suggested in addition to the crude priority-based scheduling method to increase recycling efficiency. Our mathematics and simulation findings show that our plan can meet the QoS standards while simultaneously increasing throughput, reducing delay, and doing so with little any additional overhead..

1. INTRODUCTION

A collection of IEEE standards known as IEEE 802 deal with local area networks and metropolitan area networks.The IEEE 802 standards are limited to networks carrying variable-size packets in more detail.The lower two tiers (Data Link and Physical) of the seven-layer OSI networking reference model correspond to the services and protocols described in IEEE 802, which. Indeed, the OSI Data Link Layer is divided into the Logical Link Control (LLC) and Media Access Control sublayers by IEEE 802 (MAC).The Ethernet family, Token Ring, Wireless LAN, Bridging, and Virtual Bridged LANs standards are the most commonly used.The bandwidth-intensive applications were supported by the IEEE 802.16 standard with quality of service (QoS). To ensure the QoS, bandwidth is set aside for each application..Because of this, lowering the package dropping rate effectively can make multimedia playback more flawlessly and achieve the QoS of multimedia service that consumers want.

This reliable data transfer depends on the MAC layer's scheduling algorithm for IEEE 802.16x. Unsolicited Grant Service (UGS), real-time Polling Service (rtPS), non-real-time Polling Service (nrtPS), and Best Effort (BE) are the four classes of service that are specified in the IEEE 802.16x specification, respectively..

A standards-based interoperable solution for wireless broadband is emerging after years of development and uncertainty. The Worldwide Interoperability for Microwave Access (WiMAX) Forum, a large industry group, has started approving broadband wireless technologies for interoperability and standard compliance. Wireless Metropolitan Area Networking (WMAN) standards were created by the IEEE 802.16 group and adopted by both IEEE and the ETSIHIPERN group as the foundation for WiMAX..

2. LITERATURE SURVEY

Three transmission media types are provided by the physical layer (PHY) of the IEEE 802.16 standard: single channel (SC), orthogonal frequency-division multiplexing (OFDM), and orthogonal frequency-division multiple access (OFDMA). Since OFDMA is used to facilitate mobility in the IEEE 802.16e standard, we presume it will also operate in other PHYs while constructing our analytical model. The four modulation types that OFDMA supports are BPSK, QPSK, 16-QAM, and 64-QAM..

The point-to-multipoint (PMP) mode, in which the SS is not permitted to connect with any other SSs but the BS directly, is the subject of this project. The transmissions between BS and SSs are divided into downlink (DL) and uplink (UL) transmissions based on the direction of transmission. The former are the BS to SS transmissions. On the other hand, the latter are transmissions that go the other way..

IEEE 802.16 supports the two transmission modes Time Division Duplex (TDD) and Frequency Division Duplex (FDD). TDD mode cannot be used to operate both UL and DL transmissions simultaneously; instead, FDD mode must be used. The TDD mode is the primary emphasis of our strategy in this research. The BS in WiMAX is in charge of planning both UL and DL transmissions. A

MAC frame represents every scheduling action. The structure of a MAC frame established in IEEE 802.16 standard has two parts: UL and DL subframe. For UL transmissions, there is the UL subframe. The DL subframe serves the same purpose for DL transmissions.The BS controls the SS in IEEE 802.16 networks. The DL and UL maps, which are broadcast at the start of a MAC frame, contain all coordinating data, including burst profiles and offsets.

The IEEE 802.16 network emphasises connections. It offers the benefit of enhanced network resource control to deliver QoS-guaranteed services. The IEEE 802.16 standard divides traffic into five scheduling classes in order to serve a wide range of applications: Unsolicited Grant Service (UGS), Real Time Polling Service (rtPS), Non-real Time Polling Service (nrtPS), Best Effort (BE), and Extended Real Time Polling Service (ertPS).Every application is assigned to one of the scheduling classes, and that scheduling class determines how it connects to the BS. Each connection receives a connection ID (CID) from the BS. By submitting a BR, the bandwidth reservation is made depending on the CID. Depending on its scheduling policies and available resources, the BS has the option to accept or reject a BR when it receives one.

The IEEE 802.16 standard specifies two different forms of BRs: incremental and aggregate BRs. The former make it possible for the SS to signal the additional bandwidth needed for a connection. Hence, only incremental BRs can be used to increase the amount of reserved bandwidth..

On the other hand, the SS uses an aggregate request to specify the queue's current state for the specific connection. Upon receiving the request, the BS updates its understanding of the demands for that service. As a result, the reserved bandwidth can be reduced..

2. PROBLEM STATEMENT

For efficient bandwidth usage in IEEE 802.16 networks, two approaches are utilised. Bandwidth reservation is followed by adjusted reserved bandwidth.

Bandwidth Reservation: IEEE 802.16 networks can offer QoS-guaranteed services thanks to bandwidth reserve. The necessary bandwidth is set aside by the SS before any data flows.

Reserved Bandwidth Modification

BRs can be used to change the reserved bandwidth, but the new reserved bandwidth is applied as soon as the following frame..

LIMITATION OF SYSTEM :

Reservation of bandwidth: The VBR applications' nature makes it exceedingly challenging for the SS to reserve the ideal amount of bandwidth. The amount of bandwidth that has been set up can be greater than what is needed. As a result, the allocated bandwidth cannot be used entirely.

There is no method to use the unused bandwidth in the current frame, according to the reserved bandwidth adjustment..

3. PROPOSED SYSTEM

We put out a plan called "Bandwidth Recycling" that reuses unused bandwidth without delaying the QoS-guaranteed services in any way. Our plan's main idea is to let other SSs use the unused bandwidth that the present transmitting SS has left over. Our system enables SSs with non-real time applications, which have more latitude in their latency requirements, to recycle the idle bandwidth because it is not expected to happen frequently. As a result, the current frame's unused bandwidth can be used. It differs from bandwidth adjustments where the altered bandwidth is implemented as soon as the following frame.Moreover, the existing bandwidth reservation does not change, and it is likely that the unused bandwidth will only be briefly released (i.e., only for the current frame). Hence, while still offering the same QoS-guaranteed services, our technique increases overall throughput. The uplink (UL) map shall provide transmission possibilities for all planned SSs, as per the IEEE 802.16 standard, in the current frame. In this paper, these SSs are referred to as transmission SSs (TSs). The primary goal of the suggested plan is to give the BS the ability to schedule a backup SS for each TS. When the opportunity arises, the backup SS is put on standby to recycle the unused bandwidth of its related TS.We refer to the complementary station as the backup SS (CS). In accordance with the IEEE 802.16 standard, BRs are created per-connection. The BS, however, distributes bandwidth on a per-SS basis. It offers the SS the freedom to locally distribute the allotted bandwidth to each connection. Hence, the granted bandwidth that is left available after serving all connections currently active on the SS is described as the unused bandwidth. According to our plan, whenever a TS has extra bandwidth available, it should send a message known as a releasing message (RM) to the related CS, instructing it to reuse the extra bandwidth.

4. ALGORITHM

Priority-based Scheduling Algorithm

A SS with the highest priority is scheduled as the CS using the Priority-based Scheduling Algorithm (PSA), which is depicted in Algorithm 1. The scheduling factor (SF), which is the ratio of the current requested bandwidth (CR) to the current given bandwidth, determines each candidate's priority (CG). The bandwidth is greater in demand for the SS with higher SF. As a result, we give those SSs higher priority. The SSs with 0% CG are given top attention..

nrtPS and BE connections are examples of non-realtime connections. Due to QoS constraints, the nrtPS connections ought to take precedence over the BE connections. From high to low, the following choices for CSs are prioritised: nrtPS with zero CG, BE with zero CG, nrtPS with non-zero CG, and BE with non-zero CG. To lessen the likelihood of overflow, we choose the SS with the higher CR when there are many SS with the same priority..

Algorithm: Priority-Based Scheduling Algorithm

Input: T is the set of TSs scheduled on the UL map.Q is the set of SSs running non-real time applications.

Output: Schedule CSs for all TSs in T.

For *i*=1 to //T//do

a. *St* ← *TSi*.

b. *Qt* ← *Q*−*Ot:*

c. Calculate the SF for each SS in *Qt*.

d. **If** Any SS ∈*Qt*has zero granted bandwidth,

If Any SSs have nrtPS traffics and zero granted bandwidth,

Choose one running nrtPS traffics with the largest CR.

else

Choose one with the largest CR.

else

Choose one with largest SF and CR.

e. Schedule the SS as the corresponding CS of *St*.

End For

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5. OUTPUT SCREENS

Fig.5.1 Calculating the Delay and Bitrate.

We can see the bit rate, delay, file length and bandwidth consumed in the destination node.

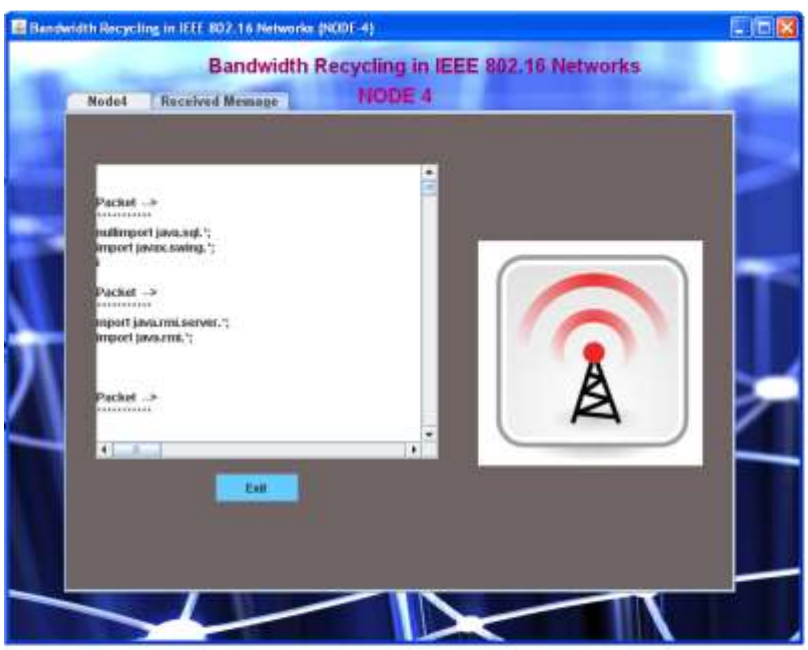

Fig.5.2. Received Message.

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We can see the received message in the destination node by clicking the "Received Message" tab.

Fig.5.3. Results & Analysis.

We can have the analysis oand results of the data transmission.

Simulation of node packet dropping by bit by bitrates:

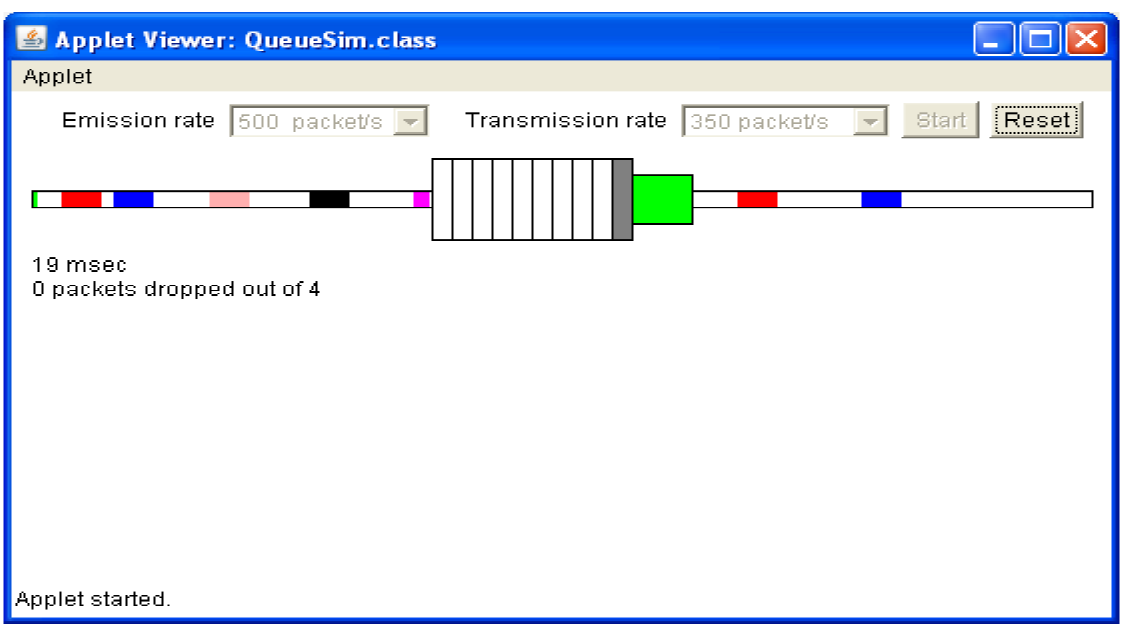

Fig.5.4. Simulation of bit rate at node.

We can see the incoming packets and transmission rate in the above simulation diagram

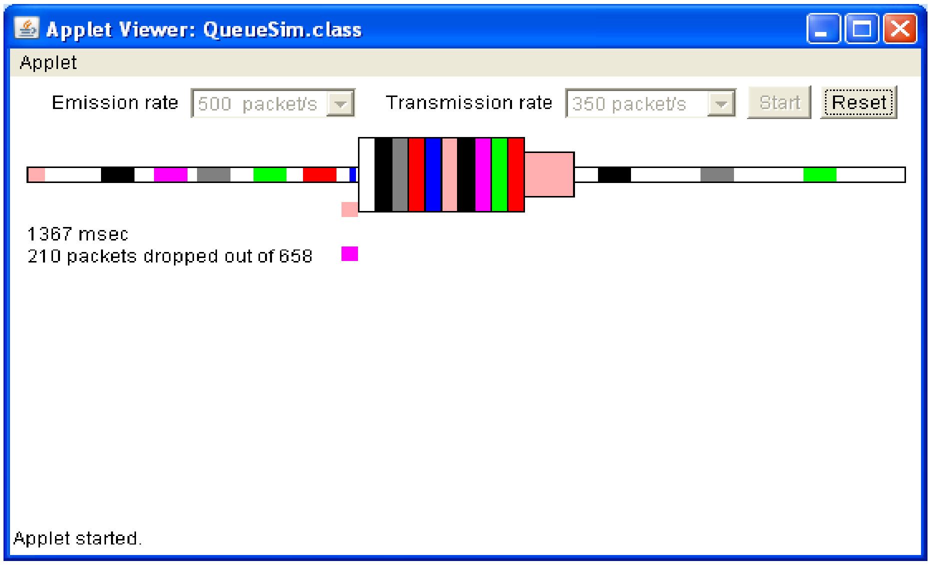

Fig.5.5. Simulation of packet dropping.

The dropped packets can be seen in the above simulation diagram

6. RESULT ANALYSIS

We can see from figure 5.6 that the recycling rate is almost zero at the start of the simulation. That happens because the network is not heavily loaded and just a few connections are transmitting data at that moment..

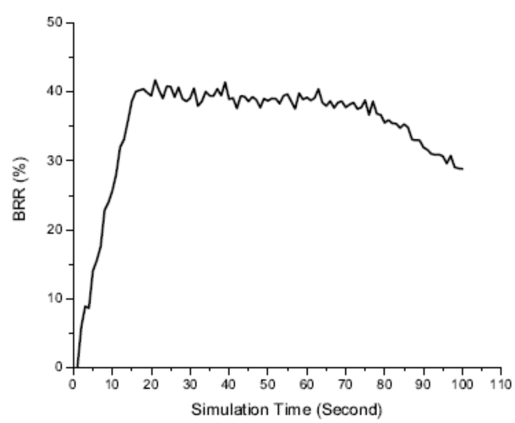

Fig 5.7. Simulation results of Bandwidth Recycling Rate (BRR).

Consequently, only a small number of connections must reuse the extra bandwidth from others. Many active connections continue to join the network throughout time. The connections' needs might not be able to be met by the available bandwidth. As a result, the likelihood that the CS recycles the unused bandwidth is high. It generates a greater BRR. Figure 5.7 shows the BRR percentages for the simulation time values.

Simulation Time (Second)	BRR (%)
1	5
5	9
10	15
15	23
20	35
30	40
50	38
70	34
90	32
100	30

Fig.5.8. Results of BRR.

The overall bandwidth demand made by SSs during the experiment is displayed in Fig. 5.8. The dashed line in the figure represents the system bandwidth capacity. Due to the QoS requirement, the BS always allots the bandwidth necessary to meet the demand for real-time connections during the simulation. As a result, the bandwidth allotted to connections that are not in real time may be reduced.

New non-real time data are generated at the same moment. As a result, the queue is filled with non-real time data. It is the cause of the ongoing rise in bandwidth demand..

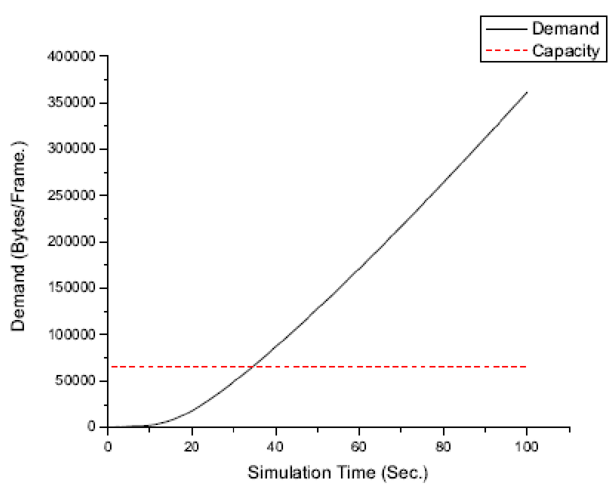

Fig.5.9. Total Bandwidth Demand

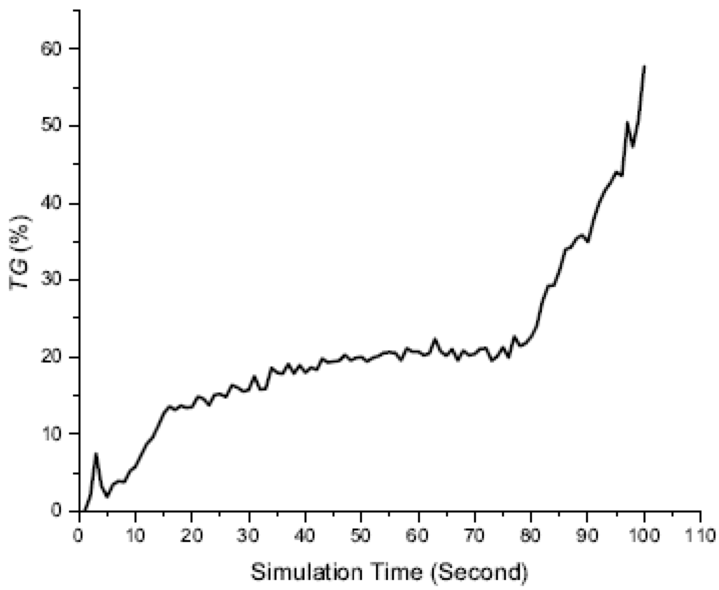

Fig.5.9. Simulation results of Throughput Gain.

The results of TG estimated from the examples with and without our technique are shown in Fig. 5.9. In the illustration, the TG is severely constrained at the start of the simulation, which is consistent with the outcomes of the BRR. It demonstrates that our technique does not much better when the network traffic is low. As the volume of traffic rises, the TG reaches 15% to 20%. It is important to notice that around the 35th second of the simulation duration, the TG hits about 20%. It coincides with the moment when the system capacity depicted in Fig. 5.27 is reached by the bandwidth demand. Once more, it shows that the suggested plan can still produce higher TG even when the network is fully utilised. The TG rises after the 75th second. dramatically. It shows that our scheme can have significant improvement on *TG* when the large amount of unused bandwidth is available.We also look at how long it takes in cases with and without our plan. By putting our plan into practise, the average delay is reduced by about 19% when compared to the delay without our plan. It comes as a result of our scheme's enhanced overall system throughput.

7. CONCLUSION & FURTHER ENHANCEMENT

According to our analysis, the CS not having data to transmit while receiving an RM is one of the variables driving recycling failures. We suggest scheduling SSs that have rejected BRs in the most recent frame in order to mitigate this issue because doing so can guarantee that the SS scheduled as CS has data to recycle the wasted bandwidth. Rejected Bandwidth Requests First Algorithm is the name of this scheduling algorithm (RBRFA). It is important to keep in mind that the RBRFA only works with networks that have rejected BRs sent from non-real time connections (i.e., nrtPS or BE). Keep in mind that the RBRFA only takes into account rejected BRs sent in the most recent frame when scheduling the current frame..

The likelihood that the RM will be successfully received by the CS is the third element that could influence how well bandwidth recycling performs. A scheduling approach called the history-Based scheduling algorithm (HBA) is suggested in order to raise this likelihood.

The two algorithms discussed above concentrate on reducing each potential reason of recycling failure. The likelihood that the CS has data to send while receiving the RM is increased by the RBRFA. The CS is more likely to get the RM if the HBA is present. But none of them can simultaneously address both problems. An approach known as the Hybrid Scheduling Algorithm (HSA) is presented by combining the benefits of RBRFA and HBA..HSA can raise both the likelihood that CSs will receive the RM and the likelihood that they will send data while receiving it.

Applications with variable bit rates produce data at various rates. It is quite difficult for SSs to forecast the volume of incoming data with any degree of accuracy. Even while the current approach enables the SS to modify the reserved bandwidth through bandwidth requests in each frame, it cannot completely eliminate the danger of not meeting the QoS criteria. Furthermore, because the bandwidth adjustment might be implemented as soon as the following frame, the unused bandwidth in the present frame cannot be utilised by the adjustment.To guarantee the same QoS-guaranteed services, our research does not alter the current bandwidth reservation. As soon as it happens, we suggested bandwidth recycling to reuse any unused bandwidth. A complimentary station can be scheduled by the BS for each transmission station. Each complimentary station keeps an eye on the whole UL transmission interval of the TS to which it corresponds and is on alert for any chances to recycle any unused bandwidth. Three more algorithms have been suggested in addition to the crude priority-based scheduling method to increase recycling efficiency. Our mathematics and simulation findings show that our plan can meet the QoS standards while simultaneously increasing throughput, reducing delay, and doing so with little any additional overhead..

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