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Comparative Analysis of TCP Traffic and UDP Traffic under AODV using Mobile Ad Hoc Network

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Abstract— The transmission of information in a MANET relies on the performance of the traffic scenario (application traffic agent and data traffic) used in a network. The traffic scenario determines the reliability and capability of information transmission, which necessitates its performance analysis. The objective of this paper is to compare the performance of TCP and UDP traffic in AODV routing protocol which we have implemented in MANET. The study has been done using NS-2. Performance metrics, such as throughput, packet delivery ratio, average end to end delay and routing overhead have been considered for the evaluation of results. The effect of variations in number of nodes and mobility on the network performance is analysed over a range of their values.

Keywords— MANET, TCP, UDP, AODV, Routing protocol, NS-2, Throughput, Packet Delivery Ratio, Average End to End delay, Routing Overhead.

I. INTRODUCTION

A Mobile Ad Hoc Network (MANET) is a wireless network of wireless mobile nodes that communicate with each other. MANET does not have a fixed infrastructure or topology. Hence making them useful in the environments such as earthquake prone areas, battlefield applications and virtual classrooms [3, 8]. In such scenarios, MANET's features like mobile nodes, abruptly changing topology, communication with the nodes within wireless range, support the need of communication by making each mobile node act as a router. The MANET need to deal with several issues to provide secure and efficient routing of data in the network [1, 2, 3, 4, 5]. So, there is a great need to develop dynamic and efficient routing protocols that can ensure efficiency and secure routes for communication. The intension of this paper is to carry out the performance evaluation of an Ad hoc On demand Distance Vector (AODV) routing protocol for Transmission Control Protocol/File Transmission Protocol (TCP/FTP) and User Datagram Protocol/Constant Bit Rate (UDP/CBR) traffic types, subjected to two varying parameters; number of node and mobility. The conclusions are drawn based on performance metrics, such as, throughput, routing overhead, packet delivery ratio, and average end to end delay, to evaluate the performance.

II. DATA TRAFFIC /APPLICATION TRAFFIC TYPES

A. TCP/FTP

In such a traffic scenario, TCP represents the data traffic and FTP represents the application traffic. Here TCP is a transport layer protocol and FTP is an application layer protocol. The communication for connection oriented environment occurs in three phases which are connection establishment, data transmission, connection termination. The three basic characteristics offered by this are:

1) *Bi-directional Communication*: In the forward direction, the sender transmits the data i.e. in forward direction and the receiver acknowledges the sender by transmitting acknowledgements in the reverse direction. This is how a bi-directional communication occurs.
2) *Conforming*: When TCP/FTP are there in a scenario, the network offers conforming nature. The network offers both flow and congestion control. By preventing overflow of recipient buffer it maintains Flow Control and by keeping the track of acknowledgements, time outs, and retransmissions it maintains Congestion Control.
3) *Reliable*: TCP/FTP offers guaranteed data delivery by employing acknowledgements. This guarantees the delivery of data at a destination making it reliable. Retransmissions are made to ensure the delivery of data at the receiver if the acknowledgements are not received. Such positive acknowledgements, timeouts, and retransmissions are required to guarantee the delivery of data in a network making TCP/FTP a reliable connection.

B. UDP/CBR

UDP represents data traffic and is a transport layer protocol and CBR as application traffic which is an application layer protocol. It offers transmission of data at constant bit rate and unlike TCP/FTP, does not communicate in phases. The traffic moves in one direction from source to destination without any acknowledgement from destination. It offers three basic characteristics mentioned below:

Unidirectional: In this scenario, only one way communication is done i.e. on the forward link. There is no provision for acknowledge on sent or receive. The destination does not send any acknowledgement to the receiver, therefore it offers unidirectional traffic.

1) *Predictable*: As it offers constant bit rate, fixed and known packet size, fixed and known packet interval, and fixed and known packet stream duration, the UDP/CBR has predictable nature of transmission.
2) *Unreliable*: As it does not set up communication in phases and does not rely on acknowledgements to recover the lost messages, it can be called an unreliable. The sender node does not take the responsibility of the successful delivery of data and neither sends any acknowledgements.

III. AODV ROUTING PROTOCOL

AODV routing protocol belongs to the category of reactive or on demand routing protocols. AODV routing protocol offers route to the destination "on-demand". In such protocols, the nodes do not update their routing tables periodically, unless new routes are demanded by any network node. It is stimulated by this feature, such protocols are not suitable for the networks that are highly dynamic and prone to frequent and unpredictable changes. AODV routing protocol does not initiate route discovery of its own, unless it is requested by some other node that is willing to transmit any data. In AODV, the life of the routes in routing table of the nodes is until the routes are no longer needed in the network, i.e., if the routes are not used for a specified period of time, they are discarded. Bandwidth in AODV is mainly consumed during the starting of any transmission, but not during the entire transmission. Here any of the source nodes willing to communicate with the destination node of the network to which it has no route information, so it has to make route discovery before making any transmission.

The route discovery and route maintenance which are the two main responsibilities of AODV routing protocol are done by the use of three types of control messages; Route Request (RREQ), Route Reply (RREP), Route Error (RERR) messages. From the available choices of route, the sender selects the one offering the shortest path to the destination. If one or more routes are of equal length, then it selects the one offering minimum traffic. AODV employs destination number as the requested node identity to find routes to the destination. This number is mentioned in the RREQ control message.

IV. PERFORMANCE METRICS

The four types of performance metrics that were used to evaluate performance of TCP/FTP and UDP/CBR in this paper are described below:

A. Throughput

The throughput is the measure of how fast we can actually send data through the network. It is the measurement of number of packets that are transmitted through the network in a unit of time. It is desirable to have a network with high throughput.

Throughput=

$$\frac{\sum PR}{\sum(tst) - \sum(tsp)}$$

Where, PR – Received Packet Size, tst – Start Time, tsp – Stop Time.

Unit – Kbps (Kilo bits per second)

B. Packet Delivery Ratio (PDR)

It is the ratio of number of packets received at the destination to the number of packets generated at the source. A network should work to attain high PDR in order to have a better performance. PDR shows the amount of reliability offered by the network.

PDR=

$$\left(\frac{\sum NR}{\sum NG}\right) * 100$$

Where, NR – Number of Received Packets, NG – Number of Generated Packets

Unit – Percentage ratio (%).

C. Average End – to – Delay

This is the average time delay consumed by data packets to propagate from source to destination. This delay includes the total time of transmission i.e. propagation time, queuing time, route establishment time etc. A network with minimum average end to end delay offers better speed of communication.

Average End - to - End Delay=

$$\sum tPR - \sum tPS$$

Where, tPR – Packet Receive Time, tPS – Packet Send Time

V. SIMULATION MODEL AND RESULTS

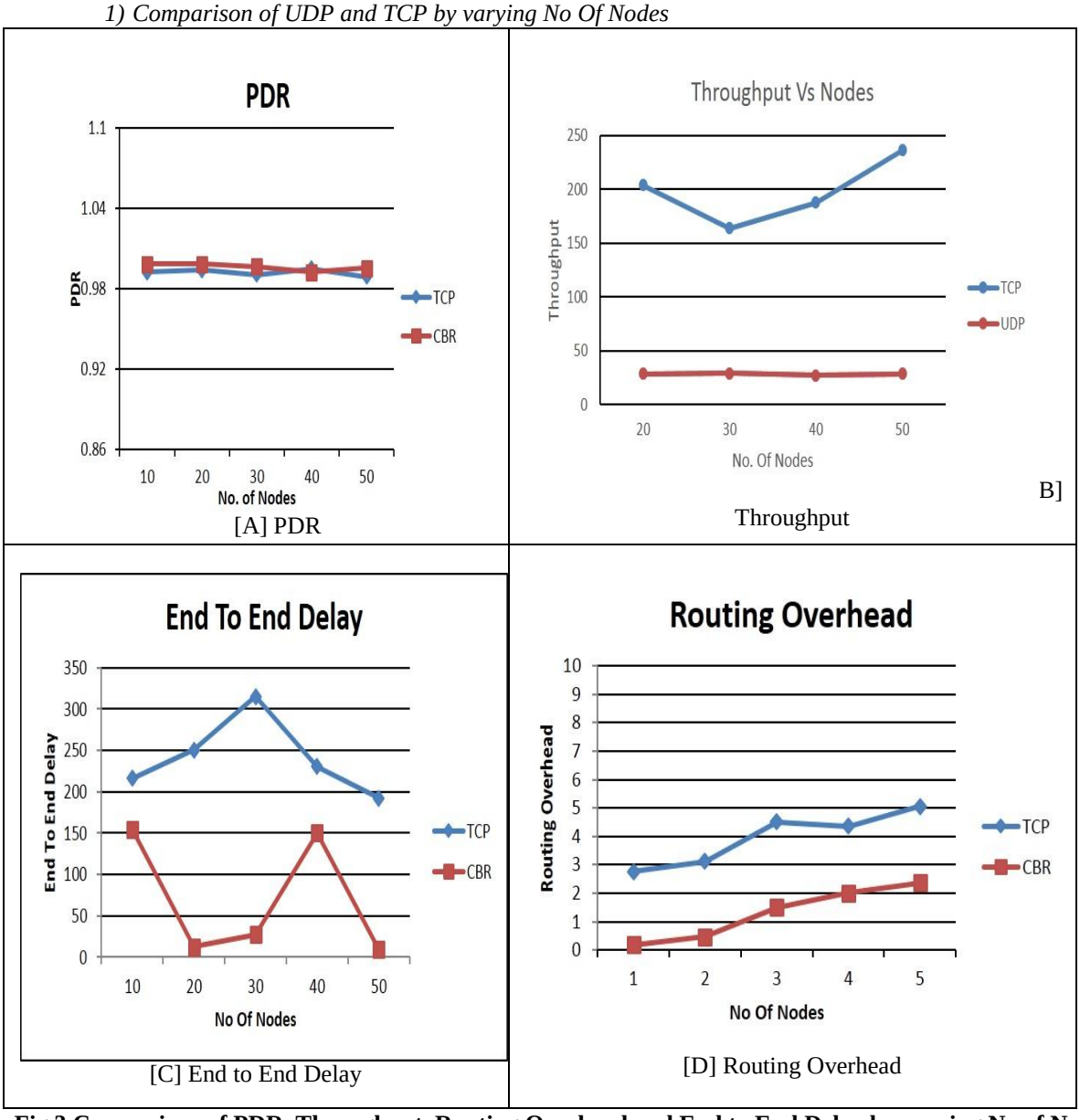
A. Network Simulator (Version 2.35), also known as NS2, is an event driven simulation tool that has been proved useful in studying the dynamic nature of communication networks. NS2 helps in simulating wired as well as protocol and wireless network (e.g., routing algorithms, TCP, UDP). We carried out the simulation and evaluated the performance of AODV with different TCP variants based on the performance metrics i.e. packet delivery ratio, throughput and end-to-end delay with the following parameters:

Parameter	Value
Radio Model	TwoRay Ground
Routing Protocol	AODV
Agent	TCP/FTP,UDP/CBR
Packet Size	512
Area	800m x 800m
Application	FTP
MAC	Mac/802_11
Simulation Time	50 s
No. Of Nodes	10,20,30,40,50
Max Speed	10,20,30,40,50

Table 4.1

B. Simulation Result

1) Comparison of UDP and TCP by varying No Of Nodes



[A] PDR

B]

Throughput

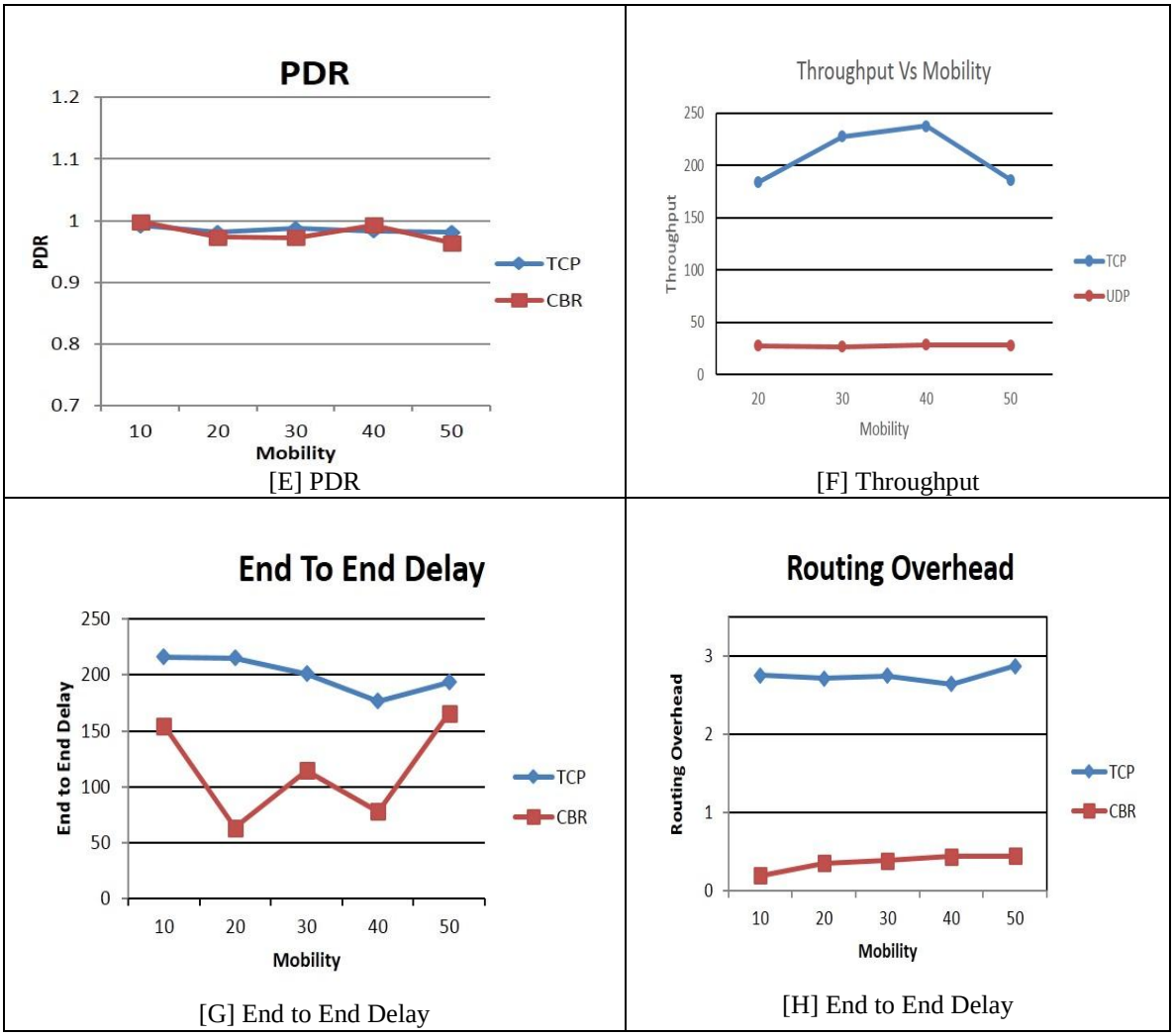
[C] End to End Delay

[D] Routing Overhead

Fig 3 Comparison of PDR, Throughput, Routing Overhead and End to End Delay by varying No of Nodes

Fig A shows the ratio of the data packets of each protocol which was able to deliver at time. We observe that UDP performs slightly better than TCP. As No of nodes are increased, PDR for UDP increases by 5 %. Considering the throughput (FIG B), TCP has clearly the best throughput than UDP. It performs around 200% better than UDP. Throughput for TCP increases as No of Nodes are increased. The End to End Delay (Fig C) is best for UDP and performs 25 -30 % better than TCP. Clearly overhead (Fig D) for TCP is better than UDP. At higher nodes TCP performs almost 50 % better than UDP when routing overhead is concerned.

2) Comparison of UDP and TCP by varying mobility



[E] PDR

[F] Throughput

[G] End to End Delay

[H] End to End Delay

Fig 4 Comparison of PDR, Throughput, Routing Overhead and End to End Delay by varying Mobility

Fig E shows the ratio of the data packets of each protocol which was able to deliver at time. We observe that TCP performs slightly better than UDP. As Mobility is increased, PDR for TCP decreased by 2 %. Considering the throughput (Fig F), TCP has clearly the best throughput than UDP. It performs around 400% better than UDP. Throughput for TCP decreases as mobility is increased. The End to End Delay (Fig G) is best for UDP and performs 25 -30 % better than TCP. Clearly overhead (Fig H) for TCP is far better than UDP. At higher nodes TCP performs almost 50 % better than UDP when routing overhead is concerned.

VI. SUMMARY

The conclusions presented in this paper compare the two traffic scenarios that are TCP/FTP and UDP/CBR, implemented in the network under test. To find the suitability from these two available traffics in a network in various environments, the results are compared and necessary conclusions are made. The paper is concluded on the basis of performance offered by the traffic patterns for the four performance metrics considered. The various conclusions drawn from various experiments, observations, and analysis done in the paper are as follows:

Throughput: Out of the two traffic types i.e. TCP/FTP and UDP/CBR, the former one provides far better performance than the latter. This proves that the network working with AODV provides better efficiency with TCP/FTP than UDP/CBR.

Packet Delivery Ratio (PDR): Although the PDR of UDP/CBR has greater maximum and minimum values than TCP/FTP, the latter offers almost a constant trend, whereas, the former offers highly varying (rising and falling trends), in all the three scenarios. Therefore, TCP/FTP is more reliable than UDP/CBR.

Average End to End Delay: The UDP/CBR offers lesser, average end to end delay, than TCP/FTP, therefore better speed of transmission, but as an exception in the scenario of number of nodes, as the density of nodes increases, the average end – to - end delay also increases and the speed of transmission decreases.

Routing Overhead: The UDP/CBR offers lesser overhead than TCP/FTP, which makes it better than TCP/FTP when routing overhead is considered.

References

[1] Panagiotis Papadimitratos and Zugmunt J. Haas, "Secure routing for Mobile Ad Hoc Networks", In Proceedings of the SCS Communication Networks and Distributed Systems Modeling and Simulation Conference (CNDS-2002), San Antonio, TX, January 27-31, 2002.

[2] Sunil Taneja and Ashwani Kush, "A Survey of Routing Protocols in Mobile Ad Hoc Networks", International Journal of Innovation, Management and Technology, Vol. 01, No. 03, August 2010, 279-285.

[3] GS. Mamatha and Dr. S.C. Sharma, "Analyzing MANET Variations, Challenges, Capacity and Protocol Issues", International Journal of Computer Science and Engineering Survey (IJCSES), Vol. 1, No.1, August 2010, 14-21.

[4] G. Vijaya Kumar, Y Vasudev Reddyr, Dr. M. Nagendra, "Current Research Work on Routing Protocols for MANET: A Literature Survey", International Journal on Computer Science and Engineering, Vol. 02, No. 03, 2010, 706-713.

[5] Jun-Zhao Sun, "Mobile Ad Hoc Networking: An Essential Technology for Pervasive Computing", Info-Tech and Info-net, 2001. Proceedings. ICII 2001- Beijing.2001 International conference, 2001, Vol. No. 03, 316-321.

[6] Imrich Chlamtac, Marco Conti, Jennifer J-N Liu, "Mobile Ad Hoc Networking-Imperatives and Challenges", Elsevier, 2003, 13-64.

[7] Priyanka Goyal, Vinti Parmar, Rahul Rishi, "MANET: Vulnerabilities, Challenges, Attacks, Applications", International Journal of Computational Engineering & Management, Vol. 11, January 2011, 32-37.

[8] Jiazi YI, "A Survey on the Applications of MANET", Polytech' Nantes, February 2008.

[9] A Rahim, I Ahmed, Z S Khan, M Sher, M Shoaib, A Javed, R Mahmood, "A Comparative Study of Mobile and Vehicular Ad Hoc Networks", International Journal of Recent Trends in Engineering, Vol. 02, No. 04, November 2009. 195-197.

[10] Bijan Paul, Md. Ibrahim, Md. Abu Naser Bikas, "Experimental Analysis of AODV & DSR over TCP & CBR Connections with Varying Speed and Node Density in VANET", International Journal of Computer Applications, Vol. 24, No. 4, June 2011.

[11] Muhammad Inayat Ullah, Nasir Nawaz, "Measuring the Effect of CBR and TCP Traffic Models over DYMO Routing Protocol", Global Journal of Computer Science and Technology, Vol. 11 Issue 14.

[12] Md. Monzur Morshed, Meftah Ur Rahman, Md. Rafiqul Islam, "An Empirical Study of UDP (CBR) Packet Performance over AODV Single & Multi – Channel Parallel Transmission in MANET, www.aiub.edu.

[13] Vikas Singla, Ajay Kumar, Rakesh Singla, "CBR and TCP Based Performance Comparison of Various Protocols of MANET: A Review", National Journal on Advances in Computing and Management, Vol. 1, No. 2, October 2010.

[14] Deepti Verma, Deepika Chandrawanshi, "Comparative Performance Evaluation of AODV over CBR and TCP Traffic", IJCST, Vol. 2, Issue 2 June 2011.

[15] V.R. Sarna Dhulipala, R.M. Chandrasekran, R. Prabakaran, "Timing Analysis and Repeatability Issues of Mobile Ad Hoc Networking Applications Traffic", International Journal of Recent Trends in Engineering, Vol.1, No.1 May 2009.

[16] Ajay Kumar, Ashwani Kumar Singla, "Performance Evaluation of MANET routing protocols on the basis of TCP Traffic pattern", International Journal of Information Technology Convergence and Services (IJITCS), Vol. 1, No. 5, October 2011.

[17] Thomas Clausen, Philip Jacquet, Laurent Viennot, "Comparative Study of CBR and TCP Performance of MANET Routing Protocols", Mindpass Center for Distributed Systems.

[18] Vikas Singla, Parveen Kakkar, "Traffic Pattern based performance Comparison of Reactive and Proactive Protocols of Mobile Ad Hoc Networks", International Journal of Computer Applications, Vol. 5, No. 10, August'2010.

