Quality of Service (QoS) in Wireless Network and NS-3, VOIP Simulation Environment

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Abstract— Quality of Service (QoS) is what determines if a wireless technology can successfully deliver high value services such as voice and video. The UGS service flow handles the traffic generated by VOIP calls in the most optimum way. Simulation is a powerful tool for analysis and improvement of networking technologies, and many simulation packages are available. One that is growing in popularity is NS-3, the successor to the popular NS-2. It is a significant departure from NS-2.

Index Terms— QoS, VOIP, IEEE 802.16 Standards, NS2, NS3.

I. INTRODUCTION

The WiMAX forum and IEEE 802.16 subcommittee are both involved in the development of open standards based broadband wireless networks. The IEEE 802.16 subcommittee is purely a technical body that defines the 802.16 family of broadband wireless radio interface standards. IEEE 802.16 defines the layer 1 (physical, also referred as PHY) and layer 2 (data link or Media Access Control – MAC) of the (Open Systems Interconnection) OSI seven layer network model. It does not define standardized network architecture beyond the base station. Standardized network architecture is essential to ensure inter-working between equipment from different vendors and inter-working between networks of different operators. While it is extremely popular, NS-2 has become somewhat dated, and a new simulator, NS-3, is being developed to replace it. Because there are significant architectural differences between the simulators, translating NS-2 models for use in NS- 3 is an extremely involved process. We discuss the process of translating the WiMAX Forum's NS-2 model to NS-3, and updating it to reflect a newer version of the WiMAX standard.

II. LITERATURE REVIEW

The IEEE 802.16 MAC layer performs the standard Medium Access Control (MAC) layer function of providing a medium-independent interface to the physical (PHY) layer. WiMAX systems are based on Orthogonal Frequency Division Multiple Access (OFDMA). It provides improved multi-path performance and operation in non-line-of-sight environments. Scalable OFDMA (SOFDMA) is introduced in the IEEE 802.16e amendment to support scalable channel bandwidths. The MAC protocol is connection-oriented. All data transmissions take place in the context of connections. A connection is a unidirectional logical link between the MAC layer on the BS and the MAC layer of the SS. A service flow is mapped to a connection and the connection is associated with a level of QoS. Connections in the downlink direction are either unicast or multicast while uplink connections are always unicast. The primary management connection is used to exchange longer more delay tolerant messages. Finally the secondary management connection is intended for higher layer management messages and SS configuration data. For actual user traffic, transport connection ID's are used. For each active service for a user, two connection ID's are created.

III. CLASS STRUCTURE

It contains descriptions of significant classes in the model. Classes are grouped into several categories: the state machines, the classification system, the physical layer, the scheduling system, timers, headers, and several additional classes that do not fit into any of these categories. The descriptions will first provide a general view of what the class does, along with any other pertinent information about it, followed by a list of important or otherwise significant functions and data members, and brief descriptions of them.

IV. FUTURE SCOPE

VOIP traffic and video streaming were the two applications considered in the current analysis. Further analysis could be done for other applications including, video telephony which combines video traffic and VOIP traffic, File Transfer Protocol (FTP) traffic etc. The WiMAX module used in the analysis did not support nrtPS and ertPS service flows that are defined by the IEEE 802.16 standards. ertPS service flow is designed for applications which generate variable rate traffic which are delay dependent. An example of such traffic is VOIP with silence suppression. In this case, the VOIP application is not required to send packets during silent periods. The capability to stop sending packets during silent periods is known as "Silence Suppression" or VAD (Voice Activity Detection). Variable rate and non-real time applications such as FTP are supported by the nrtPS service flow.

V. CONCLUSION

The IEEE 802.16/WiMAX network architecture was presented and the MAC layer features that enable end-to-end VOIP traffic and video streaming traffic was analyzed using a simulation based on network simulator, ns-2. The effect of different service flows on QoS parameters like throughput, packet loss, average jitter and average delay was studied. In general, it was observed that the UGS service flow has the least overhead in terms of bandwidth request and it is the highest in rtPS service flow.

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