ISSN: 2278 - 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering
Vol. 1, Issue 5, November 2012

Performance analysis of ANESAT Protocol for FTP, FTP generic, VBR and CBR over Satellite Communication

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Abstract: Satellite communication plays a vital role in global communication where we use artificial satellites to communicate amongst various earth stations. They are used for both analogue and digital communication for carrying voice, video and data to and from various locations. In this paper, we have created a scenario where devices communicate with satellites using ANESAT protocol for different applications like FTP, FTP generic, CBR and VBR etc and analyzed the performance of the scenario in terms of throughput, total bytes sent and received from the server to the client. We have used qualnet network simulator for simulation and analysis.

Keywords: ANESAT, CBR, FTP, LAN

I. INTRODUCTION

A satellite [1-4] is a physical object which revolves around a heavenly body due to its gravitational pull. It may be natural or artificial e.g. the moon is a natural satellite revolving around the Earth whereas INSAT (launched by USSR) is an artificial satellite. An artificial satellite is launched mainly to gather information about various locations on Earth and put it into use.

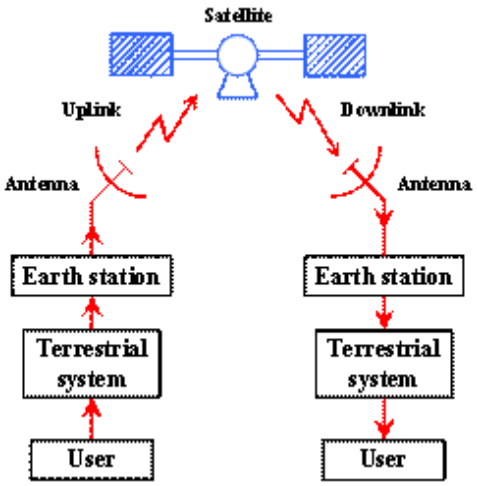

Figure 1. Block diagram of satellite communication

The basic block diagram of the satellite communication as shown above is described below:

The user sends a request by generating baseband signals which is carried to the Earth station via a dedicated link or a Terrestrial system. Here, the signal gets processed and converted to the uplink frequency and transmitted to the Satellite by the means of dish antennae. The satellite gathers the information and converts it into a downlink frequency which is received by the Earth station through a parabolic dish antenna where it is processed into a baseband signal so as to be sent to the user.

A satellite communication system works at the microwave frequency range of 1GHz to 50GHz.

This paper is organized as follows: Section I gives the Introduction to satellite Communication. Section II is important to understand the technologies and protocols used in this paper. Section III shows the simulation structures upon which the analysis

was done. Section IV shows the results of the simulation of the scenarios using FTP, FTP Generic, CBR and VBR. Section V gives the conclusion to the analysis. Section VI gives the list of references which helped us to proceed in our paper.

II. OVERVIEW

A. Abstract Network Equation – Satellite (ANESAT) Model

A system [5] consists of a singular or plural subnets operating across a bidirectional set of channels. Each subnet has a single downstream or forward link and a number of upstream links. Each downstream link working on TDMA is based on the priority dequeuing from the Network layer. Each subnet has a satellite or a ground station as a head-end and multiple client terminals. The head-end controls the usage of the upstream and downstream channels. Each upstream contains a shared set of data which may be grouped if two or more subnets wish to share their channels. A traffic conditioner is also used to limit the amount of traffic being transmitted regardless of the available rate. This traffic conditioner is connected to all nodes in the subnet. The network layer processes the information packets at all terminals. Additional queuing disciplines such as Strict Priority Queuing and Weighted Fair Queuing may be imposed at the client terminal model. Implemented Features in it are:

- Both bent-pipe and processing payload functionality.
- An advanced DAMA for the satellite models
- 80x speed up on models
- A high performance scheduler for QualNet

B. 802.11b Technology

802.11b technology is an IEEE standard for wireless LAN networks (WIFI networks) which uses a 2.4GHz radio frequency range. Using this technology a router is able to send radio signals to other computers/electronic devices. The other devices must have a WIFI card with the ability to send and receive 802.11b signals.

Its features include:

- Speed: It can transfer data at a rate of almost 11Mbps.
- Range: Extends over 50m (150 feet). However range can vary depending on the structure of buildings.
- Clarity: Since it operates at a comparatively lower frequency, the signals are clear and can even move through walls and other obstacles.
- Price: The network can be setup at a reasonable cost.
- Interference: The signals can interfere with frequencies of other home appliances cordless telephones, microwave ovens, garage door openers, and baby monitors which is regarded as a disadvantage of this technology.
- Better upcoming technologies: Although comparable to traditional Ethernet (10 Mbps), it performs significantly slower than newer Wi-Fi and Ethernet technologies including 802.11g and Fast Ethernet.

C. File Transfer Protocol

File Transfer Protocol (FTP) is a standard Internet protocol for transmitting files between computers on the Internet. FTP is commonly used to transfer Web page files from their creator to the computer that acts as their server for everyone on the Internet. It's also commonly used to download programs and other files to your computer from other servers. FTP is built on a client-server architecture and uses separate control and data connections between the client and the server. FTP users may authenticate themselves using a clear-text sign-in protocol, normally in the form of a username and password, but can connect anonymously if the server is configured to allow it. FTP support is usually provided as part of a suite of programs that come with TCP/IP.

The first FTP client applications were interactive command-line tools, implementing standard commands and syntax. Graphical user interfaces have since been developed for many of the popular desktop operating systems in use today, including general web design programs like Microsoft Expression Web, and specialist FTP clients such as CuteFTP.

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D. Constant Bit Rate

Constant Bit Rate is an encoding method where the bitrate used doesn't fluctuate. It means that the rate at which a codec's output data should be consumed is constant. CBR is useful for streaming multimedia content on limited capacity channels since it is the maximum bit rate that matters, not the average, so CBR would be used to take advantage of all of the capacity. CBR would not be the optimal choice for storage as it would not allocate enough data for complex sections (resulting in degraded quality) while wasting data on simple sections. CBR processes audio faster than VBR due to its fixed bit rate value. The downside to a fixed bit rate is that the files that are produced are not as optimized for quality vs. storage as VBR. For example, if there is a quiet section in a music track that doesn't require the full bit rate to produce good quality sound then CBR still uses the same value - thus wasting storage space. The same is true for a complex sounds; if the bit rate is too low then quality will suffer.

Most coding schemes such as Huffman coding produce variable-length codes which make perfect CBR difficult to achieve. This is partly solved by varying the quantization and fully solved by the use of padding. (However, CBR is implied in a simple scheme like reducing all 16-bit audio samples to 8 bits.)

E. Variable Bit Rate

Variable Bit Rate is an encoding method in which the bit rate changes continuously during the encoding process depending on the nature of the audio. VBR files vary the amount of output data per time segment. It is designed to achieve a better sound quality vs. file size ratio than CBR (Constant Bit Rate) encoding. For example, if there is silence to be encoded then the bit rate is lowered to optimize the file size. In contrast, if the audio to be played contains a complex mix of frequencies then the bit rate is increased to give good sound quality.

It allows a higher bitrate (and therefore more storage space) to be allocated to the more complex segments of media files while less space is allocated to less complex segments. Using the VBR encoding method will produce an audio file that will have variable bit rates from 128Kbps to 320Kbps depending on the complexity of the audio frequencies.

MP3, WMA and AAC audio files can optionally be encoded in VBR. Variable bit rate encoding is also commonly used on MPEG-2 video, Xvid, DivX, etc., MPEG-4 Part 10/H.264 video, Dirac and other video compression formats.

III. SENARIO DESIGNED

We have designed a scenario for inter satellite communication network consisting of 30 users or base stations under 2 satellites. There is a wireless link between base stations and satellite we have a wired link between two satellite for ensuring reliability and security as wired connection have better performance in this respect as compared to wireless media to stimulate lossless environment in free space. The application that is running between nodes is File Transfer Protocol (Figure 2), File Transfer Protocol Generic (Figure 3), Constant Bit Rate (Figure 4) and Variable Bit Rate (Figure 5). The Throughput is analyzed for each application for ANESAT [5] protocol to know how it performs for these applications in a given scenario and environment figure 2-5 show various scenarios designed.

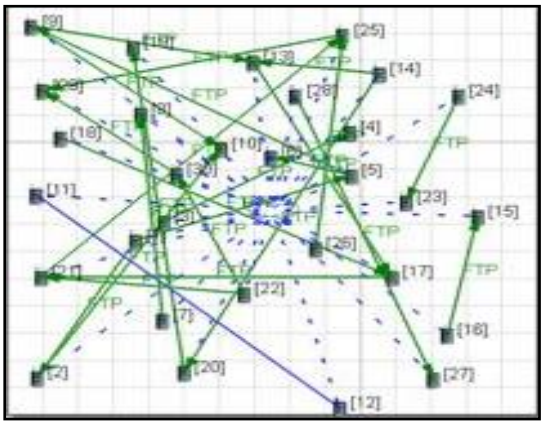

Figure 2. Scenario designed for FTP application

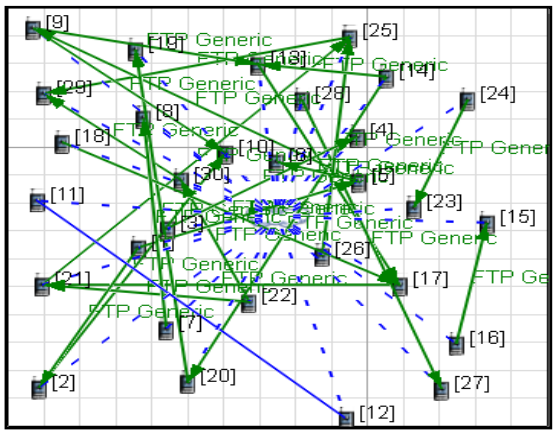

Figure 3. Scenario designed for FTP Generic application

ISSN: 2278 - 8875

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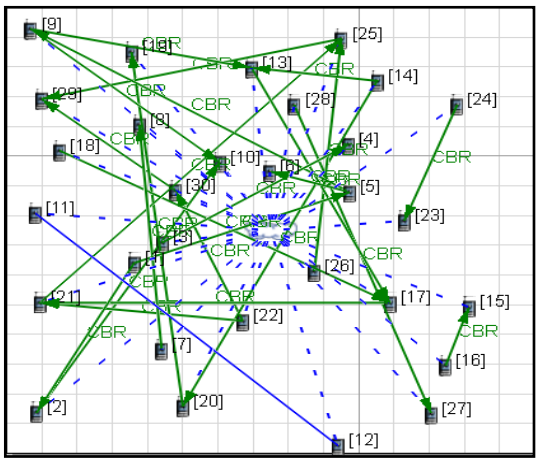


Figure 3. Scenario designed for CBR application

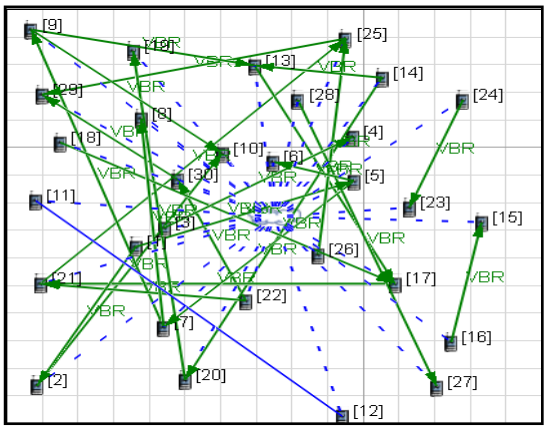
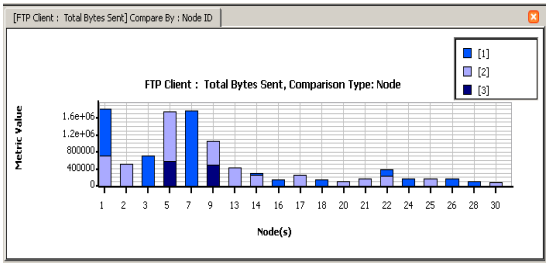


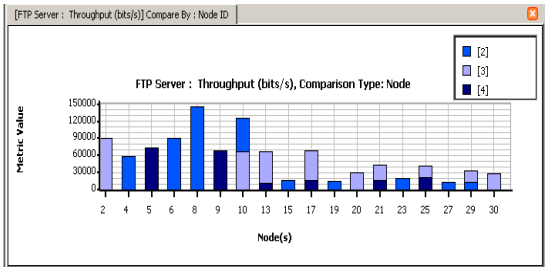
Figure 4. Scenario designed for VBR application

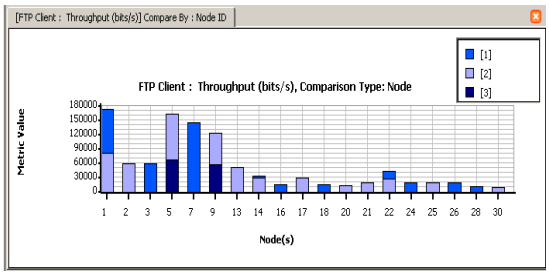
IV. EXPERIMENTAL RESULTS

A. FTP

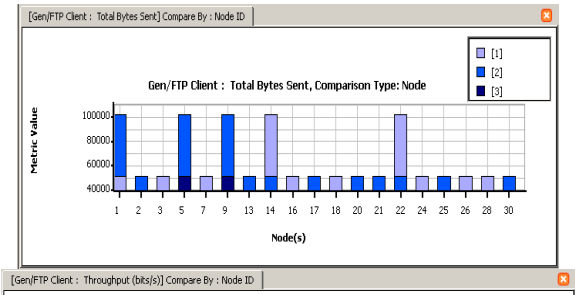
B.

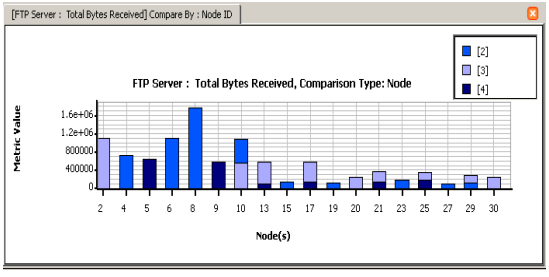


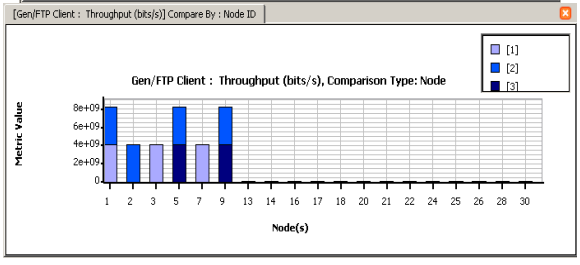




C. FTP Gen







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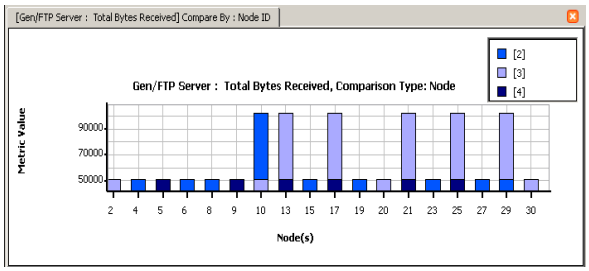
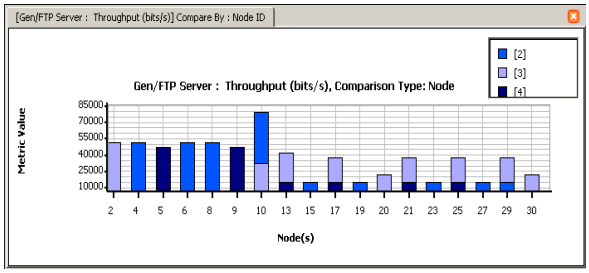
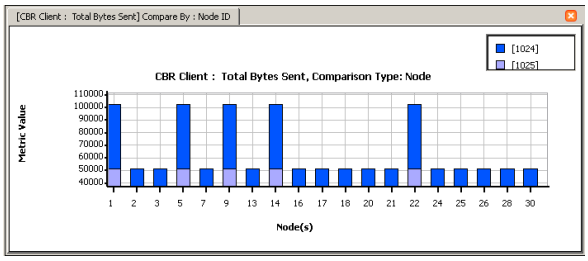
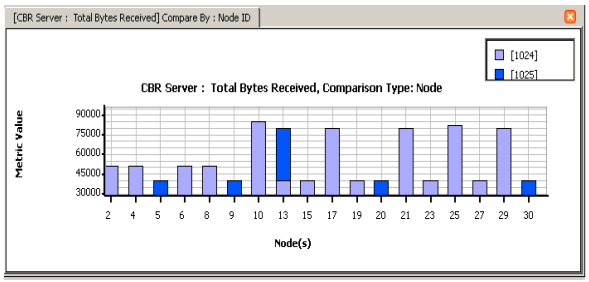
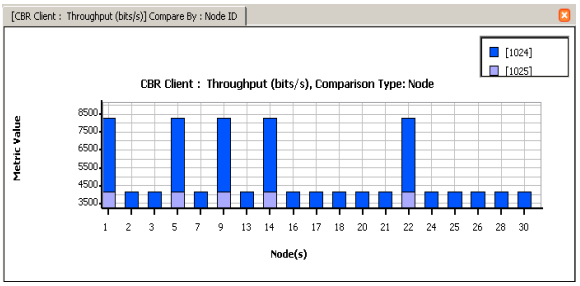




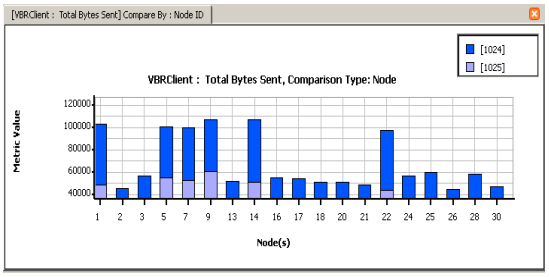
D. *CBR*

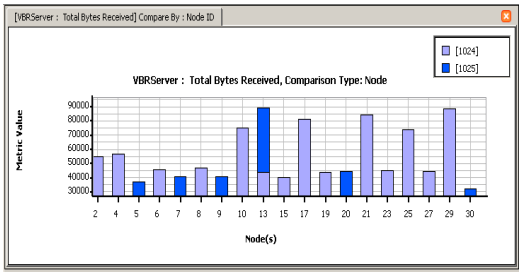






E. *VBR*





V. CONCLUSION

We have created a scenario where devices communicate with satellites using ANESAT protocol for different applications like FTP, FTP generic, CBR and VBR etc and analyzed the performance of the scenario in terms of throughput, total bytes sent and received from the server to the client. On analyzing the results obtained the performance of the system is better for FTP then FTP generic then for CBR and least for VBR on basis of bytes received and overall throughput. We have analyzed ANESAT protocol for satellite communication for various applications like FTP, FTP generic, CBR, VBR on basis of throughput and bytes received in future we can compare the performance of other satellite protocols for some other applications also.

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