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Evaluation of Performance Ip-tv in Wimax Network

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Abstract -The future of television is undoubtedly internet Protocol Television(IPTV), given its ability to give users the ability to interact with the video they watched. The expansion of this new diffusion technique could be promoted using Worldwide Interoperability for Microwave Access (WiMax) technology to serve areas not accessible by wireline technologies. Then, with the discovery of new compression technique such as H.265 standard, it could operate on high-quality videos. This dissertation aimed to analyze and optimize IPTV performance using WiMax technology as an access support and the H.265 standard as compression standard, focusing on the choice of the more favorable buffer size. The results obtained in the simulations show that the buffer size customers WiMax stations to broadcast high-definition video must be greater than 256KB for proper reception of images component video, and to avoid poor visual quality.

Keywords - *WiMax, IPTV, H.264, H.265, OPNET, QoS.*

1. Introduction

We present our study on WiMax's ability to transmit high definition video streams, as well as its improvement, choosing the appropriate size buffer to ensure Quality of Service(QoS). First, OPNET or Optimum Network Performance is a simulator to model the operation of a network during the design phase. Designed and marketed by OPNET company, OPNET Modeler is used by many network engineering companies worldwide. The graphical interface and object-oriented modeling can reproduce the actual structure of the network and its components in order to stick to the intuitive reality. OPNET has three nested hierarchical levels: the network domain, the node domain and process domain.

2. Network Domain

This is the highest level of the hierarchy of OPNET. It defines the network topology by installing routers there, hosts, devices such as switches, IP clouds, etc ... interconnected by links. Each communication entity called "node" is fully configurable and is defined by its model.

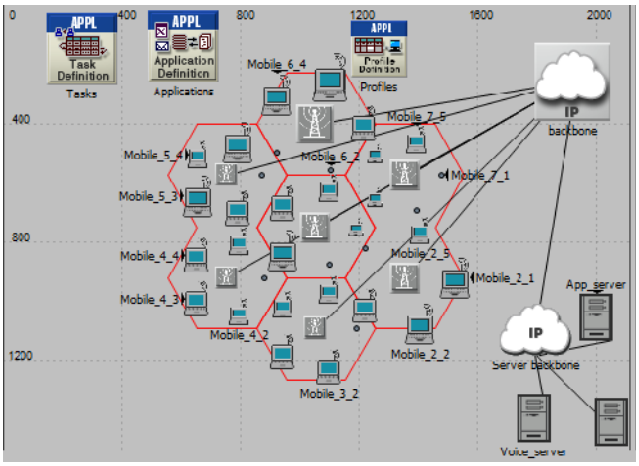

Fig.1The Domain network in OPNET

2.1 Node Domain

The Node domain defines the constitution of nodes (routers, workstations, hubs, etc...). The model is defined using blocks called modules.

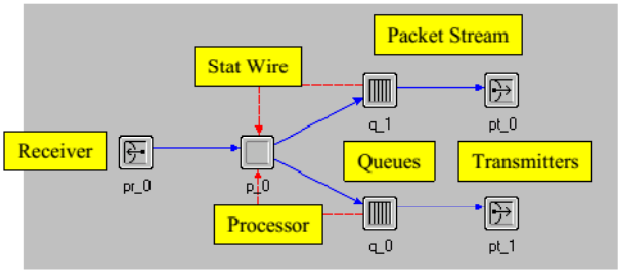

Fig 2. Node Domain in OPNET

Some modules are not programmable.It is mainly transmitters and receivers, whose sole function is to interface between the node and the links to which it is connected. The other modules are fully programmable: these are the processors and tails. The processors are modules that perform a specific task node they actually symbolize different parts of the operating system of a machine, and mainly the different network layers implemented in the node (Ethernet, IP ...). They can communicate with each other via "streams packets" (packet flow), which allow a packet to transit from one layer to another within the same machine. This organization provides a clear view of the stack of protocols implemented in a node, and quicken their interactions.

The "statistic wires" are the second type of links allowing communication between modules. As their name says, they can trace statistics information from one module to another, such as the size and timing of the tails of the transmitters.

2.2 Process Domain

It is here that we define the role of each programmable module. A module has a default primary process, which can add process and performs a specific sub-task. OPNET provides mechanisms to all processes created within a process to communicate with each domain via a shared memory block, or scheduling software interrupts.

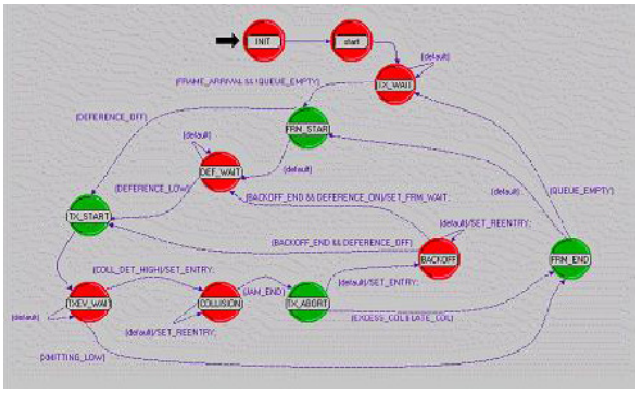

Fig 3.Process Domain in OPNET

The role of a module is determined by its process model, which is described as a finite state. Each block represents a different state, wherein the machine executes a specific code. The transitions are represented by connections between blocks and determined by conditions (interruptions, variable having a certain value, etc. ...) The actions to be taken are written in C language, and OPNET provides a library of more than 400 proprietary features specific to the use of networks (creation, sending and receiving packets, and extracting values in the different fields of a header ...)

2.3 Other Settings

In addition to the hierarchy shown above, OPNET manages two other types of objects related to the networks: links and packet formats.

Links Dozens of models are provided (e.g. a model 100Mpbs Ethernet link, anAsynchronous Transfer Mode(ATM) link pattern, etc ...) but it is quite possible to create a new model for use with the developed nodes for simulation. It is then set, for example, the flow rate of the link, the supported packet type, the type of errors generated, etc.

The last important aspect in the construction of a model is the frame type on the network. OPNET provides standard model of most of the known headers, immediately usable in the Process Domain. However, in the case of developing a new protocol, the creation of a new packet format is required. We can then use the packet editor, and define the size, position and type of data in each field.

2.4 Simulation in OPNET

OPNET standard provides an impressive list of node implementations such as routers, workstation, and switch. Thus, modeling and simulation in OPNET can be done in two ways:

- Using pre-model in the library range of OPNET
- Self-programming the following components in hierarchical order

The latter is obviously more complex than the first, and requires good knowledge of programming and networks. However it is essential in the case testing a new algorithm. The simulations are based on the first method.

3 Managing Service Quality

The concept of Quality of Service describes, in encrypted form, the level of performance that users expect from the network. The content of this concept obviously depends on the proposed service. Thus, he has the service response time requirements; what its sensitivity to transmission errors is, etc…. Managing service quality is the process that determines the bandwidth allocation and examination of subscriber stations on the status of their queue. In the 802.16 standard, different types of services that we saw in the previous paragraph are used.

4. QoS Parameters taken into Account

In this study, as in the transmission of video, we will evaluate the quality of the network through different metrics such as latency (delay), jitter and packet loss rate.

4.1 Deadline

It characterizes the time interval between the transmission and reception of a packet. The time includes propagation delay, transmission delay, the waiting time in the queue, and the processing time in the intermediate equipment networks. The delay constraint in terms of QoS varies from Internet applications. The figure shows ... a recommendation from the international Telecommunication Union(ITU) in terms of delay and jitter for real-time applications such as video.

4.2 Jitter

This is a short-term variation in the arrival times of the packets, usually caused by network congestion or server. Therefore, the delivery times for packages are certainly not the same. This phenomenon led to the synchronization problem, such as packets of voice or video should have happened in a certain order. To compensate the variation of the delay, the receiver often uses buffers to synchronize the arriving packet. However, this synchronization mechanism lengthens the delivery time.

Table 01: Delay and jitter recommended by the ITU-T

METRIC	Acceptable value
Latency	<150ms Max 250ms
Gigue	0ms:excelente 75ms: good 125ms:acceptable 225ms: worst

4.3 Packet Loss

It is either not receiving a packet, or receiving an erroneous packet. It may have multiple reasons: bandwidth limitations, network congestion, failed links and transmission errors

5. Implementing Simulation in OPNET

5.1 Overview of the Simulation

The simulation will focus on sending high definition video stream from a server, to cross an IP core network, and get into a WiMax base station that it will issue multiple subscriber station.

Our goal is to evaluate the performance of IPTV on WiMax networks, and propose solutions to any problem encountered. For this, our analysis will be done according to certain criteria directly related to QoS as already stated above. We also assess the impacts of the buffer size on the subscriber stations at receptions of high definition video streams.

5.2 Scenarios

The simulation will include three scenarios occurring in the same way, that is to say, sending the video stream from the server to the subscriber stations, but with different buffer size. In the first, the buffer size is 64KB, while in the second it will be 128KB; and in the third, it will be set at 256KB.

5.3 Simulation Model

As illustrated in figure ... our simulation uses 3 types of equipment:

- A server that is in charge of providing the video to different customers.
- A base station
- Stations of subscribers, for the client access to IPTV services.

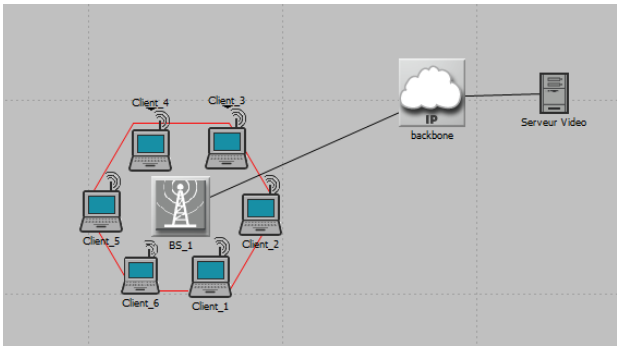

Fig.4: Model Simulation

5.4 Configuration of Devices and Applications

Throughout the simulation which follows, we will focus on the performance of the WiMax MAC layer to deliver high definition video streams, regardless of the constraints to the levels of the PHY layer. For this, we will use WiMax in its best performance, where the modulation used is the 64-QAM and without mobility.

5.4.1 Access Technique

Not taking into account the effects of the physical environment, such as fainting in free space, multipath, etc ..., we selected "Framing Module Enabled" as the value of the attribute "Efficiency Mode" of Wimax_Config node.

However, we will use the profile OFDMA proposed by default on OPNET as technical network access. This profile uses 2048 sub-channels with TDD technique. The duration of a symbol is 100.8 microseconds. OFDMA this profile, as well as the choice of the simulation environment shown in FIG 5.

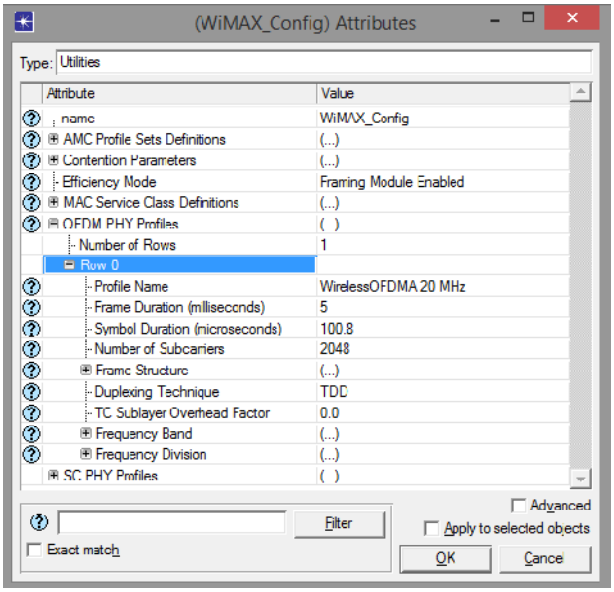

Fig.5: Profile OFDMA Efficiency and choice of fashion

5.4.2 Class of Service

To ensure a better QoS, the selected service class is the rtPS with a minimum flow of reserved 1Mbps, a maximum throughput of 10Mbps and a maximum delay of 150ms. Fig 6

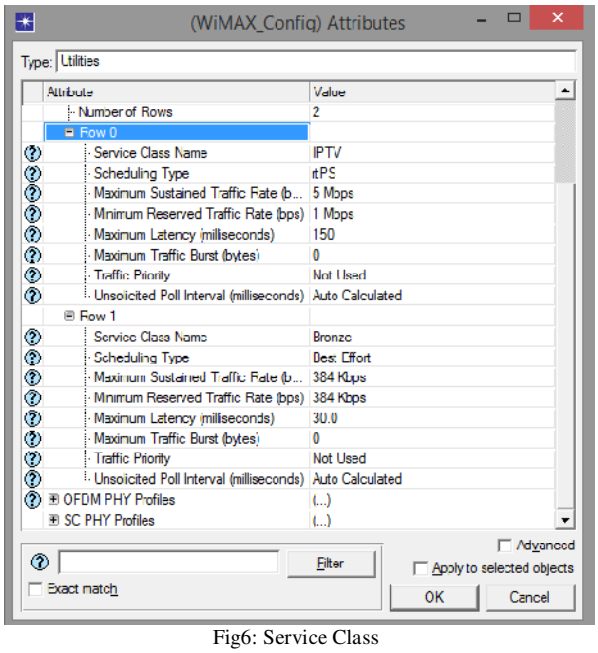

Fig6: Service Class

5.5 Interpretation of the Simulation Results

5.5.1 Traffic Sent During Simulation

Traffic sent during the simulation is shown in figure .... We see on this graph that the size of the video stream data packets is variable. This is due to the difference in size of each image constituting the video.

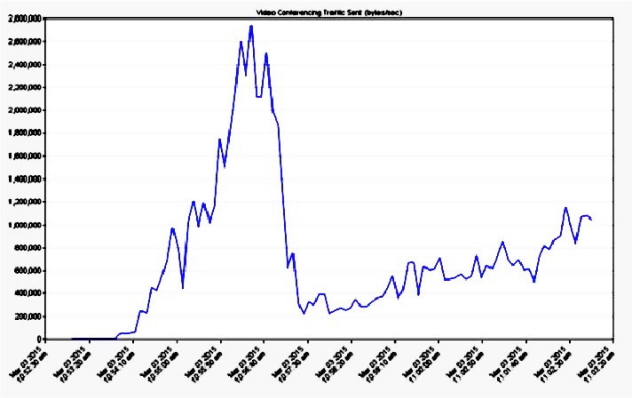

Fig7: Traffic sent during simulation

5.5.2 Packet Loss

The figure shows a comparison of packets received and those sent during the simulation.

- For the scenario "buffer 64KB" an average loss of 10paquets / sec for a period of time that lasts 120s from 10:55:00 is observed. This is due by the considerable increase in traffic received, which causes the buffer to overflow. Hence, packets arriving at the input of the buffer will be rejected. This loss could cause a deterioration of the displayed video, especially if these packets carry an image.
- For the scenario "128KB buffer" packet loss is reduced to an average of 3paquets / second during the same time interval than the previous one.
- For the scenario "256KB buffer", there is almost no packet loss.

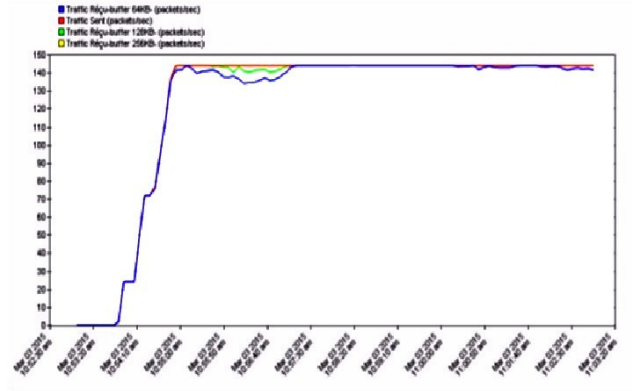

Fig8: Comparison of numbers of packets received per second

5.5.3 Deadline

The transmission time for each scenario is illustrated in figure ..., where one can see that there is an increase with the size of the buffer. This is due to the presence of several packages on hold in the latter. Larger the size, the more there will be queued packets.

However, time is still satisfactory with a 256KB buffer, since the latter has an average of a few milliseconds (more specifically less than 7ms). Fig 9.

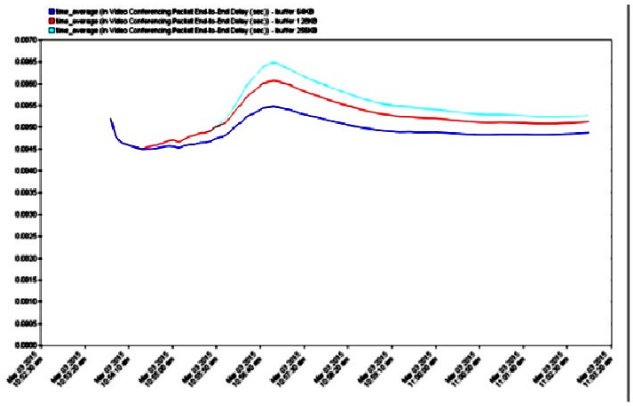

Fig9: Comparison of transfer times

5.5.4 jitter

As shown in figure ., jitter also increases with the size of the buffer. This is because of the packet queuing variation in the buffer. This variation may be material as far as the buffer size is.

The jitter at the scenario "256KB" has an average time of less than 50 microseconds, which remains satisfactory for the transmission of video. Fig10

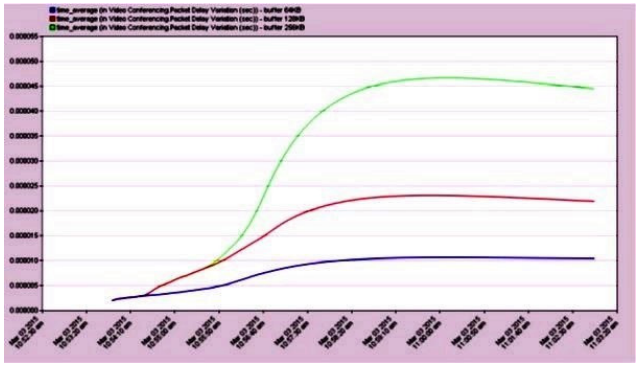

Fig10: Comparison of delay variation (jitter)

6. Conclusions

The choice of the buffer size during Video transmission with WiMax is crucial to ensure a desired QoS. A large buffer size might lead to increased delay and jitter. A sufficient size could be the cause of a packet loss which would harm the quality of the video. The result of this study allowed us to look at the size of 256KB buffer at a high definition video transmission, since it avoids considerable loss of packets with duration and satisfactory jitter.

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