International Journal For Technological Research In Engineering
Volume 4, Issue 12, August-2017 *ISSN (Online): 2347 - 4718*

PERFORMANCE STUDY OF ROUTING PROTOCOLS BY EMULATION FOR VIDEO TRAFFIC IN WIFI NETWORKS

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Abstract: In this paper, we design and deploy a mobile Ad-hoc Network testbed that is integrated with EXata 5.1 network emulator to evaluate the performance of real-time video streaming applications. A routing protocol is used to determine the optimal path to forward the packets from server to client. A different set of protocols is designed for IEEE 802.11n networks such as AODV, DYMO, LANMAR and OSPFv2. The performance is evaluated for different routing protocols for WiFi network over change in mobility of the destination node and change in weather condition. Throughput and End to End delay are considered as performance metrics for the emulation studies.
Index Terms: Routing Protocols, IEEE 802.11n, AODV, LANMAR, DYMO, OSPFv2.

I. INTRODUCTION

In the recent years, wireless LAN (WLAN) has huge diversity for mobile equipment's. The advantage of wireless network is that the location of devices is flexible, and users do not need to worry about cabling. Without complex cabling, wireless network is easy to setup and use[1]. Currently, IEEE 802.11 family is the most used wireless LAN protocol. because of its advantages its system possesses such as interoperability, mobility, flexibility, and cost-effective deployment. The 802.11n standard offers several advantages over previous wireless LAN technologies. The most majorable advantages are substantially improved reliability and greater application data throughput. However, the low transmission rate of its medium access control (MAC) and a physical (PHY) layer protocol restrict to support high data rate application[2]. Current WLAN systems having difficulties with the increasing expectations of users and with volatile bandwidth and delay-boundary demands from new higher data rate services, such as high-definition television (HDTV)), file transfer, and online gaming, video teleconferencing, multimedia streaming[3], voice over IP (VoIP. The major aim of the IEEE 802.11n Task Group is to have maximum data throughput of at least 100 Mb/s. IEEE 802.11n gives recent propositions for PHY which includes multiple input multiple output (MIMO) antennas with orthogonal frequency division multiplexing (OFDM) and various channel binding mechanism[4]. Routing protocols in mobile adhoc networks helps to connect server to client node to send and receive packets[5]. Many protocols are designed but it is not easy to decide which one is the best. This paper throws light on comparative results of AODV, DYMO, LANMAR and OSPFv2 protocols of mobile adhoc networks using EXata emulator. The result draws some general conclusion by considering throughput and end to end delay metrics which can be helpful for future research. The rest of the paper is organized as follows. Section 2 gives the system description. Section 3 describes the results of all the protocols in WiFi networks. Finally we conclude our paper in section 4.

II. SYSTEM DESCRIPTION

We designed two scenarios using EXata 5.1, a software that provides scalable emulation[6] of wireless networks to analyze the performance of different routing protocols in WiFi environment with real video traffic for different video codec bit rates.

Description of scenario

The WiFi network uses 802.11n physical layer. The number of access point is 12, four routers, one hub and 44 mobile nodes. Among 44 mobile nodes we have consider some 12 mobile nodes as random way point. Altogether having 60 nodes placed within 1500x1500 square meters area. As shown in Figure 1 is the snapshot of the scenario. Emulation test bed established consists of an emulation server and four computers interconnected using network router. The connections between them are established using EXata connection manager[7].

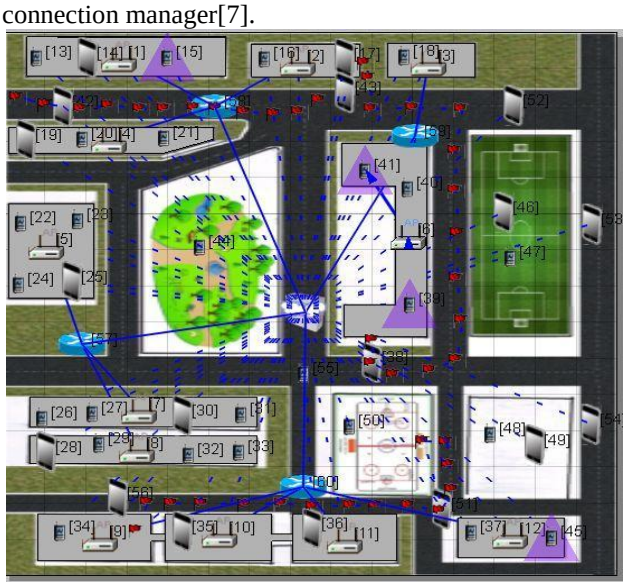

Figure 1. Snapshot of testbed

As shown in Figure 1, where four user equipment's are mapped onto four real computers. Among these four computers two of them are configured as media servers and the other two as media clients. Each media server transmits

mp4v encoded video file using VLC media player to the corresponding client. Packets are captured using Wireshark network protocol analyzer version 1.10.6 at both the media server and client for analysis of performance metrics considered.

Parameter	Values
Emulator	Exata 5.1
Emulation-Time	235 sec
Emulation Area	1500m x 1500m
Propagation-channel-frequency	2.4GHz
Antenna Model	Omni-directional
Transport layer Protocol	UDP
Network Protocol	IPv4
Physical Layer Model	IEEE 802.11n
Mac Protocol	IEEE 802.11e
Path-loss model	Two ray
Routing Protocol	AODV, DYMO, LANMAR and OSPFv2
Channel Bandwidth	20 MHz
Mobility model	Random way-point
Node mobility speed	10
PHY-Num-Antenna	2x2

Table 1. Emulation parameters

The emulation parameters considered are listed in Table 1. With change in network mobility we have taken the destination nodes as random way point in our first case study and secondly we checked with respect to weather condition by changing intensity of rain. The results presented in this two sections shows that the video bit rate used for transmitting a video stream over a network has great effects on its quality at sender as well as receiver node. Emulation study is carried out for video codec bit rate of 16 Kbps with specified routing protocol. Throughput and end to end delay are calculated by capturing packets at media servers and clients. Emulation studies are repeated for video codec bit rates: 16, 32, 64, 128, 256, 512, 1024 and 2048 Kbps.

III. EMULATION RESULTS AND DISCUSSION

Scenario 1: Change in destination node mobility. In this scenario, Emulation has been carried out with change in destination node with mobility. Performance metrics such as average throughput and average end-to-end delay connections are recorded in order to find best routing protocols. Emulation studies are repeated by changing the video codec bit rate of each routing protocols.

Figure 2 shows the average throughput performance of specified routing protocols for different video codec bit rates. It is evident from Figure 2 that OSPFv2 routing protocol shows the better performance for moving destination node. Where OSPFv2 finds the best path to reach destination node. It is also observed from Figure 3 that for higher video codec bit rates, throughput performance of OSPFv2 routing protocol is better than AODV, LANMAR and DYMO.

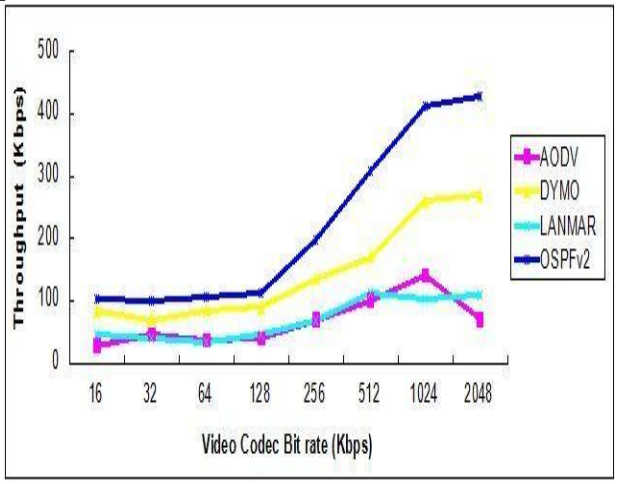

Figure 2: Average Throughput performance for destination nodes movement

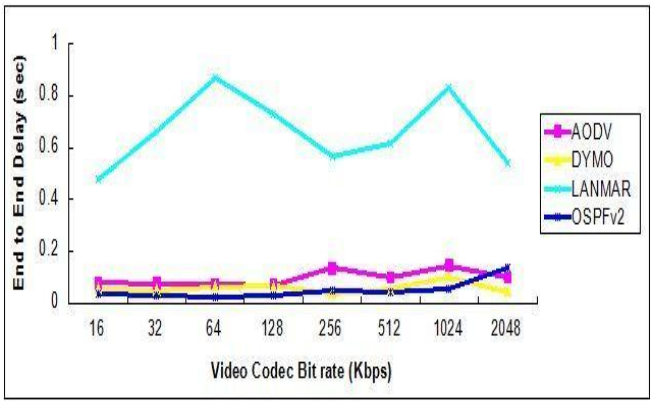

Figure 3: End to End Delay Analysis for destination node movement

Figure 3 shows the End to End Delay for different video codec bit rates. Here we observed that LANMAR, DYMO, and AODV have high delay. So OSPFv2 performs the low delay. Since OSPFv2 has the advantage of large networks and converges much faster than other routing protocols due to its calculation algorithm and finds the best routing path.

Scenario 1: Change in weather condition in terms of intensity.

In this scenario, Emulation has been carried out with change in weather condition by changing intensity(10, 60). Performance metrics such as average throughput and average

end-to-end delay connections are recorded in order to find best routing protocols. Emulation studies are repeated by changing the video codec bit rate of each routing protocols.

Figure 4 and 5 shows the average throughput performance of specified routing protocols for different video codec bit rates. It is evident from Figure 4 and 5 that OSPFv2 routing protocol shows the better performance for moving destination node. Where OSPFv2 finds the best path to reach destination node. It is also observed from Figure 4 and 5 that for higher video codec bit rates, throughput performance of OSPFv2 routing protocol is better than AODV, LANMAR and DYMO.

Figure 6 and 7 shows the End to End Delay for different video codec bit rates. Here we observed that LANMAR, DYMO, and AODV have high delay. So OSPFv2 performs the low delay. Since OSPFv2 has the advantage of large networks and converges much faster than other routing protocols due to its calculation algorithm.

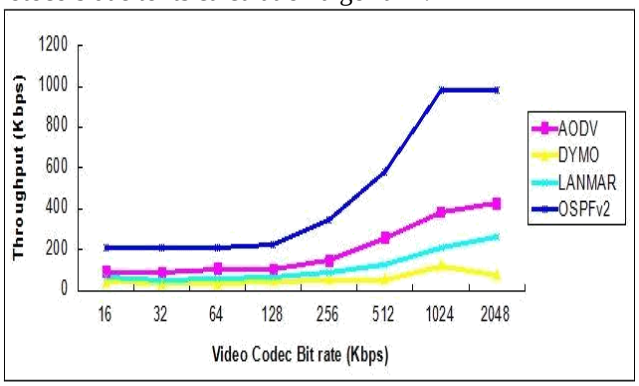

Figure 4: Average Throughput analysis for intensity 10

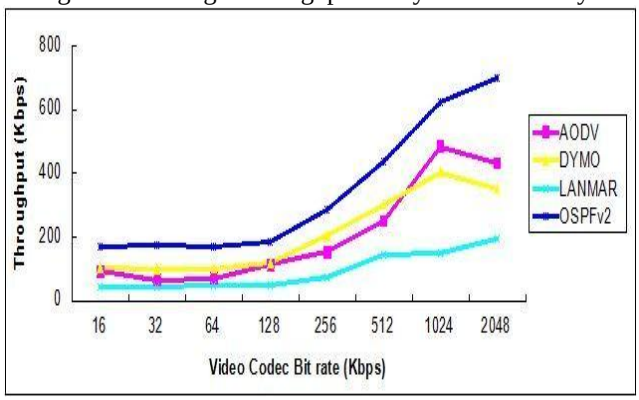

Figure 5: Average Throughput analysis for intensity 60

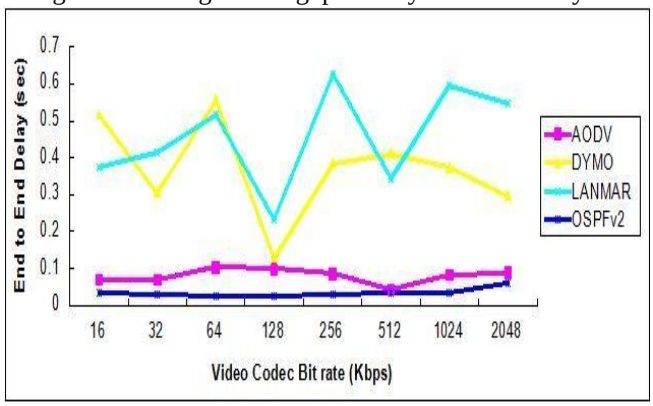

Figure 6: End to End delay analysis for intensity 10

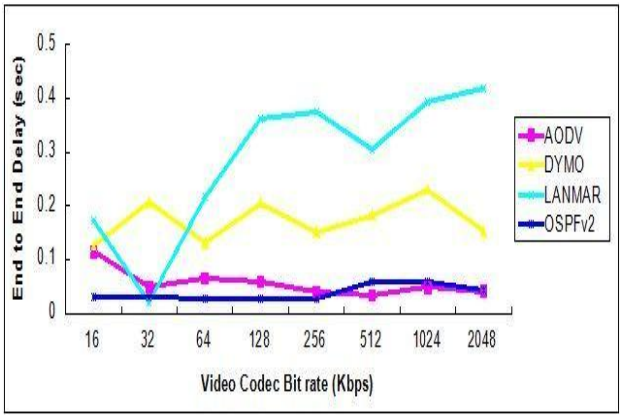

Figure 7: End to End delay analysis for intensity 60

IV. CONCLUSION

On analyzing the results it is concluded that protocols behave differently in wifi networks for different video codec bit rates. OSPFv2 gives a maximum throughput in both the scenarios. Thus OSPFv2 is superior to other protocols in terms of throughput. Where as end to end delay is lowest for OSPFv2 in WiFi networks for video streaming applications.

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