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# Analysis and comparison of video streaming by varying protocols

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**Abstract: -** WiMax (IEEE 802.16) belongs to a family of wireless communication for broadband wireless access (BWA) network with advancement in technology. Multicast and broadcast service of transportable Wireless is the fastest growing technology in the past few years, because it provides the multimedia content to big range users in a cost efficient method. The high speed Wireless networks have completed it possible to provide real time multimedia streaming. The requirement for portable Multimedia streams has been increasing in the earlier period few years. Multimedia streams can be transported to mobile mechanisms over a variety of WiMax networks, include 3G, Wi-Fi etc. The major purpose is to execute video streaming over WiMax. Video buffering is the major problem occurs during online playing so an improved method is used to enhance the QOS of video which doesn't loss the video quality after compression of video's size. The purposes approved out for the multicast video streaming WiMax is the system concern to carry out its sub stream configuration of video stream. Performance estimate comparison for the existing process is analyzed and its relative assertion is tabularized. The original thought is intended for improving performance metrics such as packet delivery ratio, throughput, average delay, energy and frame lost ratio to manage Quality of Service in WiMax networks using NS-2.35.. Multicast routing protocol PUMA, RTP, RTCP is used to attain scalability in the network. The Wireless patch of NIST forum is used to carry out the simulations.

**Keywords: -** WiMax, video streaming, NP-Complete, MPEG, HD, NS-2.

## I. INTRODUCTION

The internet is worldwide system for inter connection of computer systems using internet protocol. The internet carriers an extensive range of information resources and services such a documentation, videos, e-mail, telephony and file sharing. There are different medias available on internet connection such as with cables, Bluetooth, Wi-Fi and WiMax. WiMax internet accesses for subscribers support various network services. One of these multicast and broadcast service which can be used for multimedia traffic delivers to large- scale users.

WiMax provides wide area coverage and quality of service capabilities for applications ranging from real time delay-sensitive and voice-over-IP (VoIP) to real time streaming video and non real time downloads [1]. Mentioned that the streaming video over an MBS is more efficient in terms of resource management by focusing on a certain area and ensuring high bit rate that results in a higher quality service [5].

## II. WiMax Network Architecture

The architecture of a sensor node is shown in Figure 1. A WiMax node consists of four major components:

I. Sensing unit
II. Processing unit
III. Transceiver unit
IV. Power unit

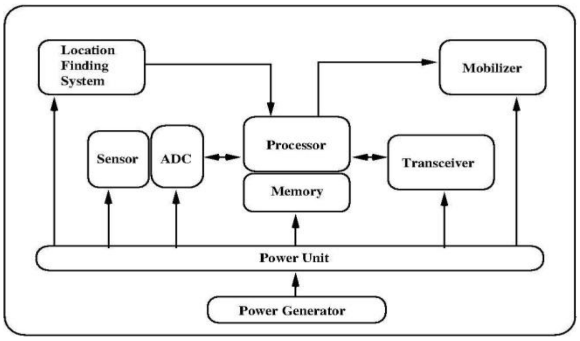


**Figure 1:** WiMax architecture

A sensor have a global positioning system (GPS) and mobilize for localization and static respectively. Network generates analog signal of sensed data, which is converted to digital signal by means of analog-to-digital converter (ADC), and is transmitted to the processing unit. The processing unit has an embedded micro-controller that performs the computing job. Transceiver unit is responsible for data transmission. Power unit manages the power supply to all other components.

## III. Routing protocol

A routing protocol specifies how routers communicate with each other, distributing information that enables them to select routes between any two nodes on a computer network. A routing protocol shares this information first among immediate neighbors, and then throughout the network.

Real time routing protocols are used in IP for real time traffic. Real time routing discovers an optimum route from source to destination which meets the real time constraints. Timely and reliable data delivery is very important for positive results as out-dated data may lead to disaster effects.

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Designing a network protocol to support streaming media raises many issues. Datagram protocols, consisting of the User Datagram Protocol (UDP), send the small packets of media circulate as a series. This is simple and efficient; but, there's no mechanism in the protocol to guarantee delivery. It's miles as much as the receiving software to locate loss or corruption and recover facts the usage of errors correction techniques. If records are lost, the movement may additionally suffer a dropout. The real-time transport Protocol (RTP), the real-time control Protocol (RTCP) and PUMA have been in particular designed to move media over networks.

### 3.1 Real-time Transport Protocol

The real time media that is being transferred 'RTP Payload'. RTP header contains information related to the payload e.g. the source, size, encoding type etc. However the RTP packet can't be transferred as it is over the network. For transferring, transfer protocol called UDP is used. To transfer the UDP packet over the IP network, encapsulation is done with an IP packet. To transfer the IP packet over the physical network even the IP packet is sent within other packets. Those are not shown here.

| | | | |
|---|---|---|---|
| IP Header | UDP Header | RTP Header | RTP Payload |

**Figure 2: Real-time transport protocol**

### 3.2 Real-time Control Protocol

A real- time control protocol (RTCP) gives out-of-band facts and control facts for an RTP session. It companions with RTP in the delivery and packaging of multimedia facts; however does no longer delivery of media data itself.

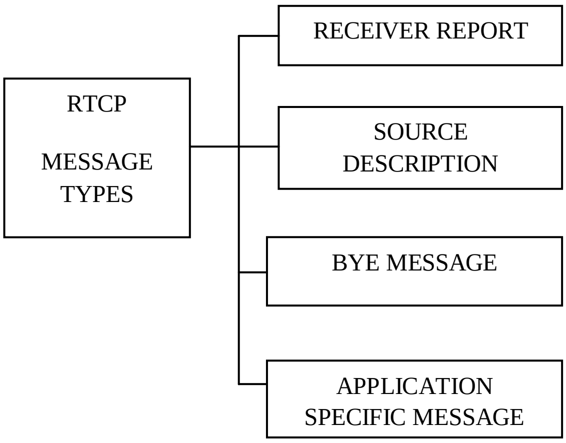


**Figure 3:** RTCP Message type

The primary function of RTCP is to provide comments on the QoS in media distribution by periodically sending information data to participants in a streaming multimedia session.

#### 3.2.1 Sender document (SR)

The sender report consists of an absolute timestamp. Absolutely the timestamp allows the receiver to synchronize RTP messages.

#### 3.2.2 Receiver record (RR)

The receiver file is for proactive contributors, the ones that do not send RTP packets.

#### 3.2.3 Source description (SDES)

The source Description message is used to send the CNAME item to discussion participants.

#### 3.2.4 Good-Bye (BYE)

The fact that other resources can detect the absence of a source, this message is a detect statement. It is also beneficial to a media mixer.

#### 3.2.5 Application-precise message (APP)

The utility-precise message affords a mechanism to design application-precise extensions to the RTCP protocol.

### 3.3 PUMA

PUMA helps any source to send multicast packets addressed to a given multicast organization. PUMA does not want some other unicast routing protocol due to the fact it is able to act as unicast protocol. Channel Manager: the role of the channel manager is to assign available channels to wireless links to satisfy a performance goal Layer Control Plane, Data Plane, Constraint Solver, Channel Manager, Declarative Networking Engine Routing Protocols, Channel Selection Protocol, Constraints and Goals, Forwarding Agent Network, Network Layer Status.

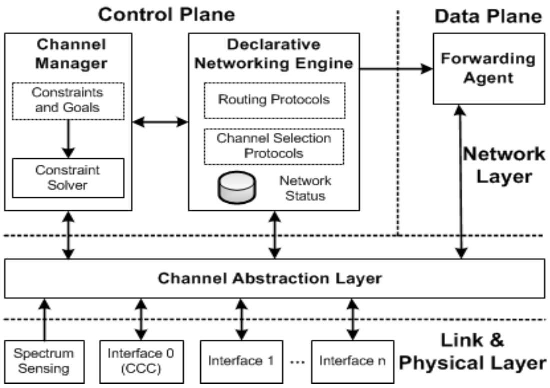


**Figure 4:** PUMA

The channel manager takes as additional input network status information, which includes network topology and the set of channels available to each node. Declarative Networking Engine: At the network layer, the Rapid Net declarative networking engine is deployed within the control plane to implement a variety of neighbor discovery and routing protocols. Each PUMA node runs a number of multi-channel wireless radio devices (interfaces). Typically, the first interface operates on the common control channel (CCC), reserved solely for routing and channel selection protocol messages.

## IV. IMPORTANT OVERVIEWS

### 4.1 Video Streaming

Streaming multimedia permits the person to begin viewing video clips stored on server, without first downloading the complete file. After a sudden duration of initializing and buffering, the document will begin to exchange. Streaming video is normally sent from pre recorded video files, but may be disbursed as a part of a live broadcast "feed". In a stay broadcast the video signal is converted into a compressed virtual sign and transmitted from a unique internet server. It is capable of do multicast sending, the same report to multiple users on the same time. Buffering is ones system downloading the video faster than it performs [11] which raises a problem called NP-complete.

### 4.2 NP-complete

NP-complete problems are in NP, the set of all decision problems whose solutions can be verified in polynomial time; NP may be equivalently defined 1. as the set of decision problems that can be solved in polynomial time on a non-deterministic Turing machine. A problem p in NP is NP-complete if every other problem in NP can be transformed (or reduced) into p in polynomial time.

NP-complete problems are studied because the ability to quickly verify solutions to a problem (NP) seems to correlate with the ability to quickly solve that problem (P). It is not known whether every problem in NP can be quickly solved this is called the P versus NP problem. But if any NP-complete problem can be solved quickly, then every problem in NP can, because the definition of an NP-complete problem states that every problem in NP must be quickly reducible to every NP-complete problem (that is, it can be reduced in polynomial time). Because of this, it is often said that NP-complete problems are harder or more difficult than NP problems in general.

A decision problem is NP-complete if:

1. C is in NP
2. Every problem in NP is reducible to C in polynomial time.

C can be shown to be in NP by demonstrating that a candidate solution.

### 4.3 Energy Efficient Video Streaming

Consider a scenario where the stream data transmission can be scheduled to provide better energy efficiency at mobile subscribers. Significant research studies have been dedicated for energy management at mobile subscribers utilizing the sleep mode feature. When the device is idle, sleep mode will be activated so as to minimize the energy consumption by using the minimal energy to maintain the running system.

However, frequent switching from sleep mode to normal mode can result in excessive energy consumption. If a mobile station switches back and forth regardless of the amount of data to be received, unnecessary energy could be wasted. This effect is more severe when the mobile subscriber is watching a streaming video because video decoding and screen lighting already consume a lot of energy.

### 4.4 Process of Video Streaming

**1. Video compression: -** Raw video need to be compressed before transmission to acquit performance. Video compression schemes may be labeled into two categories: scalable and non-scalable video coding. Scalable video is capable of gracefully handling the bandwidth fluctuations inside the internet

**2. Utility-layer QoS control: -** To provide scope with various community conditions and individual presentation fine requested through the users, diverse utility-layer QoS manipulate techniques had been proposed. The application-layer strategies include congestion manage and mistakes manipulate. Their respective capabilities are as follows, Congestion control is employed to save you packet loss and reduce postpone. Blunders manage, alternatively, is to improve video presentation first-class inside the presence of packet loss. Mistakes control mechanisms include ahead mistakes correction (FEC), retransmission, and errors-resilient encoding and errors concealment.

**3. Non-stop media distribution services: -** To be able to offer fine multimedia presentations, ok internet work aid is important. That is due to the fact network guide can lessen delivery postpone and packet loss ratio. Constructed on the top of the net (IP protocol), continuous media distribution services are capable of achieve QoS and efficiency for streaming video/audio over the exceptional attempt. Non-stop media distribution offerings consist of network changing, software-level multicast, and content replication.

**4. Streaming servers: -** Streaming servers play a key function in providing streaming services. To over nice streaming offerings, streaming servers are required to manner multimedia information base timing constraints and aid interactive manage

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operations together with pause/resume, fast forward and rapid backward. Moreover, streaming servers need to retrieve media additives in a synchronous style. A streaming server generally consists of 3 subsystems, specifically, a communicator (e.g., shipping protocols), a running gadget, and a storage gadget.

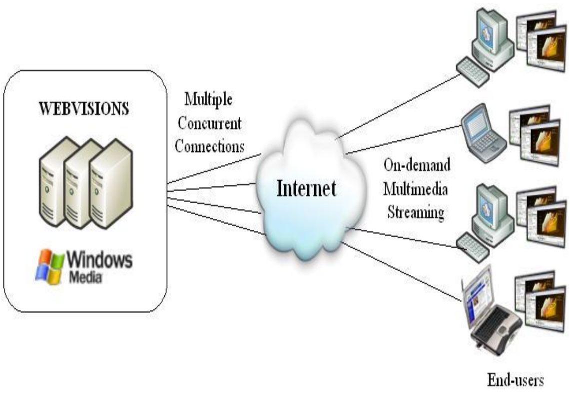


**Figure 5** Streamline Media

**5. Media synchronization mechanisms: -** media synchronization is a main characteristic that distinguishes multimedia programs from other traditional statistics applications. With media synchronization mechanisms, the software at the receiver aspect can gift numerous media streams within the identical manner at the start captured. An example of media synchronization is that the actions of a speaker's mouth suit the performed-out audio.

## V. VIDEO FORMAT

There are two types of video we are using in this paper.

1. MPEG

2. HD video

MPEG stands for "Moving Picture Experts Group." The MPEG organization, which works among the International Organization for Standardization (ISO) and IEC the International Electro technical Commission, develops standards designed for digital audio and video compression. The set frequently works to expand more efficient methods to digitally compress and maintain audio and video documents. This is why various movies at the net, which includes movie trailers and song motion pictures, exist within the MPEG format.

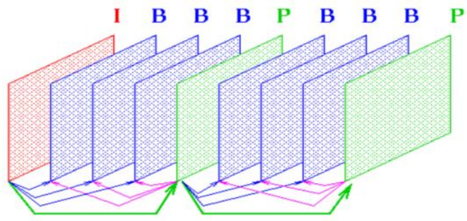


**Figure 6.** Frame Coding Techniques

→ Forward prediction of P frames

→ Forward prediction of B frames

→ Backward prediction of B frames

## VI. SIMULATION ENVIRONMENT

Network simulator (Version 2.35), wide referred to as NS-2, is just a discrete event driven network simulation tool for studying the dynamic nature of communication networks. It's an open source solution built in C++ and Otcl programming languages. NS-2 provides extremely modular Platform for wired and wireless simulations supporting totally different network component, protocol (e.g., routing algorithms, TCP, UDP, and FTP), traffic, and routing types. In general, NS-2 provides users with the simplest way of specifying network protocols and simulating their corresponding behaviors and result of the simulation is provided within a trace file that contains all occurred events.

An overview of how a simulation is performed in NS-2 from the user input, within the OTCL script, to processing; the user creates node movement and traffic generation files. A TCL script is used to bridge the OTCL script created by the user with the C++ code resident within the NS-2 simulator to perform the simulation.

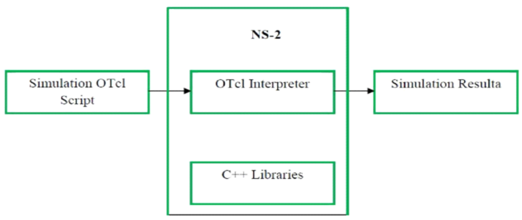


**Figure 7.** Some component explain below

This simulation consists, WiMax Scenario for NS-2 and different routing protocols with the use of different performance matrices like Packet Delivery Ratio, End to End delay, Residual Energy and Throughput. The work uses two types of video formats: MP4 and HD (High Definition). Video sizes are as follows:

1. MP4: 400MB and 154MB
2. HD: 343MB and 172MB

## VII. SIMULATION PARAMETER

The simulation compares performance of WiMax network in MP4 and HD.

**Table 1: Simulation Parameter**

| | |
|---|---|
| Simulation tool | Network simulator-2.35 |
| IEEE scenario | Wireless(802.11) |
| Mobility model | Two ray ground |
| Number of nodes | 20,60,100,150,200,250,300 |
| Node movement speed | 10m/sec,28m/sec. |
| Traffic type | UDP |
| Antenna | Omni direction antenna |
| MAC Layer | IEEE 802.11 |
| Routing Protocols | RTP,RTCP,PUMA |
| Queue limit | 50 packet |
| Simulation area(in meter) | 2000*2000 |
| Queue type | Drop-tail |

## VIII. PERFORMANCE METRICS

Performance metric concludes project behavior and performance. It specifies that how many times an event occurs, period of time interval and size of a few parameters. It is use to evaluate project activities and performance. Before explaining performance metrics, it is reminded that the research focuses only on data transmission, and the metrics calculate their features with respect to data packets. The details of simulation parameters are as follows:

- Packet Delivery Ratio
- Throughput
- End to End Delay
- Residual Energy

### Packet Delivery Ratio

This is the fraction of the data packets received by the destination to those sent by the source. This classifies the ability of the protocol to discover routes. The greater value of packet delivery ratio means the better performance of the protocol.

**Packet delivery ratio= ∑ Number of packet receive / ∑ Number of packet send**

This is the defined of the data packets generated by the TCP source to those delivered to the destination.

### Throughput

Throughput is defined as the number of packet flowing through the channel at a particular instant of time. This performance metric signifies that the average rate at which the data packet is delivered successfully from source node to destination node over a communication network is known as throughput.

**Throughput= N/1000**

Where N is the number of bits received successfully by all destinations.

### End to End Delay

This is the average delay between the sending of the data packet by the source and its receipt at the corresponding receiver. This includes all the delays caused during route acquisition, buffering and processing at intermediate nodes.

$$\text{End to end delay} = \frac{\text{Sum of the time spent to deliver packets for each destination}}{\text{Number of packet received by the all destination nodes}}$$

This is the average delay between the sending of the data packet by the CBR source and its receipt at the corresponding CBR receiver

### Residual Energy

It is the total amount of remaining energy by the nodes after the completion of Communication or simulation. If a node is having 100% energy initially and having 70% energy after the simulation than the energy consumption by that node is 30%.The unit of it will be in Joules.

## IX. SIMULATION RESULTS

### 1. Result of MP4 Video size 400MB

**Simulation of PDR MP4 Video size 400 MB**

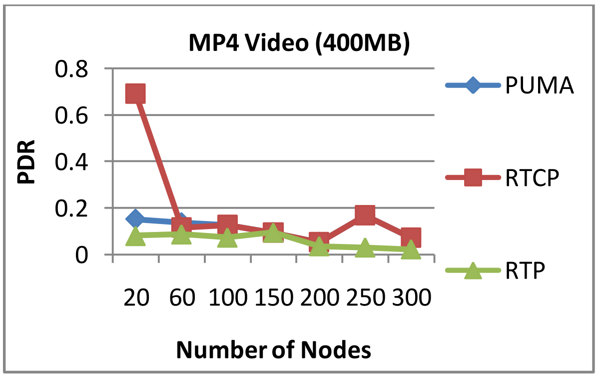


**Figure 8** PDR MP4 Video (400MB)

In this graphical representation of packet delivery ratio of using in this three protocols RTP, RTCP and PUMA. We observe that PUMA routing protocol are better performance for PDR.

**Simulation of Throughput MP4 Video (400MB)**

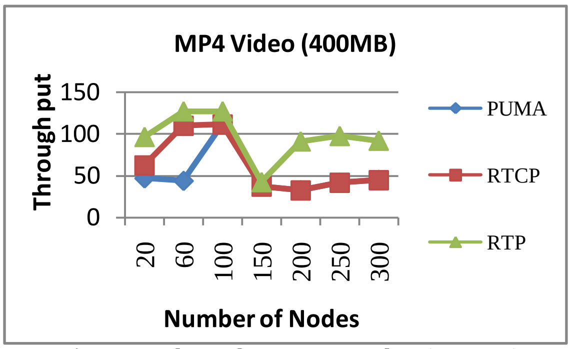


**Figure 9** Throughput MP4 Video (400MB)

In this throughput section we are using basically three protocols. All protocols provide the values at different number of nodes. RTP is better for throughput

**Simulation of Energy MP4 Video (400MB)**

End to End Delay MP4 Video 400MB In this end to end delay video we see the RTCP is better than other routing protocols.

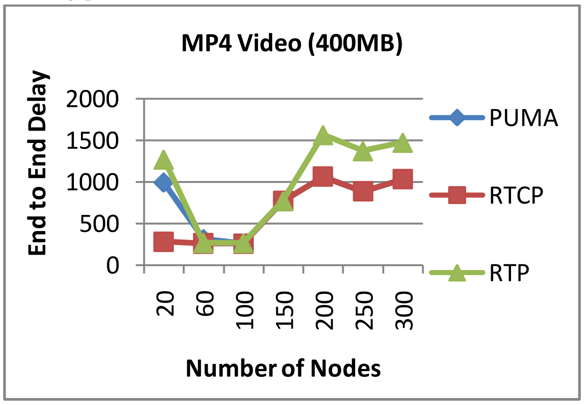


**Figure. 10** End To End Delay MP4 Video (400MB)

**Simulation of Energy MP4 Video (400MB)**

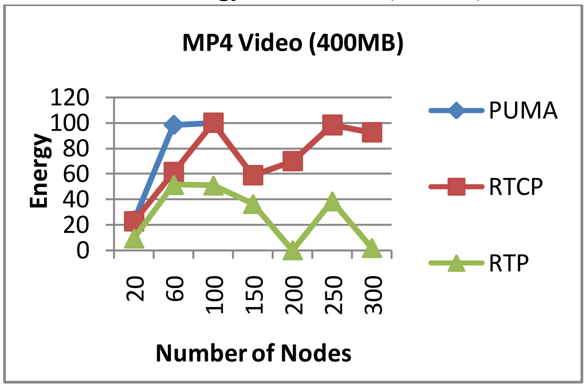


**Figure 11.** Energy MP4 Video (400MB)

In the above graph number of nodes represent on abscissa and energy represent on ordinate, this graph represents the relationship between number of nodes and energy on different protocols which are PUMA, RTCP and RTP. We got the PUMA is better performance for energy.

**2. Result of MP4 Video size 154MB**

**Simulation of Packet Delivery Ratio MP4 Video (154MB)**

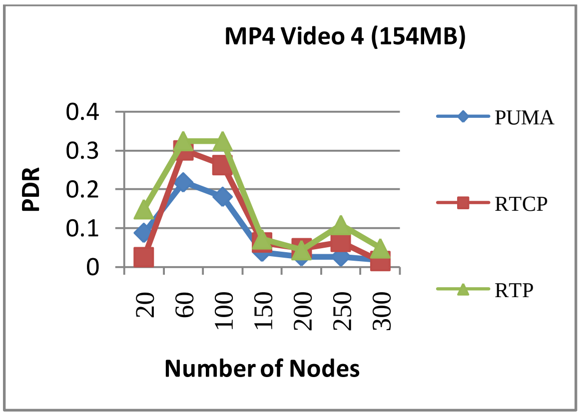


**Figure 12.** PDR MP4 Video (154MB)

This is the last portion of packet delivery ratio MP4 video on number of different nodes with different protocols RTP, RTCP and PUMA. Performance of RTP is better.

**Simulation of Throughput MP4 Video (154MB)**

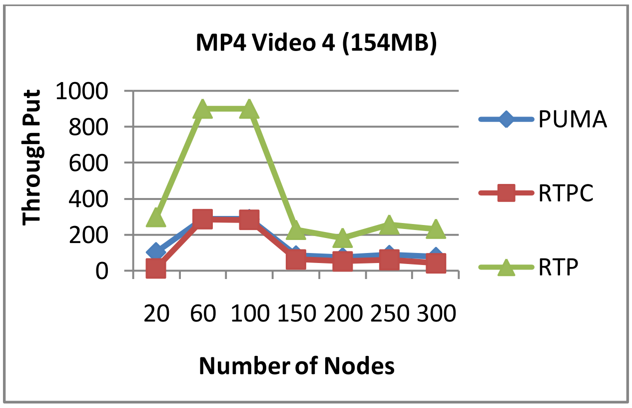


**Figure 13.** Throughput MP4 Video (154MB)

The next section of through put video we use the 154 MB video size for different number of nodes on the different protocols. We got the RTP is better results for through put.

**Simulation of End To End Delay MP4 Video (154MB)**

The next Figure shows below the representation of value of end to end delay for MP4 video, RTP performs well.

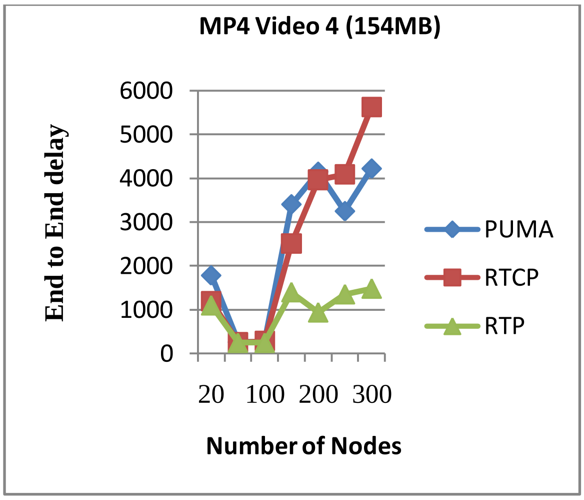


**Figure 14.** End To End Delay MP4 Video (154MB)

**Simulation of Energy MP4 Video (154MB)**

The next and last type of MP4 video is 154 MB presented above in Figure 6.33 represents the result of energy for different number of nodes on the behalf of PUMA, RTP and RTCP. We obtain the RTP is better for energy.

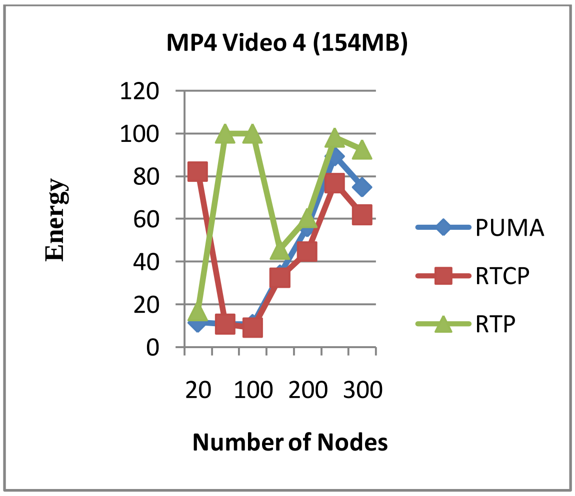


**Figure 15.** Energy MP4 Video (154MB)

**3. Result of HD Video Size 353MB**

**Simulation of Packet Delivery Ratio HD Video (353MB)**

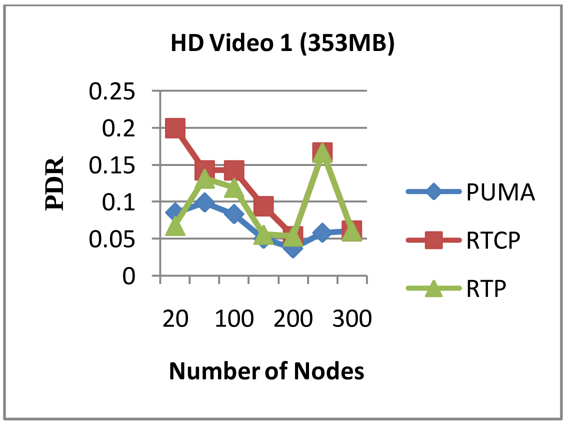


**Figure 16.** PDR HD Video (353 MB)

In this section we observe RTCP is better routing protocol for PDR.

**Simulation of Throughput HD Video (353MB)**

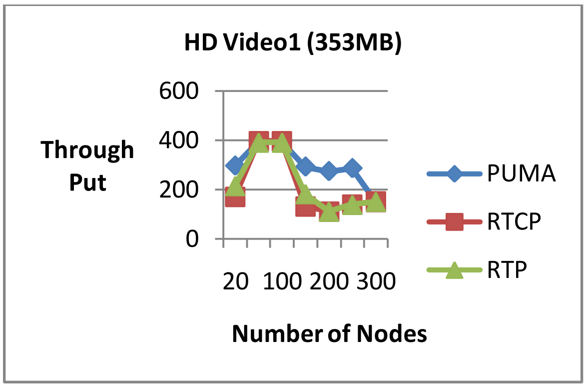


**Figure 17.** Throughput HD Video (353MB)

We are noted in this portion the result of Through put for better performance of routing protocol is PUMA.

**Simulation of End To End Delay HD Video (353MB)**

RTCP is better perform of the average delay for data packets (End to End Delay) in the below figure

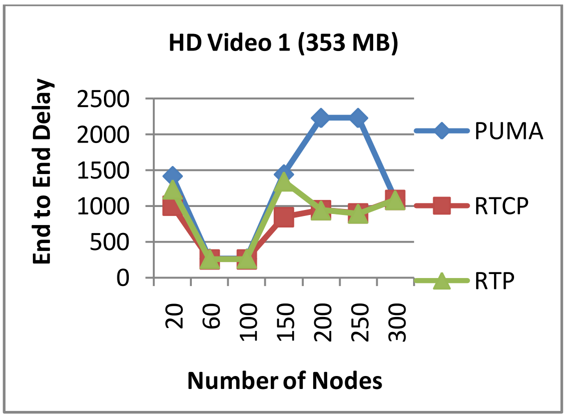


**Figure 18**. End To End Delay (353MB)

**Simulation of Energy HD Video (353MB)**

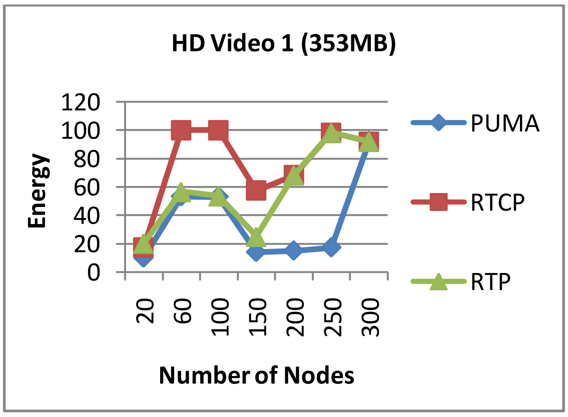


**Figure 19.** Energy HD Video (353MB)

The above graph shows that the maximum energy consumptions by using RTCP protocol.

### 4. Result of HD Video (172MB)

**Simulation of Packet Delivery Ratio HD Video (172MB)**

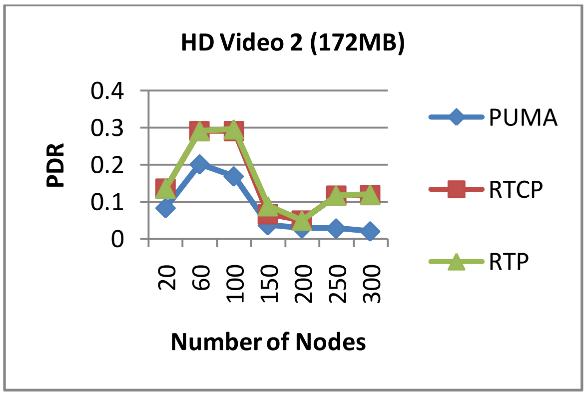


**Figure 20.** PDR HD Video (172MB)

In case of this HD video we have observe RTP is better performance for PDR.

**Simulation of Throughput HD Video (172MB)**

In this graph given below we got the PUMA performance is better for throughput.

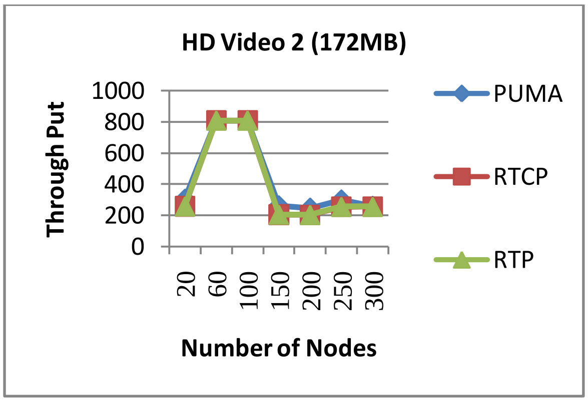


**Figure 21.** Throughput HD Video (172MB)

**Simulation of End To End Delay HD Video (172MB)**

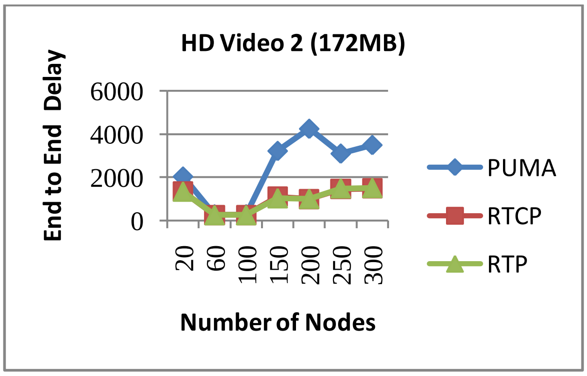


**Figure 22.** End To End Delay HD Video (172MB)

RTCP got the minimum delay compare to other protocols in this HD video.

**Simulation of Energy HD Video (172MB)**

We observe RTP and RTCP both routing protocols perform well in this HD video.

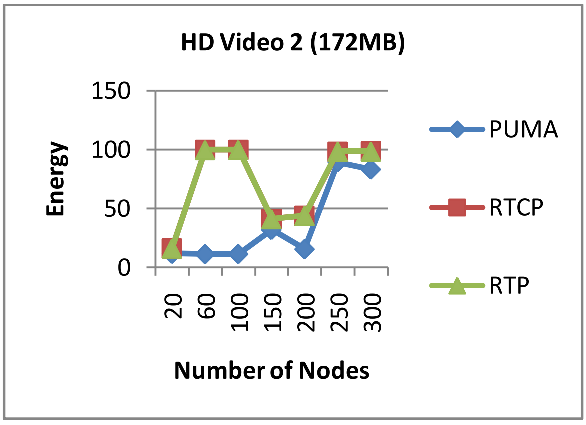


**Figure 23.** Energy HD Video(172MB)

## X. CONCLUSION

The simulation scenario consists of two different video types HD and MP4 with four parameters like packet delivery ratio, throughput, end to end delay and Residual energy of node to compare the performance of three routing protocols PUMA,RTP and RTCP with the help of these simulation metrics, comparison among routing protocols was done.

In HD video, two sizes were choosed. They are 172MB and 353MB, for 172MB the value of PDR and residual energy, RTP performs well. The value of end to end delay and residual energy by RTCP was better than other and for throughput PUMA performs. Hence for overall scenario RTCP and RTP both works. For 353MB, the performance of RTCP for PDR, end to end delay and residual energy was better and for throughput PUMA performance. So for both HD videos RTCP performs well.

For MP4, video sizes taken was 400MB and 154MB which near to the sizes of HD videos. We are tried to take video sizes of at most same. For 154MB, RTP performs well in all the four parameters PDR, throughput, end to end delay and energy. For 400MB, performance of PUMA in PDR and energy is better but RTP performs for throughput and RTCP performs in end to end delay. Hence over all performance of MP4 any routing protocols cannot perform well. It is always non-deterministic to find out the suitable routing protocols.

In conclusion, the performance of RTCP routing protocol was better than both the RTP and PUMA routing protocols.

## II. REFERENCES

[1] Chandra .R, Saravanaselvi .P. A Key issue on multicast video streaming over Wireless network. December 2012, Volume. 2, Issue 12.

[2] S. Sharangi, R. Krishnamurti and M. Hefeeda, "Energy-Efficient Multicasting of Scalable Video Streams Over Wireless Networks," *IEEE Transactions on Multimedia*, vol. 13, no. 1, pp. 102-115, Feb. 2011.

[3] IEEE Std. for Local and MAN Part 16:Air Interface for Fixed Broadband Wireless Access Systems- Amendment 2: MAC Modifications and Additional Physical Layer Spec. for 2-11 GHz, Std 802.16a-2003 (Amendment to IEEE Std 802.16-2001), 2003.

[4] P. Hosein, "Broadcasting VBR traffic in a Wireless network," in Proc. of IEEE Vehicular Technology Conference (VTC'08), Calgary, Canada, September 2008, pp. 1–5.

[5] P.sankar and Chellamuthu."Virtual Clock Scheduling Algorithm for Video Streaming" in International Journal of Computer Theory and Engineering, Vol. 1, No. 5, December, 2009.

[6] M. Garey and D. Johnson, Computers and Intractability: A guide to the Theory of NP-Completeness. W. H. Freeman and Company, 1979.
[7] Arjun Desai, Raj Jain. RTP, RTCP, RTSP= internet protocol for real time multimedia communication.

[8]Available:http://standards.ieee.org/getieee802/802.16.html.

[9] IEEE 802.16e standard, http://standards.ieee.org/getieee802/802.16.html.
Chandra.R*,Saravanaselvi.P# ,"A Key Issue on Multicast Video Streaming Over WIRELESS Network, International Journal of Scientific Reserach Publicatios, Vol.2, Issue 12, dec.2012

[10] SwarnaParvathi.S K.S.Easwarakumar,"Performance Evaluation of Multicast Video Streaming over Wireless, International Journal of Applied Information Systems, Vol.3-No.4,July 2012

[11]http://en.wikipedia.org/wiki/Scalable_Video_Co

[12] H. Schwarz, D. Marpe, T. Iigand, Overview of the scalable video coding extension of the H.264/AVC standard‖, IEEE Trans. Circuits Syst. Video Technol, vol. 17, no. 9, pp.1103-1120, Sept. 2007.

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