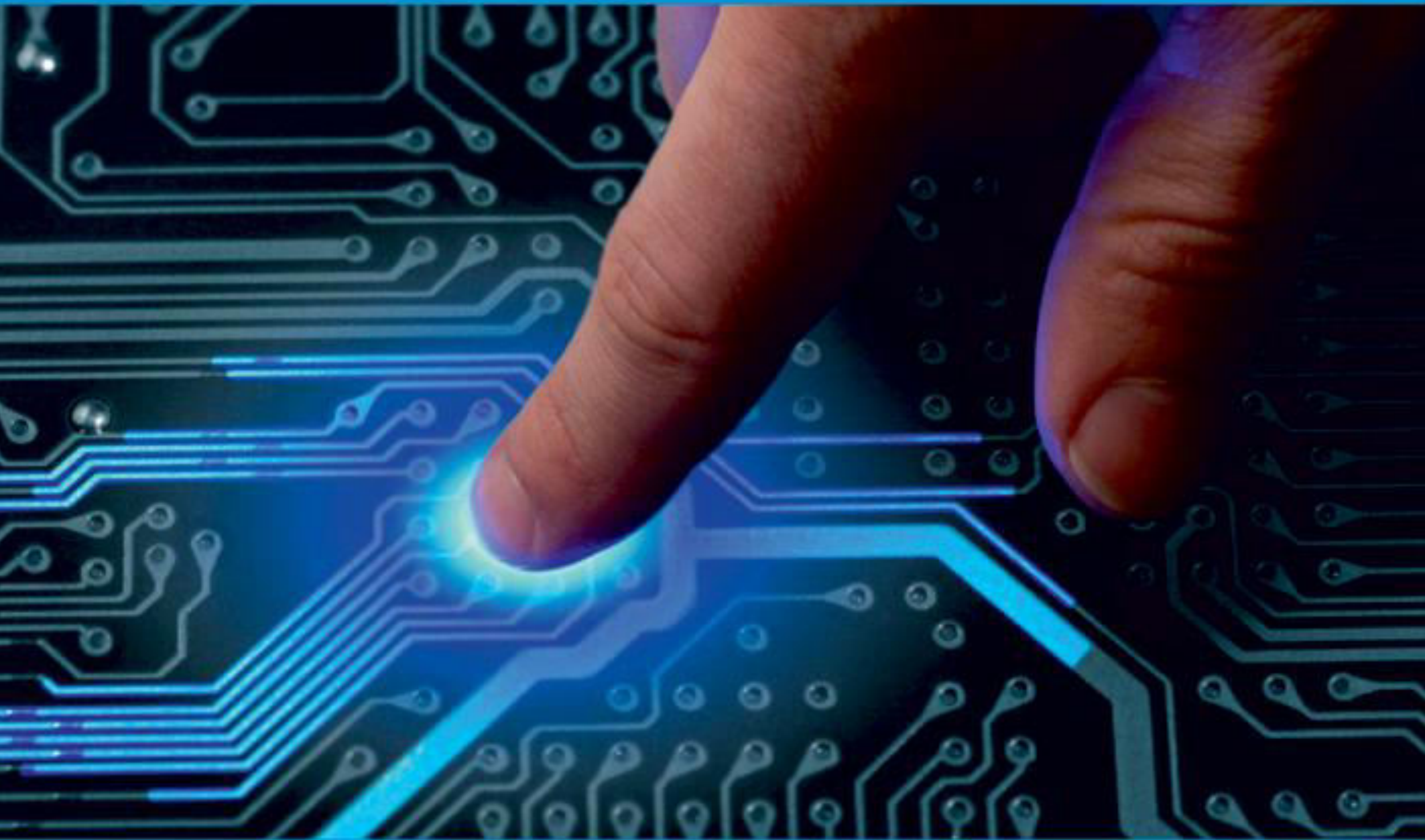
IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 10, Issue 12, December 2022

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.165

9940 572 462 6381 907 438 ijircce@gmail.com www.ijircce.com

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165

|| Volume 10, Issue 12, December 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1012023 |

Performance Analysis of Routing Protocols using NS2 Framework

Archana Ratnaparkhi, Radhika Purandare, Rohit Kamthe, Karan Mane, Vaibhav Dhawale, Arman Kavathekar

Department of E&TC, VIIT, Pune, India

Department of E&TC, VIIT, Pune, India

Department of E&TC, VIIT, Pune, India

Department of E&TC, VIIT, Pune, India

Department of E&TC, VIIT, Pune, India

Department of E&TC, VIIT, Pune, India

ABSTRACT: Wireless connectivity provides the main advantage of user mobility and ease of deployment. The routing protocol used in wireless network design plays a critical role because routing preferences need to be dynamically altered when link failures or packets delays occur. The transport agent used also affects communication. In this work, simulations were performed in Network Simulator 2 to analysis the effect of combination of different routing protocols and transport agents on the communication network by changing various parameters such as the No. of nodes and allocating different channels. The platform used for the analysis is Network Simulator 2. The routing protocols analyzed for these experiments are the dynamic source routing (DSR), ad hoc on-demand distance vector (AODV) andoptimal link-state routing protocol (OLSR). While different combinations of transport agents such as TCP, UDP, TCP Vegas, and TCP Reno are employed.

KEYWORDS: Routing protocols, AODV, OLSR, DSR,Transport agent, TCP, UDP, Packet delivery ratio, Average Throughput.

I. INTRODUCTION

Wireless networks have various requirements; for example, some devices are little sensors with minimal resources that consume relatively little power. While some gadgets consume a lot of resources, they also need a lot of electricity and must be connected all the time. A MANET is a mobile ad hoc networkof wirelessly linked devices that is constantly self-configuring. Because devices in a MANET can move in any direction independently, information transmission necessitates frequent adjustments in connection with other devices. Understanding the numerous aspects that influence their effectiveness allows you to visualize and use such connections more effectively.

Reactive, proactive, and hybrid routing protocols are the three categories of routing protocols[1].

A. Proactive Routing protocols

In this each node has at leastone table that depict the overall network architecture. These tables are updated regularly to ensure that routing information is always up to date. It necessitates the constant transmission of topological information between nodes, resulting in a rather significant network overhead. Routes will always be accessible on demand, resulting in a persistent overhead of routing traffic, but no initial latency. For instance, DSDV and OLSR.

B. Reactive Routing Protocol

In this a connection is only made when a node requires to communicate to another node, this is also known as on-demand routing. Thus, overhead is decreased since no routing table has to be constructed in order to retain node data. Route request packets are flurried over the network for the route determination process. Flooding consumes bandwidth and adds overhead to the network. Every time a packet requires routing, a routing request is made, which might delay packet transmission while calculating routes. Like AODV and DSR.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165

|| Volume 10, Issue 12, December 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1012023 |

C. Hybrid Routing Protocol

Routing protocols that are both proactive and reactive are used in this protocol. It works well with a zone routing strategy where pathways between nodes are chosen based on reactive routing protocols and zone neighbors are chosen based on proactive routing protocols. It brings together the advantages of proactive as well as reactive routing techniques. These are flexible and adjust to the geographic region where the source and receiver mobile nodes are located. TORA and ZRP, for instance. Depending on the use case, routing protocols are used. The reactive routing protocols AODV and DSR were taken into consideration in this study. The proactive routing protocol OLSR was also considered.

A. Ad hoc On-Demand Vector Routing (AODV)

In this each node makes use of forwarding tables. A routing request packet is sent by a node whenever it wishes to transmit a packet to a certain destination. When a packet is broadcast to nearby nodes, this process is continued till the packet is received by its target. For the receiver node to reply by sending an RREP packet, a return path must be created before delivering an RREQ. A route error message is used to alert other nodes of a broken connection when it is discovered on an active route.

B. Dynamic Source Routing (DSR)

The source routing mechanism is foundation of DSR. Nodes keep a route cache in this case. When new nodesare discovered, route caches are updated. DSR consists of two processes: Route Discovery& Route Maintenance, which operate together to assist nodes to find and manage routes to receivers. When source node sends a packet to a receiver node, it first checks the route cache for the path to the receiver. The source node delivers the packet to the receiver if the destination route is already stored in the route cache; otherwise, it sends a Routing Request packet. An address consists of a senders address, a receiver address, and a special identifying No..

C. Optimized Link State Routing Protocol (OLSR)

Both proactive and reactive routing protocols are used in this protocol. It is best suited for a zone routing protocol in which proactive routing protocols determine zone neighbors and reactive routing protocols determine paths between nodes. It combines the benefits of reactive as well as proactive routing techniques. These protocols are adaptive, meaning that they adjust to the zone and position of the source and destination mobile nodes. For example, TORA and ZRP. Because TCP protocols were originally designed for wired networks, they cannot provide optimized performance in wireless networks. TCP variants such as TCPReno & TCPVegas must be used to ensure a reliable transfer [2].

II. LITERATURE SURVEY

The paper[1] explains the structure and organization of three different protocols. Network's information is updated using the proactive routing protocol. The network structure is determined by the reactive protocol. Additionally, this study contrasts the common parameters of different types of protocols.Three main methods used by Vegas are explained in this paper [2], together with the reasons behind them. It compared performance of the TCP Vegas and TCP Reno.The transportation layer protocols TCP and UDP are regarded as the fundamental internet protocols.

To precisely identify which of these protocols is superior, the paper [3] examined and contrasted the behaviour of TCP and UDP in two separate circumstances. The PDR, average end-to-end time, average throughput, and packet loss ratio for these two protocols were all calculated. In this study [4], reactiveprotocols and proactive protocols with various packet sizes are subjected to TCP & UDP performance analysis. The network size and node count are adjusted for each traffic scenario while the packet size is varied between 512 and 1000 bytes.

This study [5] demonstrates the performance assessment of Regarding TCP and UDP traffic patterns, the OLSR protocol adjusting parameters such as node density, node speed, and stop duration. The performance of OLSR has been evaluated in terms of generally used performance measures, such as packet loss, end-to-end latency, & throughput, in various network circumstances.

AODV and OLSR were two common MANET routing protocols whose performance was examined in this work [6]. (OLSR). With the use of NS2, numerous metrics, including the PDR, packet loss, and routing overhead, are used to analyse the performance variances.

III. METHODOLOGY

This section outlinesthe procedure used in the experiment. In the experiment that follows, two nodes are used in a wireless OLSR, AODV, and DSR using various types of TCP agents. The simulation is started with the two nodes close together, and it then adds two more nodes in the network for taking further observations, until the PDR and Average

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165

|| Volume 10, Issue 12, December 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1012023 |

Throughput are at their lowest possible values. For various TCP agents, such as TCP, TCP Reno, and TCP Vegas, the change in Packets Delivery Ratio and Average Throughput is noted for the corresponding change in several nodes. Then, in our experiment, we plot graphs showing the relationship between the No. of nodes and the PDR and the No. of nodes and average throughput for individual TCP agents.

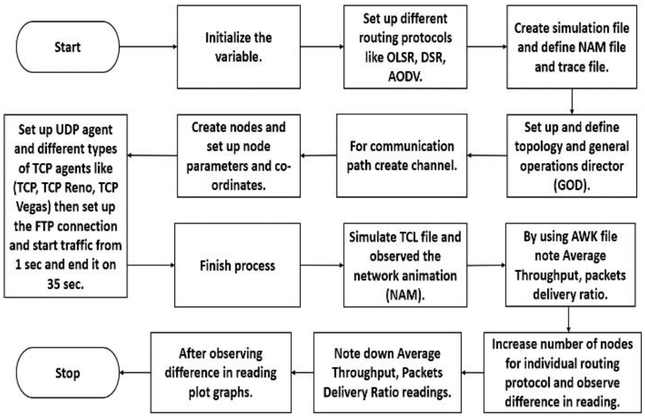


Figure 1. Methodology

IV. EXPERIMENTATION AND DISCUSSIONS

A. Simulation environment

Simulation is performed using AODV, DSR, and OLSR routing protocol over TCP, UDP, TCP Vegas, and TCP Reno transport agents respectively. In these sections analysis of routing methods' effectiveness when altering the No. of nodes and transport agents used. The positions of each nodeare kept identical for each routing protocol for comparison purposes.

B. Result analysis by varying the No. of Nodes

In the following experiment, we observed the modification of PDRand average throughput concerningthe change in the No. of nodes. For each succeeding, iteration, we have changed the No. of nodes from 0 to 18. observation, a link of 2 nodes is added to the network.

1. Comparing transport agents

In this experiment, we have used UDP (with CBR), TCP, TCP Vegas, and TCP Reno as transport protocols for AODV, DSR, and OLSR routing protocols while varying the No. of nodes (i.e. adding links in the network). The values for PDR (in %) and average throughput are measured and plotted against the No. of network nodes andPDR (in %) vs No. of nodes plot analysis is made in figures 2, 3,4, 5, 6, 7, 8.

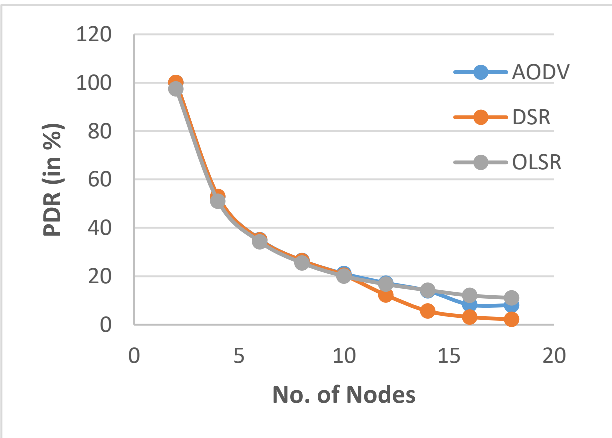


Figure 2. UDP PDR analysis

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165

|| Volume 10, Issue 12, December 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1012023 |

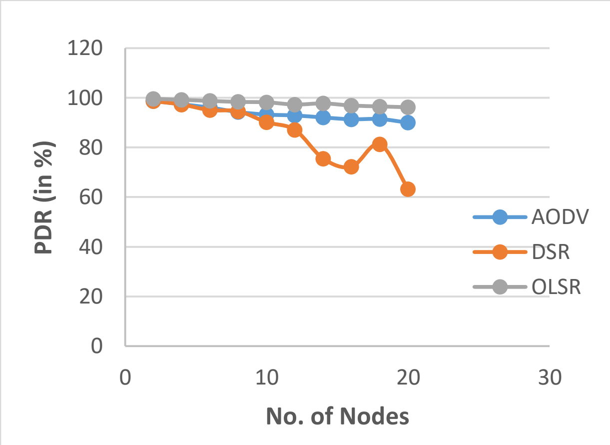


Figure 3. TCP PDR analysis

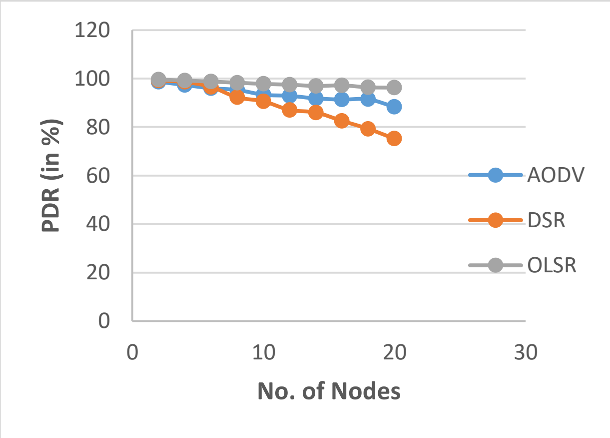


Figure 4. TCP Reno PDR analysis

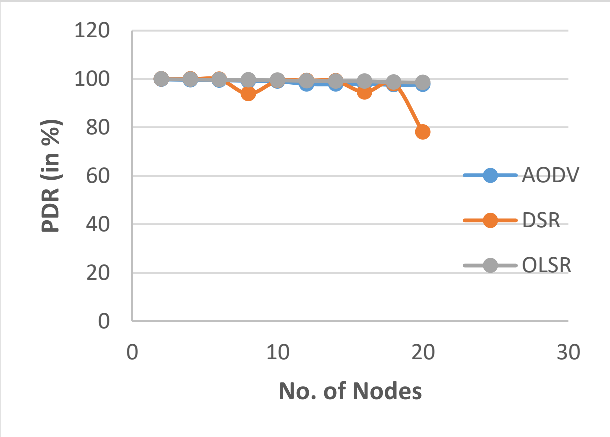


Figure 5. TCP Vegas PDR analysis

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165

|| Volume 10, Issue 12, December 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1012023 |

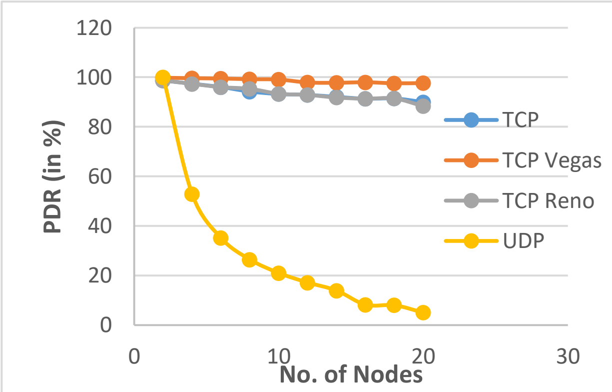


Figure 6. AODV PDR for different agents

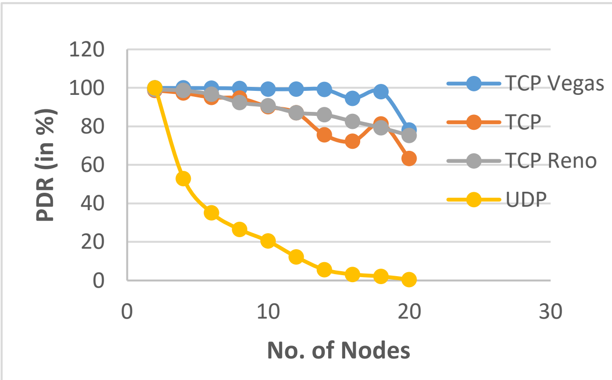


Figure 7. DSR PDR for different agents

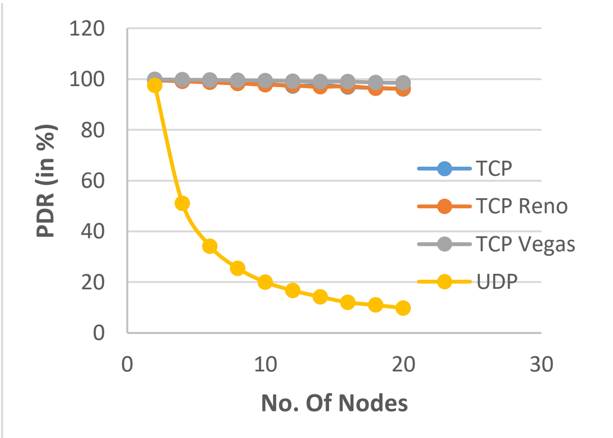


Figure 8. OLSR PDR for different agents

In figures 3, 4, 8, and 9 thePDRof UDP transport agent decreases rapidly as the count of nodes increases. TCP is more reliable than UDP because it utilises retransmissions and message acknowledgement if there is some packet loss. As a result, no data is lost in the network. In the case of UDP, there is no guarantee that the data has arrived at the recipient or not. [3].

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165

|| Volume 10, Issue 12, December 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1012023 |

TCP Vegas showed the best performance with routing protocols used, as can be observed from ffigures7, 8, and 9. While TCP and its implementation TCP Reno did not have a significant difference in PDR.

Average throughput (in kbps) vs No. of nodes plot analysis is performed in figures 9, 10, 11, 12, 13, 14, 15.

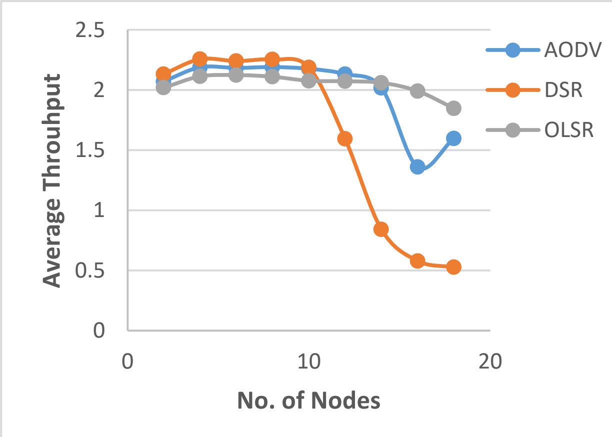


Figure 9. UDP Average Throughput analysis

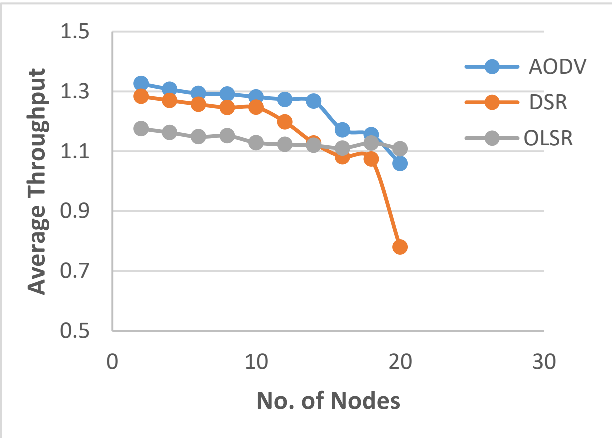


Figure 10. TCP Average Throughput analysis

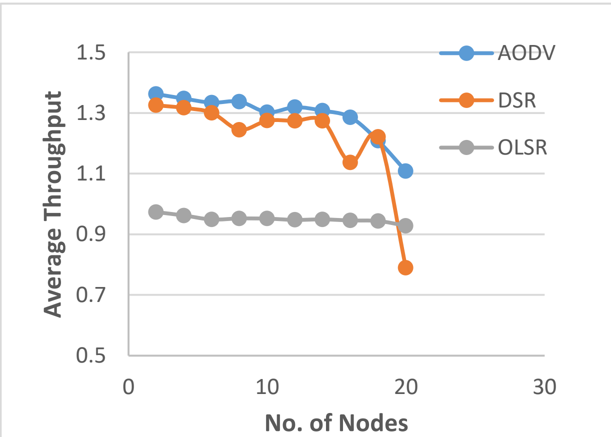


Figure 11. TCP Vegas Average Throughput analysis

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165
|| Volume 10, Issue 12, December 2022 ||
| DOI: 10.15680/IJIRCCE.2022.1012023 |

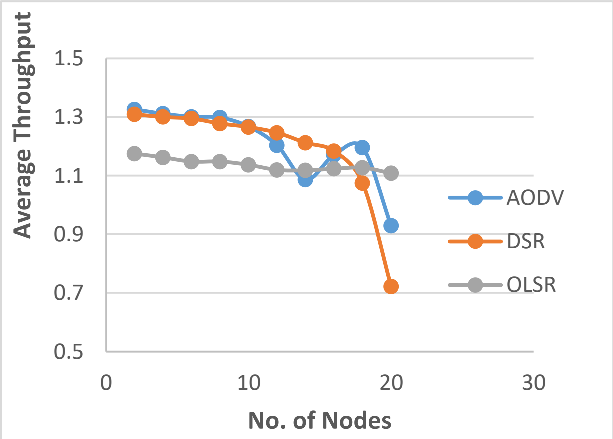


Figure 12. TCP Reno Average Throughput analysis

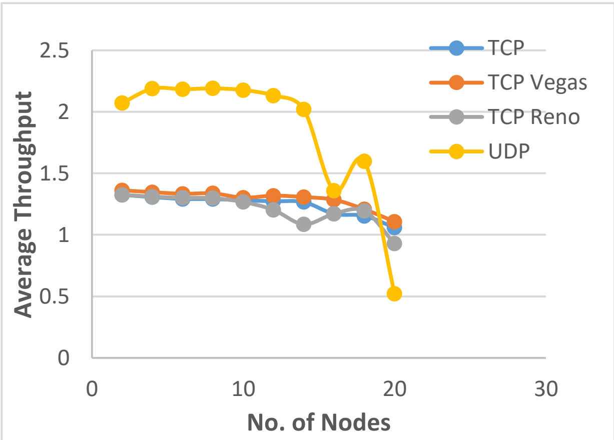


Figure 13. AODV Average Throughput for different agents

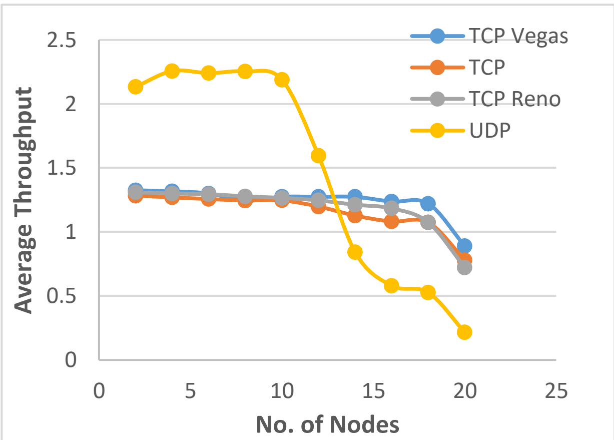


Figure 14. DSR Average Throughput for different agents

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165
|| Volume 10, Issue 12, December 2022 ||
| DOI: 10.15680/IJIRCCE.2022.1012023 |

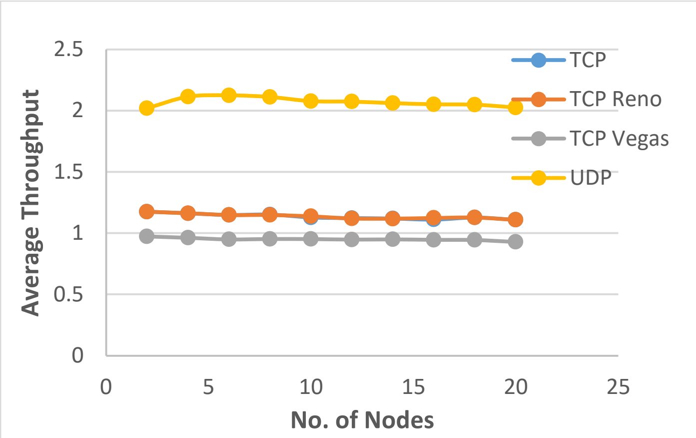


Figure 15. OLSR Average Throughput for different agents

In the given figures the Average throughput using the UDP transport agent initially remains higher as compared to the TCP and its variants, after the No. of nodes increases the average throughput values for UDPgradually decrease. At the same time, TCP and its implementation TCP Reno and TCP Vegas did not have a significant difference in average throughput.

2) Effect of interference

In the figures,16,and 17 NS2 simulation diagrams, nodes 2 and 3 are establishing a UDP connection in which node 2 is the sender and node 3 is the receiver. As the receiver does not give an acknowledgment in UDP, its application agent is set as NULL. In this case, we considered both the origin and final destination as stationary nodes. Here receiver does not provide any feedback (acknowledgment), thus the sender does not get the information related to whether the receiver has received all the data or not. this makes the communication prone to losing packets in the communication, thus leading to some packets dropout without the sender getting any information for flow control.

Nodes 0 and 1 are establishing a TCP connection, in which node 0 is the source and node 1 is the receiver. Here we have considered the source (node 0) as the stationary object while the receiver (node 1) is considered mobile. As the receiver gives acknowledgment in TCP hence its application agent is set as SINK.To check the effect of interference of TCP and UDP on each other, we have allocated both linksto the same channel and noted the observed recordings in Table 1. We then allocated different channels to each of them to measure the values without interference and noted the observed recordings in Table 2.

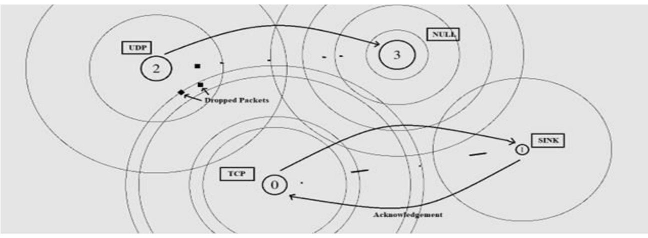


Figure 16. Setup for measuring interference for links in the same channel

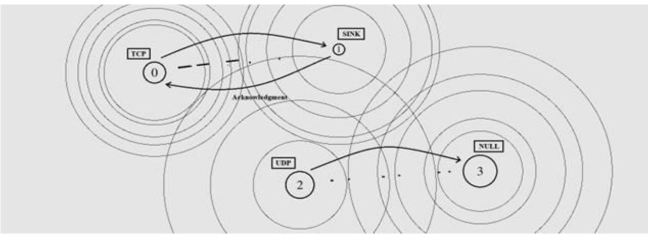


Figure 17. Setup for measuring interference for links in different channels

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165

|| Volume 10, Issue 12, December 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1012023 |

From Tables 1 and 2, we that when there are 2 links on the same channel, with one link being UDP, the packet loss increases due to interference from network links. In all cases, TCP Vegas performed better compared to TCP and TCP Reno because TCP Vegas is a congestion avoidance algorithm.

From Table 2, we observe that when no interference is present (i.e., when different channels are allocated), the PDR is much higher compared to when other transport agents are present on the same channel.

Table 1. Measurements when links are present in the same wireless channel

Routing protocol	Comparison agents	Individual agents	Observations			
			Send packets	*Received packets*	*PDR*	*Throughput*
AODV	TCP and UDP	TCP	13429	4342	48.998436	1.021764
		UDP		2238		0.511549
	TCP Vegas and UDP	TCP Vegas	13331	4261	51.316480	1.002608
		UDP		2580		0.589888
	TCP Reno and UDP	TCP Reno	13429	4342	48.998436	1.021764
		UDP		2238		0.511549
DSR	TCP and UDP	TCP	13333	4246	48.346209	0.999170
		UDP		2200		0.502862
	TCP Vegas and UDP	TCP Vegas	13224	4154	50.756201	0.977413
		UDP		2558		0.585110
	TCP Reno and UDP	TCP Reno	13333	4246	48.346209	0.999170
		UDP		2200		0.502862
OLSR	TCP and UDP	TCP	12979	3891	49.5262	0.915590
		UDP		2537		0.580428
	TCP Vegas and UDP	TCP Vegas	12147	3075	57.1993	0.723873
		UDP		3873		0.885283
	TCP Reno and UDP	TCP Reno	12979	3891	49.5262	0.915590
		UDP		2537		0.580428

Table 2. Measurements when links are present in different wireless channels

Routing protocol	Comparison agents	Individual agents	Observations			
			Send packets	*Received packets*	*PDR*	*Throughput*
AODV	TCP and UDP	TCP	14709	5622	99.857230	1.322984
		UDP		9066		2.072370
	TCP Vegas and UDP	TCP Vegas	14846	5776	99.973057	1.359291
		UDP		9066		2.072405
	TCP Reno and UDP	TCP Reno	14709	5622	99.857230	1.322984
		UDP		9066		2.072370
DSR	TCP and UDP	TCP	14575	5488	99.855918	1.291672
		UDP		9066		2.072388
	TCP Vegas and UDP	TCP Vegas	14696	5626	99.972782	1.324053
		UDP		9066		2.072407
	TCP Reno and UDP	TCP Reno	14575	5488	99.855918	1.291672

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165

|| Volume 10, Issue 12, December 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1012023 |

		UDP		9066		2.072388
OLSR	TCP and UDP	TCP	14091	5003	98.4032	1.177354
		UDP		8863		2.025986
	TCP Vegas and UDP	TCP Vegas	13205	4133	97.2435	0.972495
		UDP		8708		1.990577
	TCP Reno and UDP	TCP Reno	14091	5003	98.4032	1.177354
		UDP		8863		2.025986

V. CONCLUSION

We have observed the change in Packet Delivery Ratio and average throughput concerningthe change in the No. of nodes.PDRofUDP transport agent decreases rapidly as the No. of nodes increases. We observed that the TCP is more dependable compared to the UDP. It does not in the case of UDP ensure whether or not the data has arrived at the recipient.TCP Vegas showed the best performance with the routing protocols used. While TCP and its implementation TCP Reno did not have a significant difference in PDR.

Average throughput using a UDP transport agent initially remains higher as compared to the TCP and its variants, after the No. of nodes increases the average throughput values for UDP gradually decrease. At the same time, TCP and its implementationdid not have a significant difference in average throughput.we also observed that by allocating different channelsthe PDR is much higher compared to when other transport agents are present on the same channel.

REFERENCES

[1] S. Saranya, and Dr. R. Manika Chezian. (2016). Comparison of Proactive, Reactive, and Hybrid Routing Protocol in MANET. International Journal of Advanced Research in Computer and Communication Engineering ISO 3297:2007 Certified Vol. 5, Issue 7, July 2016

[2] Lawrence S. Brakmo, Sean W. O'Malley, and Larry L. Peterson. 1994. TCP Vegas: new techniques for congestion detection and avoidance. SIGCOMM Comput. Commun. Rev. 24, 4 (Oct. 1994), 24–35.

[3] Al-Dhief, Fahad & Sabri, Naseer & Albadr, Musatafa. (2018). Performance Comparison between TCP and UDP Protocols in Different Simulation Scenarios. International Journal of Engineering & Technology.

[4] Singh, Barinderpal & Hans, Rahul. (2015). TCP and UDP Based Performance Analysis of AODV, DSR, and DSDV Routing Protocols under Different Traffic Conditions in Mobile AdHoc Networks. International Journal of Future Generation Communication and Networking. 8. 73-92. 10.14257/ijfgcn.2015.8.2.7.

[5] Ahmad, Mushtaq & Khan, Zahid & Chen, Q. & Najam-ul-Islam, Muhammad. (2015). On the Performance Assessment of the OLSR Protocol in Mobile Ad hoc Networks Using TCP and UDP. 9502. 294-306. 10.1007/978-3-319-27293-1_26.

[6] Anjum, Shaista & Bhadauria, Sarita. (2011). TCP and UDP Based Analysis of AODV and OLSR in Mobile Ad-Hoc Networks. 10.1109/CSNT.2011.43.

INNO SPACE

SJIF Scientific Journal Impact Factor

Impact Factor: 8.165

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

निस्केयर NISCAIR

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

9940 572 462 6381 907 438 ijircce@gmail.com