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Evaluation of Multimedia Transmission for Wireless Multihop Networks using the Evalvid Tool

Ms. Renita Blossom Monteiro[1]

PG Student, Department of ISE, NMAM Institute of Technology, Nitte, India[1]

Abstract: Simulation and analysis of Video transmission in NS-2 is a challenging task because of limited resources available and as a result of this the video quality will be degraded. In this paper we are trying to simulate video transmission in an IEEE 802.11 multihop network using the chain network. Multiple video streaming is compared and analysed with various factors and efficiency is recorded. Analysis is done for various protocols such as AODV, DSR, AOMDV and DSDV and in each case the results are recorded. From the evaluation results it is clearly understood that the performance varies with the protocol and AODV had better results as compared to other protocols.

Keywords: IEEE 802.11e, multihop network, multipath routing, video streaming, Evalvid-2.7.

I. INTRODUCTION

With the increase in development of wireless technologies, there is a great attention paid to wireless video communications. Multihop wireless communications are more flexible as compared to infrastructure based wireless networks. Hence, lot of research is being carried out in wireless video streaming using the multihop networks [1]. Multihop wireless network means there consist of more than one hop from source to destination. The data packets need to pass through many hops to reach destination. Hence, there arises the need for multipath routing. There are many papers that deal with multipath routing. In multipath routing since the video has to pass through many nodes there may be loss of packets. The different encoding standards like MPEG-4, H.264/AVC define the different frame types like I, P and B. These Group of Pictures (GOP) will help in measuring the performance of video transmissions by mapping the frame losses. Multipath routing will have great impact on end-to-end delay parameter. Video flow varies from protocol to protocol. In this paper we are attempting to simulate the video transmissions in multihop networks and analyzing the performance with the help of various protocols. The paper organization is as follows. Section II is Literature Survey. Section III is related work. In section IV evaluation of results of video transmissions in multihop network is explained. Section V is the conclusion with the focus on future work.

II. LITERATURE SURVEY

In [2] the author has designed the cross-layer scheme for video transmission in multihop networks. Comparison of multipath routing with single path routing is done. EDCA and its two modifications are being evaluated for multihop networks. EDCA scheme provides the distributed access to the channel. In [3] the author has designed the MDC approach for error resilience in the wireless multihop networks. When this approach is integrated with multipath transmissions it allows for traffic dispersion and removes the error caused by the packet losses and hence the network throughput is enhanced. The analysis is done using AOMDV protocol. In [4] video transmission over wireless multihop networks is done using various routing techniques. By using this techniques path establishment is done effectively. In this the performance of various techniques is analyzed for different network conditions. The techniques proposed are (DYMO), AODV and OLSR. According to the result analysis AODV is having better performance than others. In [5], an architecture is being proposed to support multiple video streaming in multihop networks, an on-demand multicast protocol is proposed to do the video transmissions. A simulation is being proposed and the results demonstrate that the proposed scheme works more effectively than the existing scheme. In [6] authors proposed various wireless schemes to improve video performance they are: routing metric to evaluate parameters of the path, traffic adjustment modules to make the routing schemes adaptable to changing environments and scheduling algorithm. The results show that the proposed method is better than the existing method. In [7] authors have proposed a scheme for the evolution video frame losses. This scheme allows for designing the routing policy for video traffic through which the distortion can be reduced to a lot extent. The results demonstrate that the proposed scheme reduces the distortion to about 20% as that compared to the traditional method.

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III. RELATED WORK

To transmit the video in multihop network Evalvid-2.7 tool [8] was used and it was integrated inside the ns-2.35. We have used Ubuntu-14.04 LTS OS in our work. Evalvid is a video tool for evaluating the video quality that is transmitted over a real or simulated environment; it was developed by the TKN group at the Technische University at Berlin. The Evalvid tool has different parameters at the sender and the receiver sides they are: Raw uncompressed video, encoded video, time stamp and type of packet sent and received. Evalvid uses various video codec's like ffmpeg, xvid and gpac for compression and conversion of the video.

A. Evalvid tool

Evalvid is a video transmission tool used in NS-2. In a simulated environment evalvid tool can be used. It can be used to measure QOS parameters like end-to-end delay, Jitter, Loss of frames; rate at receiver side, PSNR calculation on frame to frame basis can be done.

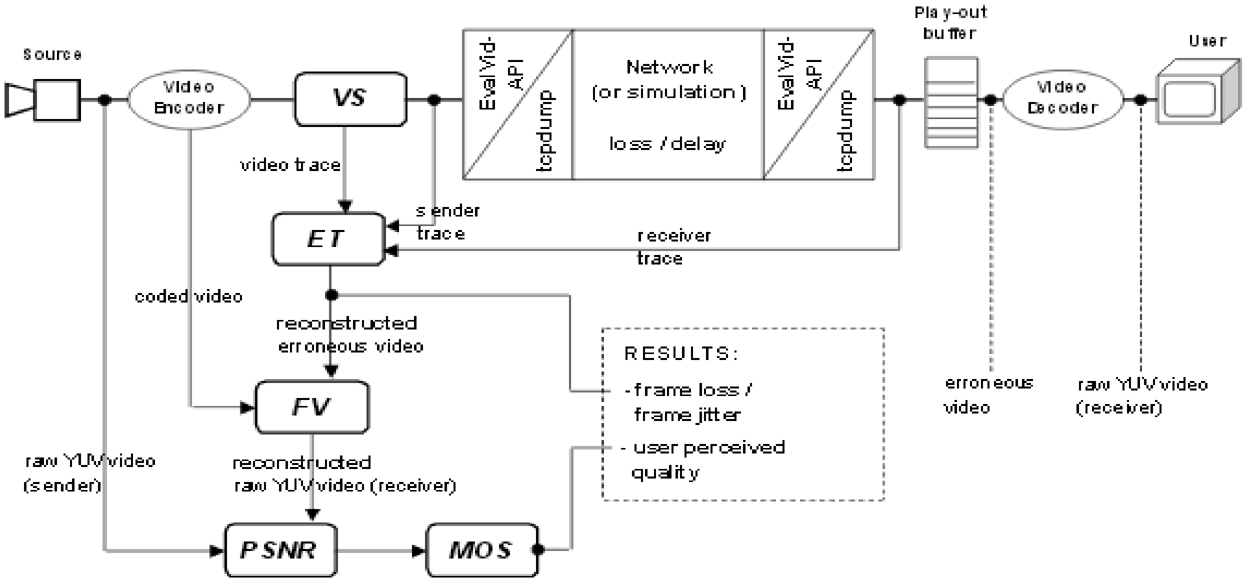

Figure1 Evalvid tool framework

Figure 1 above shows the framework of Evalvid tool used in NS-2. The sender side and the receiver side in Evalvid has various components. The sender side has information like raw video which is uncompressed, encoded video, timestamp and type of every packet sent with video in mp4 format. Receiver side has same information like type and timestamp of packet that is received, reassembled decoded video, raw video that is uncompressed with video file in mp4 format that is received. Various codec's like ffmpeg, gpac and xvid are needed in the installation of Evalvid to help in conversion, compression and in playback of video.

Components of evalvid are:

- Source (S): This has video files in YUV format that need to be encoded.
- Video sender (VS): responsible for the generation of video and sender trace files.
- Evaluate trace (ET): responsible for reconstruction of erroneous video using receiver trace file.
- Fix video (FV): used when the video packets are lost and thus could not be provided by the codec's like ffmpeg, xvid.
- Peak Signal to Noise Ratio (PSNR): used as a derivative of SNR to measure the signal energy to noise.
- Mean Opinion Score (MOS): used to measure video quality ranges from 1 (good) to 5 (worst).

B. Evalvid on NS2

The interfaces connecting between NS2 and Evalvid are:

1. MyTrafficTrace: it reads the trace file of the video and extracts the video frame size and frame type and then it fragments the video frames into video packets and passes it to the lower layers for processing.
2. MyUDP: is responsible for the generation of the trace file of the video at the sender side. The trace file contains data such as the timestamp, packet type, payload size and packet id.
3. MyUDPSink: acts as a receiving agent at the receiver side for the video packets sent at the sender side. It generates the receiver trace file which contains the same information as the sender trace file.

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C. The steps for video generation in NS2 are as follows:

1. Uncompressed video files were used which are available from [9]. These video files are in the CIF format.
2. Further the video files are compressed using the H.264 format AVC standard with 30 frames per second.
3. Further, these video files are packed together using the RTP (Real Time Protocol). MP4Box software is used for this purpose [10]. The packet size is 1000 B.
4. The tracefile that need to be sent into the network is generated and for this purpose the mp4trace command of Evalvid is used.
5. Finally, the traffic is generated in the NS2 simulator and the UDP shipping agent is used.

D. Simulation Environment

The figure 2 below shows the chain topology (with 3 hops) used in the transmission of video for multihop networks. Figure 2 shows the simulation environment.

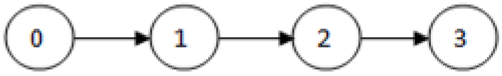

Figure 2 Chain topology

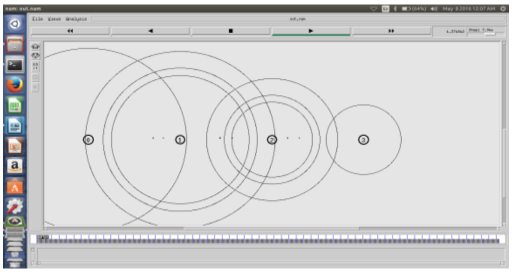

Figure 3 Simulation Environment

In the above figure 3 the source node is 0 and the destination node is 3. The video with 300 frames is being sent from the node 0 to the node 3 through the two intermediate nodes 1 and 2. The following are the simulation parameters.

Table 1 Simulation Parameters

Parameter	**Value**
Protocols studied	AODV, AOMDV, DSR and DSDV
Simulation Time	200 sec
Simulation Area	1500 X 1500 m
Traffic Type	video (UDP)
Payload size	1000 Bytes / packet

Performance analysis is being done by considering various other parameters like the throughput, end-to-end delay, loss and jitter for various protocols like AODV, DSR, DSDV and AOMDV.

IV. EVALUATION

(i) Throughput

Throughput of a network is calculated as the number of packets received by the destination node in per second time.

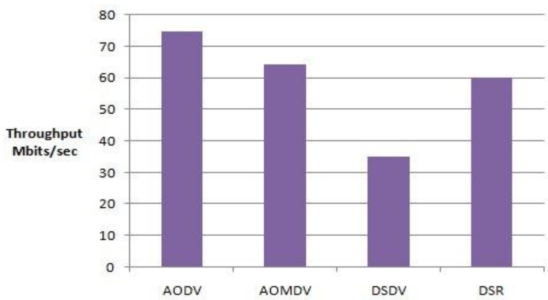

Figure 4: Throughput

In the above figure 4 demonstrates that the AODV has higher throughput than the other three protocols.

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(ii) End-to-end delay

End-to-end delay is the average time packet takes to reach the destination.

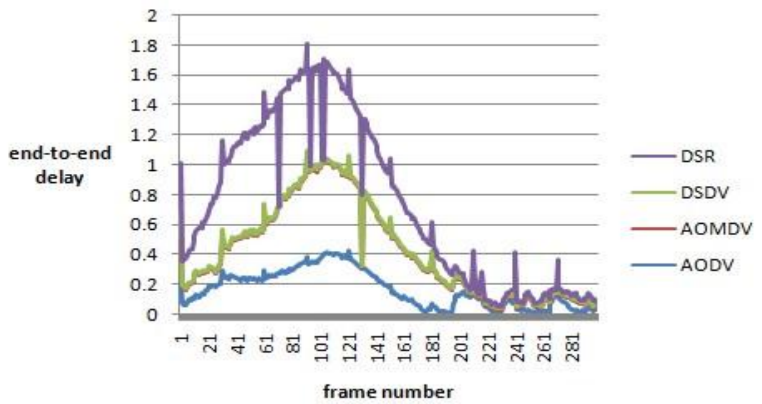

Figure 5: End-to-end delay

In the above figure 5 AODV has less delay as compared to other protocols.

(iii) Jitter

Jitter is the variation in the packet transmission delay.

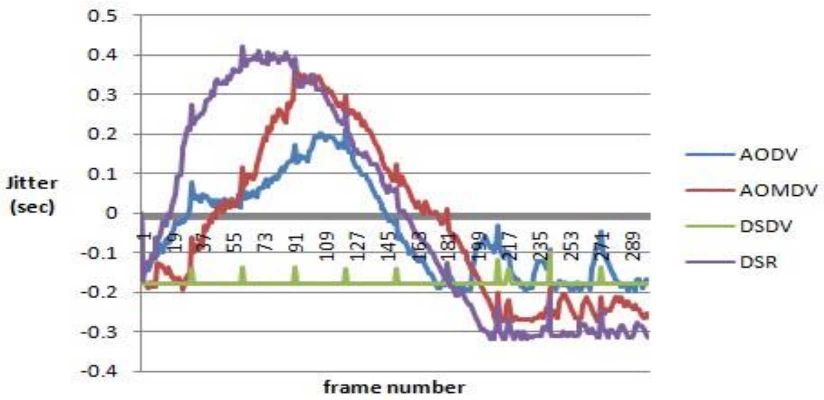

Figure 6: Jitter

In the above figure 6 the Jitter of AODV is comparatively less than others.

(iv) Packet loss

The table 2 below shows the frame loss of I, P, B frames and the overall loss in percentage.

Table 2: Packet loss in percentage

Protocol	**Akiyo Video sequence**			
	I	**P**	**B**	**Overall**
AODV	0.00	0.00	0.00	0.00
AOMDV	0.00	0.34	0.00	0.33
DSDV	0.00	3.19	0.00	3.14
DSR	0.00	1.38	0.00	1.33

In the above table it can be found out that the percentage of packet loss is higher in DSDV than other protocols and AODV has 0 losses. From the above results it can be clearly concluded that the throughput and PDR of DSDV is low as compared to DSR. This is because that DSDV uses the proactive table-driven routing whereas DSR uses the reactive on demand routing and DSDV has one route per destination whereas DSR has multiple routes per destination.

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(v) PSNR
PSNR which indicates the video quality is the ratio of signal to noise energy. The below figure 7 shows the psnr of the video with respect to the frame number.

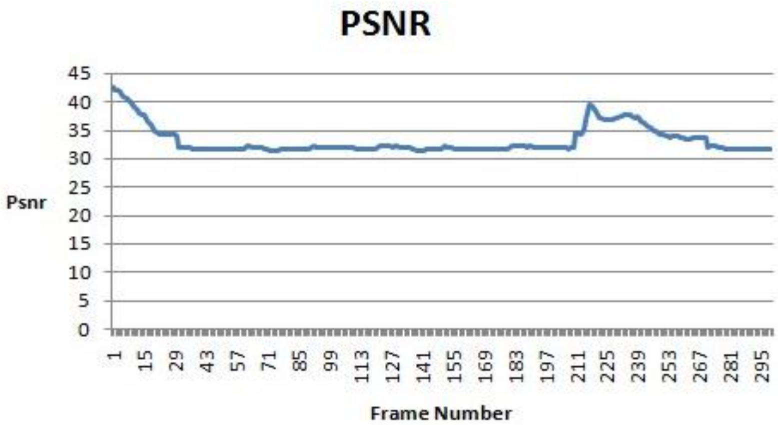

Figure 7 PSNR of video

(vi) Rate at Receiver
The below figure 8 indicates the rate at the receiver for various protocols.

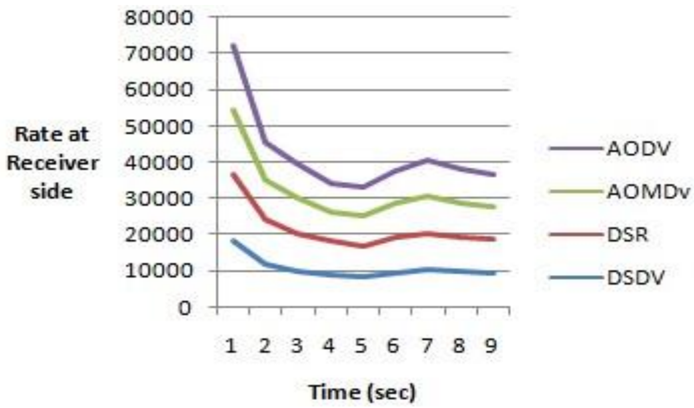

Figure 8 Receiver rate

The above figure shows the rate is better for AODV protocol and is less for DSDV protocol.

(vii) Packet Delivery Ratio
Packet Delivery ratio is the ratio of the packets received to the packets sent. The below figure 9 shows the pdr for various protocols.

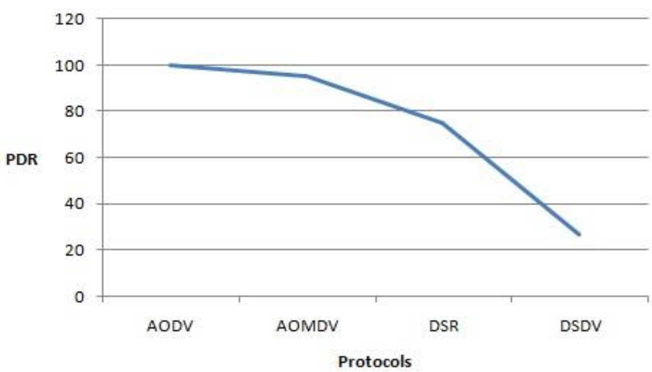

Figure 9 PDR

It is clear from the figure that the pdr is better for AODV than others.

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V. CONCLUSION AND FUTURE WORK

This paper explains about the multihop evaluation carried out for various protocols and from the results it can be clearly analyzed that the AODV protocol is having good throughput as compared to other protocols. As a future work the same can be implemented with other topologies that have a greater number of nodes and analysis can be done for various protocols with the use of some new mechanisms.

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