Bandwidth Recycling using Variable Bit Rate

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Abstract

IEEE 802.16 standard was designed to support the bandwidth demanding applications with quality of service (QoS). Bandwidth is reserved for each application to ensure the QoS. For variable bit rate (VBR) applications, however, it is difficult for the subscriber station (SS) to predict the amount of incoming data. To ensure the QoS guaranteed services, the SS may reserve more bandwidth than its demand. As a result, the reserved bandwidth may not be fully utilized all the time. In this paper, we propose a scheme, named *Bandwidth Recycling*, to recycle the unused bandwidth without changing the existing bandwidth reservation. The idea of the proposed scheme is to allow other SSs to utilize the unused bandwidth when it is available. Thus, the system throughput can be improved while maintaining the same QoS guaranteed services. Mathematical analysis and simulation are used to evaluate the proposed scheme. Simulation and analysis results confirm that the proposed scheme can recycle 35% of unused bandwidth on average. By analyzing factors affecting the recycling performance, three scheduling algorithms are proposed to improve the overall throughput. The simulation results show that our proposed algorithm improves the overall throughput by 40% in a steady network.

Keywords: WiMAX, IEEE 802.16, Bandwidth Recycling

1.Introduction

The Worldwide Interoperability for Microwave Access (WiMAX), based on IEEE 802.16 standard standards is designed to facilitate services with high transmission rates for data and multimedia applications in metropolitan areas. The physical (PHY) and medium access control (MAC) layers of WiMAX have been specified in the IEEE 802.16 standard. Many advanced communication technologies such as Orthogonal Frequency- Division Multiple Access (OFDMA) and multiple-input and multiple-output (MIMO) are embraced in the standards.Supported by these modern technologies,WiMAX is able to provide a large service coverage, high data rates and QoS guaranteed services.

In order to provide QoS guaranteed services, the subscriber station (SS) is required to reserve the necessary bandwidth from the base station (BS) before any data transmissions. In order to serve variable bit rate (VBR) applications, the SS tends to keep the reserved bandwidth to maintain the QoS guaranteed services.
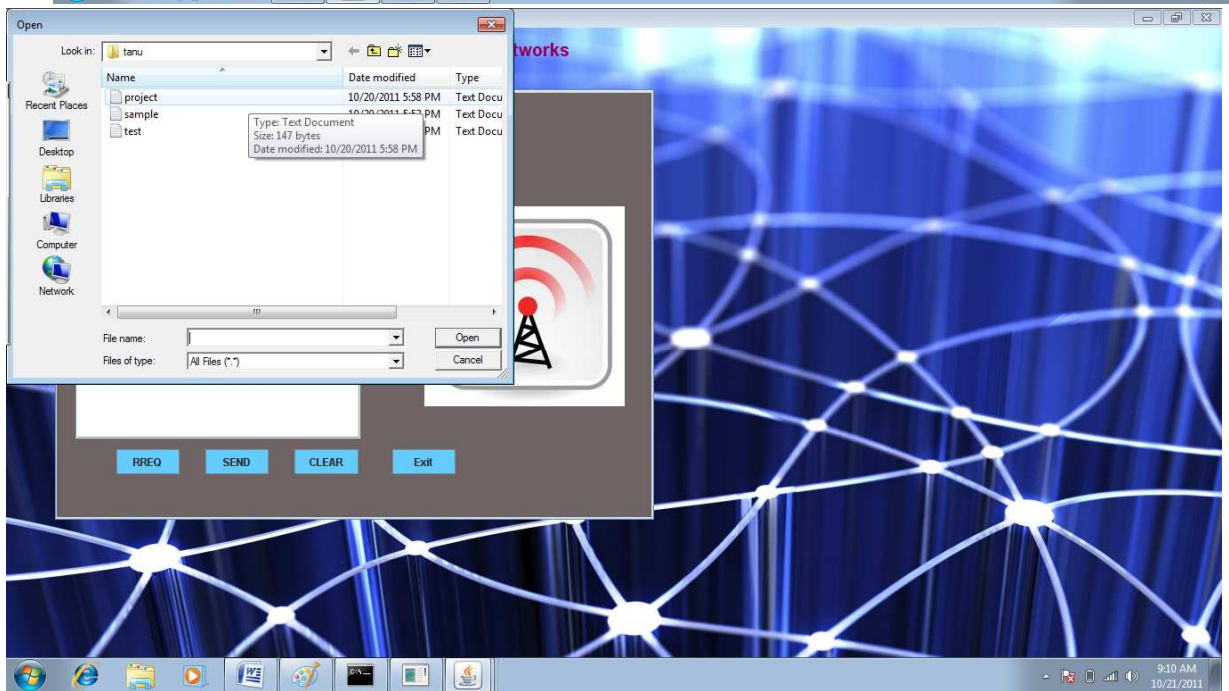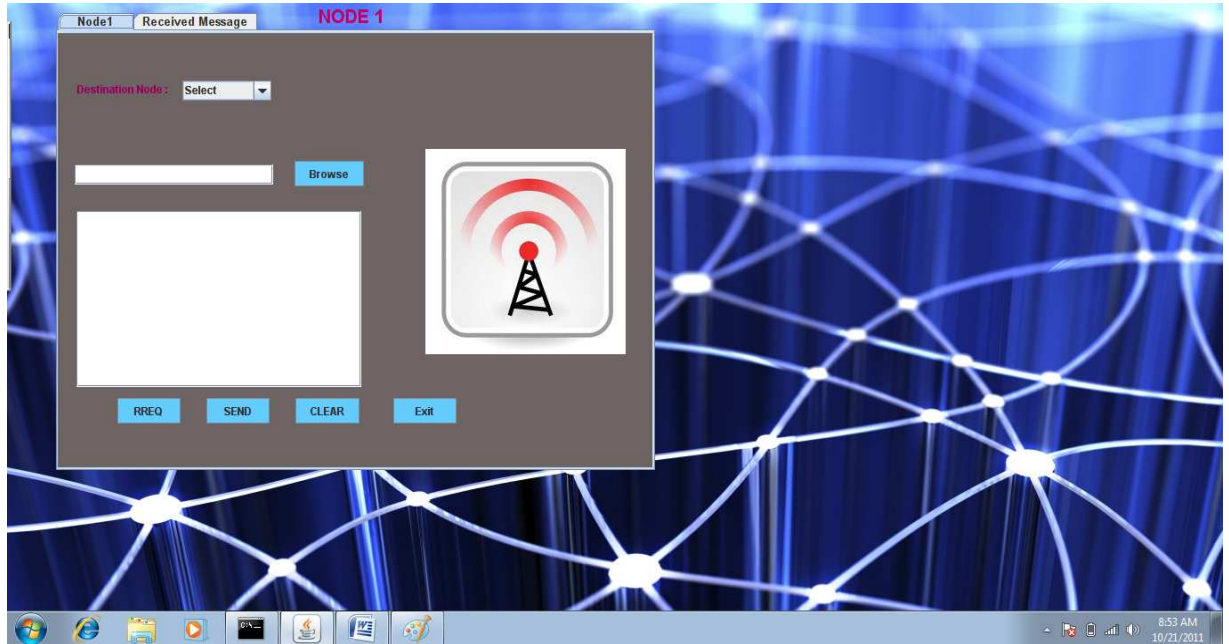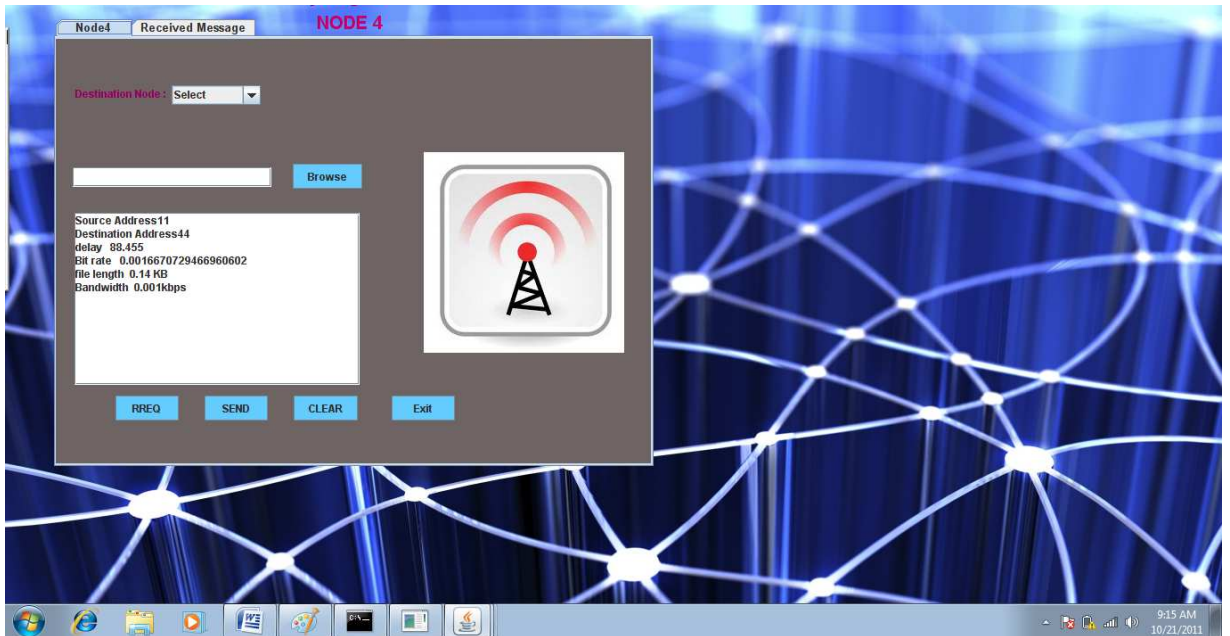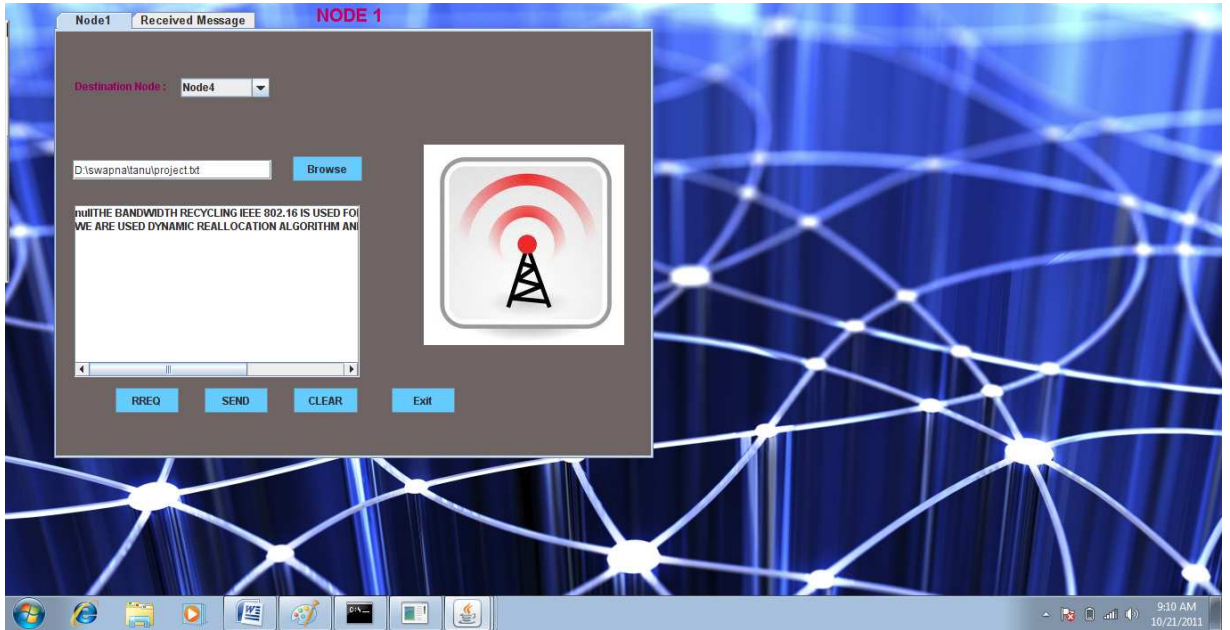
1.1 Previous Work

Important part in bringing out the network services lies in existing technology. Routing and switching are the main methods of delivering the data through the network. Both have their disadvantages and benefits and there are many variations of them applying in different ways to different situations. Another big issue is the resource handling with QoS. In IP world, there are a few proposals to resource handling problems and besides that there are a few technologies providing different approaches to QoS problems. These include for instance ATM and Gigabit Ethernet
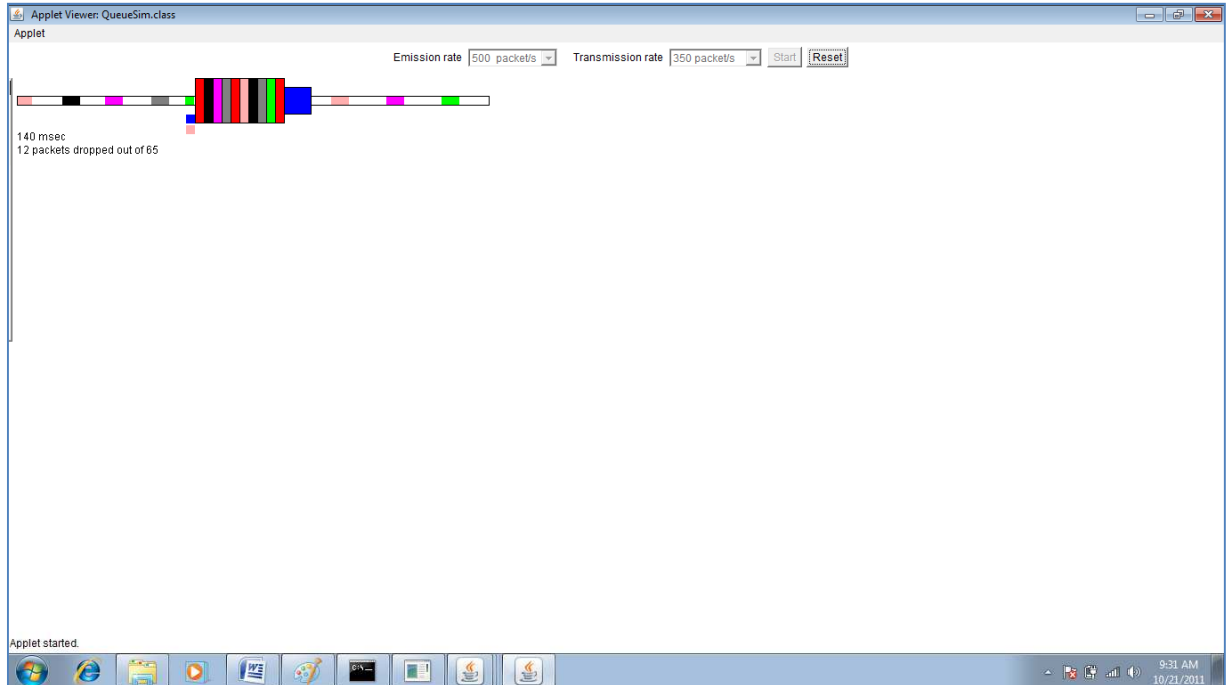
2. Proposed System

Bandwidth reservation allows IEEE 802.16 networks to provide QoS guaranteed services. The SS reserves the required bandwidth before any data transmissions. Due to the nature of VBR applications, it is very difficult for the SS to make the optimal bandwidth reservation. It is possible that the amount of reserved bandwidth is more than the demand. Therefore, the reserved bandwidth cannot be fully utilized. Although the reserved bandwidth can be adjusted via BRs, however, the updated reserved bandwidth is applied as early as to the next coming frame and there is no way to utilize the unused bandwidth in the current frame. In our scheme, the SS releases its unused bandwidth in the current frame and another SS pre-assigned by the BS has opportunities to utilize this unused bandwidth. This improves the bandwidth utilization. Moreover, since the existing bandwidth reservation is not changed, the same QoS guaranteed services are provided without introducing any extra delay.

3. Results

3.1 Performance Analysis

The proposed paper is implemented in Java technology on a Pentium-III PC with 20 GB hard-disk and 256 MB RAM with apache web server. The propose paper's concepts shows efficient results and has been efficiently tested on different Messages.

4. Conclusion

Variable bit rate applications generate data in variant rates. It is very challenging for SSs to predict the amount of arriving data precisely. Although the existing method allows the SS to adjust the reserved bandwidth via risk of failing to satisfy the QoS requirements. Moreover, the unused bandwidth occurs in the current frame cannot be utilized by the existing bandwidth adjustment since the adjusted amount of bandwidth can be applied as early as in the next coming frame. Our research does not change the existing bandwidth reservation to ensure that the same QoS guaranteed services are provided. We proposed bandwidth recycling to recycle the unused bandwidth once it occurs. It allows the BS to schedule a

complementary station for each transmission stations. Each complementary station monitors the entire UL transmission interval of its corresponding TS and standby for any opportunities to recycle the unused bandwidth. Besides the naive priority-based scheduling algorithm, three additional algorithms have been proposed to improve the recycling effectiveness. Our mathematical and simulation results confirm that our scheme can not only improve the throughput but also reduce the delay with negligible overhead and satisfy the QoS requirements.

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