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QoS in WiMax and GSM Networks

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Abstract

This paper deals with Worldwide Interoperability for Microwave Access (Wimax) technology and Global System for Mobile communication (GSM) with focus on Quality of Service (QoS). QoS is very important to determine the performance of the network and the extent of continuity of service and customer satisfaction with the services provided by the network. Vary the parameters set for the quality of service in each network, in this paper we will discuss these parameters the explanation and we will discuss two types of networks: GSM network and is considered one of the cellular networks, and Wimax network and is considered one of the wireless networks.

Keywords: *WiMax, QoS, GSM Networks, DSL, Delay, Jitter.*

Introduction

Quality of Service (QoS) is a measurement of the networks performance and plays an important role in the networks. QoS defined as the measurement of the performance level for services provided by the network, if there is a high QoS then the performance of the network is high and that makes a greater satisfaction for the customer.

When QoS is achieved in the network, results:
1. Greater usage for resources.
2. Best delivery for information carried by the network.

There are many parameters that affect to QoS:
1. Delay.
2. Jitter.
3. Packet loss.
4. Throughput

In this paper we discuss the QoS in two different networks: WiMAX network and GSM network.

WiMax Networks

WiMAX or worldwide interoperability for Microwave Access is a modern communication technology aimed at providing wireless data over long distances via cellular telephone is compatible with the global standard IEEE 802.16, or Wireless MAN (Wimax). Wimax name came from naming the Wimax Forum, which was held in 2001, which concluded that the identification and definition of this technique as a technique based on a standard that allows Connect widespread wireless access and this replace the place of digital cable DSL.

There are two types of Wimax:

1. Fixed...Where the customer receives a signal from a fixed location, whether at home or the office. We have to capture device two forms either in the building or internal surfaces near windows.
2. Mobile... Where the user can move from one place to another during the browse and use of the Internet.

WiMax Features

1. Provides high speeds through central Wimax stations connected to a Wi-Fi connection centers in major cities without the need for a direct field or a straight line of sight between the transmitter and receiver, and not affected by buildings and natural barriers between the central transmitters and receivers, i.e. Wimax support multipath.
2. Wimax technology provides the exchange of media (information, voice, and image) between users at high speeds up to 280 Mbps.

3. Wimax technology provides the exploitation of frequency transmission channels with high efficiency. Through the re-use of these frequency channels, which increases the capacity of cells communicate with network growth which in turn can increase the number of subscribers.
4. Designed frequencies in the Wimax ranging from one to 100 users each channel of the frequency channels where you start the communication channels of 1.75 MHz frequency 1.75 MHz up to 20 MHz 20 MHz
5. WiMAX is designed to give high speeds in all environments, whether transmitters and receivers on the direct routing or indirect routing. Could reach the distance between the transmitter and the receiver up to 70 miles at speeds up to 70 Mbps per transmission channel using the techniques of smart antennas and networks of random paths.

WiMax Components

The system of (Wimax) consists of two components:

1. WiMAX tower which is in principle similar to a mobile phone tower, One tower provides area about 8,000 kilometers square.
2. Wimax receiver which can be a small box or located inside the (laptop) as it exists in today's devices to Wi-Fi.

GSM Networks

Global System for Mobile Communication (GSM) is the second generation of digital cellular communication systems. Planning began in 1982 and with the development of digital technology and the growing demand.
This generation features of capacity or the ability of the system of several times higher than the analog system.
It also offers more service-features, high quality and low cost. Europe has begun work with this system in 1991 introduced a new frequency is 900MHz for cell phone service.

Features

1. Common Standard.
2. International roaming; we are able to use mobile phone, and number in other countries around the world that operate a GSM network.
3. Provide high speed circuit-switched data (HSCSD).
4. Supports multiple frequency levels like 900 MHz, 1800 MHz, and 1900 MHz.
5. Digital encryption techniques.
6. TDMA digital transmission
7. Low power consumption.
8. Low cost equipment.

GSM Components

GSM network consists the basic components:

1. NSS (Network Switching System).
2. OMC (Operation and Maintenance Center).
3. MS (Mobile Station).
4. BSS (Base Station System).

QoS in Networks

Quality of Service (QoS) in cellular networks (for example GSM) is defined as the capability of the cellular service providers to provide a satisfactory service which includes voice quality, signal strength, low call blocking and dropping probability, high data rates for multimedia and data applications etc.

For network based services QoS depends on the following factors:

1. Throughput: the unit-time packet throughput is probably the most basic QOS parameter for many end users, and is obviously limited by the physical-layer pipe between the base station and the subscriber terminal in WiMAX (and other wireless technologies), and also by the number of subscribers that are active in parallel, since the overall system bandwidth is shared. Generally, if the overall bandwidth of a given system is big enough.
2. Delay: the end-to-end packet transmission time is caused by the granularity of the

physical-layer chain, and is typically almost 5ms in 802.16 systems. Latency is also affected by how packet queuing, various QoS protocols, and user characterizations are implemented.

3. Jitter: the variation of latency over different packets has to be limited by packet buffering. Since the buffer on the mobile terminal is likely to be small, jitter control in wireless networks tends to fall onto the base station, which has to ensure that different packets receive different prioritization if necessary.
4. Packet Loss Rate The rate at which a packet is lost. This should also be as minimum as possible.
5. Packet Error Rate This is the errors which are present in a packet due to corrupted bits. This should be as minimum as possible.
6. Reliability: the proportion of successfully delivered packets leads to more complications in wireless networks than in fixed-line ones, and the problems are specifically acute in mobile networks. The issue is that wireless networks have an inherent unreliability because of the vicissitudes of radio wave propagation – especially to mobile terminals with small antennas and low powers in cluttered environments such as urban areas. So packet loss (and numbers of error packets) will be higher than for fixed-line networks.
7. It is for these reasons that providing QoS has been a great challenge in the past and it continues to be a hot topic as there is still a lot of scope to provide better service standards.

QoS in WiMax Network

In order to categorize the different types of quality of service, there are five Wimax QoS classes that have been defined:

1. Unsolicited Grant Service (UGS): Used for real-time services, so Low delay and low jitter is very important. At the same time low percentage of packet drops is possible.
2. UGS flows are configured to send fixed size packets at recurring intervals with as little delay and jitter as possible.
3. Example: Voice over IP (VoIP).
4. Real-Time Polling Service (RTPS): RTPS is designed to support real-time service flows that generate variable size data packets on a periodic basis. It used for real-time services including video streaming. Also used for enterprise access services where guaranteed rates are needed. It is offers a variable bit rate but with guaranteed minimums for data rate and delay.
5. Extended Real Time Packet Services (ERTPS): Used for applications where variable packet sizes are used - often where silence suppression is implemented in VoIP. Also called Enhanced Real Time Variable Rate or Extended Real Time Packet Services. Example: Skype.
6. Non-Real-Time Polling Service (NRTPS): Support non-real-time service flows that require variable size data packets and a minimum data rate. It used for services where a guaranteed bit rate is required but the delay is not critical. Also used for various forms of file transfer such as FTP.
7. Best Effort (BE): Support data streams that don't require minimum guaranteed rate, and could be handled on best available basis. BE packets may take a long time to transmit during network congestions. Delays may be occurred and jitter is not a problem. It Used for Internet services such as email and browsing.

Table 1: Wimax Application Classes

Classes	Application	Bandwidth	Delay	Jitter
1	Interactive Gaming	Low Bandwidth (50KB/S)	Low Delay (80 ms)	N/A
2	Voice Telephone (VOIP) Video Conference	Low Bandwidth (32-64 KB/S)	Low Delay (160 ms)	Low Jittering (<50 ms)
3	Streaming Media	Moderate to High Bandwidth(<2MB /S)	N/A	Low Jittering(<100 ms)
4	Instant Messaging Web Browsing	Moderate Bandwidth(2MB/ S)	N/A	N/A
5	Media Content Download	High Bandwidth (10 MB/S)	N/A	N/A

QoS in GSM Network

QOS parameters in GSM network can be categorized in five phases during service use from the customer's point of view:

1. Network Availability: Probability that the mobile services are offered to a user.
2. Network Accessibility: The ability of a mobile network to set up and hold calls. The ability to successfully establish calls between two terminals on the same network or between a terminal on a mobile network and a terminal on the PSTN (Public Switched Telephone Network).
3. Service Accessibility: How successful is the service access (call setup rate and call setup time), if the user wants to use a service, the network operator should provide him as fast as possible access to the service.
4. Service Integrity: The Quality of Service during service use, and measures by:

a. Throughput: The sum of bytes that had been sent or received to the duration it took.
b. Overall Service Success: Tests percentage that have been successfully completed. It is calculated by excluding from the sum of tests the ones that failed either at the setup phase either they dropped.

5. Service Retain ability: Describe the termination of services and count the time that a service can retain (Drop Call Rate or call holding time). It measures by:

A. Download Time: The interval of time between the first and the last byte.
B. RTT (Round Trip Time): The interval of time between packets is sent and received.
C. Drop Rate: Tests percentage that failed and had already started normally.

6. Coverage (Signal levels): The test equipment used allowed us to measure the strength of the signal received by the mobile terminal. Measurements were taken on the control channel and therefore were not affected by frequency hopping and downlink power control algorithms.
7. Audio quality: Measured conversation perception for successful set up calls over a pre-determined period of time.

Results and Discussion

Table 2: Wimax Compare with GSM

	Wi MAX	GSM
Frequency Band	2-11GHZ	900MHz
Data Rates(Mbps)	75	14.4
Multiple Access	OFDMA	TDMA
Duplexing	FDD/TDD	FDD
Coverage	Mid	Large
Mobility	Portable	Full
Modulation	QPSK/QAM	MSK/GMSK
QOS	Reliable	Reliable
Cost	Mid	Low

In Table 2 there are general comparison between Wimax network and GSM network. From the table we find that the frequency band of Wimax network is wider than GSM network, but the coverage of GSM network larger than Wimax network. Most important characteristic of Wimax network its fast compare with GSM network.

Conclusion

The paper shows the difference between Wimax and GSM, and makes a comparison between them and Highlighted the quality of service in two different networks and parameters assigned to it. We concluded that the specific parameters for network performance varies depending on the type of network and application or service desired from the network, for example, in the Wimax network we found that the delay is the most important parameter of QoS and has been divided into several classes according to priority and how likely to delay application. In GSM networks we found that the availability of the network and the sound quality of the most important parameters of the specific QoS.

References

[1] Analysis of Quality of Service (QoS) in Wimax Networks-Rohit Talwalkar-Florida Atlantic University-Boca Raton, Florida-May, 2008.
[2] Survey on the Quality of Service of Mobile Networks- May 2000.
[3] "QoS in Cellular Networks", Dushyanth Balasub Romanian, Washington University in Saint Louis.
[4] Wimax and End-to-End QoS Support-Mohammad Abdul Awal and Lila Boukhatem-Univ. of Paris-Sud 11, CNRS-Bat 490, 91405 Orsay Cedex.- {awal, lila} @ lri.fr.
[5] QoS Support in WiMax Networks: Issues and Experimental Measurements.
[6] Introduction of GSM, UMTS & Wimax Technology.
[7] Radio Frequency Optimization & QoS Evaluation in Operational GSM Network-Bilal Haider, M. Zafrullah and M. K. Islam.