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802.11 DCF in Dynamic MANET On-demand Routing

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Article Info	ABSTRACT
	A Mobile Ad-Hoc Network (MANET) is a collection of wireless mobile nodes that communicates with each other without using any existing infrastructure, access point or centralized administration .wireless LAN is an IEEE 802.11 standard supported DCF and MAC features. In this article discuss performance on Distributed Coordination Function (DCF) in Dynamic MANET on demand routing protocols on constant bit rate (CBR).Using Qualnet simulation tools 5.0.2 and finally discuss combine comparative performance analysis 802.11 DCF .The effective performance of 802.11 DCF in Dynamic MANET on demand routing protocol on the performance metrics such as 802.11 DCF: Broadcasts sent, Broadcasts received, Unicasts sent, Unicasts received, CTS packet sent, packet drops due to retransmissions limit, RTS packet sent, ACK packet sent, RTS retransmissions due to time out and packet retransmissions due to ACK timeout..

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1.   INTRODUCTION

MANET [5] is a collection of wireless mobile nodes that communicates with each other without using any existing infrastructure, access point or centralized administration. A variety of routing protocols with varying network conditions are analyzed to find an optimized route from a source to some destination. Each node can move randomly thus, each node function as a router and forward packet to each other device. Due to high node mobility network topology changes frequently. Therefore, routing in ad-hoc network becomes a Challenging task. QualNet 802.11 MAC [3,8] model is based on the IEEE Standard 802.11. It is acollection of MAC and PHY sepecification for wireless lan or 802.11 IEEE standard. The original standard was establised in 1997. 802.11 IEEE wireless LAN Standard both the MAC and physical layers to support various features such as higher bandwidth, QoS, security, and so on in mobile ad hoc wireless network (MANET).

DCF [3, 4,8,13] is a distributed channel access based on Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) [3,9] with method of the IEEE 802.11 MAC is DCF. The DCF shall be implemented in all STAs, for use within both ad hoc and infrastructure network configurations. Form STA1 to transmit to RTS, it shall sense the medium to determine, if another STA2 is transmitting. If the medium is not determined to be busy, then the transmission may proceed and send CTS frame . If the medium is determined to be busy, the STA1 shall defer until the end of the current transmission. The CSMA/CA distributed algorithm mandates that a gap of a minimum specified duration exist between contiguous frame sequences. A transmitting STA2 shall ensure that the medium is idle for this required   duration before attempting to transmit again. After deferral to an ongoing transmission, or prior to attempting to transmit again immediately after a successful transmission, the STA2 shall select a random backoff interval and shall decrement the backoff interval counter while the medium is idle. A refinement of the method may be used under various   circumstances to further minimize collisions. Here, the transmitting and receiving STA

exchange short control frames (Request-To-Send (RTS) and Clear-To-Send (CTS) frames) after determining that the medium is idle and after any deferrals or backoffs, prior to data transmission.

The Dynamic MANET On demand (DYMO) [1, 2, 6, *9*] is a reactive or on demand, multi-hop, uni-cast routing protocol that not update route information periodically. The DYMO is a small memory stores routing information and generated Control Packets when a node receives the data packet from route path. The basic operations of Dynamic MANET On demand source router generates Route Request (RREQ) messages and floods them for Destination routers for whom it doesn't have route information. Intermediate nodes store a route to the originating router by adding it into its routing table during this dissemination Process. The target node after receiving the RREQ responds by sending Route Reply (RREP) Message. RREP is sent by uni-cast technique towards the source. An intermediate node that receives the RREP creates a route to the target and so finally it reaches to originator. Then Routes have been established between source and destination in both directions.

To find a route between the end-points is a major problem in mobile multi hop ad-hoc dynamic networks. The problem is further aggravated because of the nodes mobility. Many different approaches are reported to handle this problem in recent years, but it is very difficult to decide which one is best routing algorithm. Other aspects of ad-hoc networks are also subject to current research, especially the dynamic changing network topology of nodes.

For this scenarios to create in Qualnet 5.0.2 simulation tools are used both wireless and wired network. Qualnet is faster 10 times as compare to Glomosim .actually Qualnet is advance version of glomosim but in case of Glomosim only used for wired network. firstly create a 20 node we use random waypoint mobility model, this model the nodes randomly selects a position, moves towards it in a straight line at a constant speed that is randomly selected from a range from source node to destination node. In the scenarios use Constant Bit-Rate (CBR) traffic flows are used with 4 packets/second and a packet size of 512 bytes and data rate 2 Mbps from source node to destination node respectively [12,10,9,18] to [15,3,2,13]. To evaluate the performance of routing protocols, we used different quantitative metrics to compare the performance of Dynamic MANET On demand routing protocol. They are performance metrics such as 802.11 DCF: Broadcasts sent, Broadcasts received, Unicasts sent, Unicasts received, CTS packet sent, packet drops due to retransmissions limit, RTS packet sent, ACK packet sent, RTS retransmissions due to time out and packet retransmissions due to ACK timeout. Figure 1 showing the node placement scenarios and figure 2 showing the animation view of those scenarios.

We have done in literature review in the chapter 1Introduction to explain the comparing of many research papers with other papers, that it is innovative, finding many problems and its solution. In chapter 2 discuss the research methodology and its platform that gives the better performance as compare to other routing protocols.in chapter 3 showing the analysis and results of the basis of taken performance metics and final chapter 4 conclusion .

2. RESEARCH METHOD

We are using the Optimized Network Engineering Tool (QUALNET 5.0.2) software for our simulations. QUALNET is a network simulator. It provides multiple solutions for managing networks and applications e.g. network operation, planning, research and development(R&D), network engineering and performance management. QUALNET 5.0.2 is designed for modeling communication devices, technologies, protocols and to simulate the performance of these technologies. QUALNET 5.0.2 is a commercial version of glomosim. QUALNET 5.0.2 Technologies provides solutions for the academic research, for example assessment and improvement of wireless network technologies such as WiMAX (Worldwide Interoperability for Microwave Access), Wi-Fi, UMTS (Universal Mobile Telecommunications System) and seamless communication and Design and assessment of MANET protocols, analysis of optical network, and enhancement in the core network technologies such as IPv6, IPv4, MPLS and power management schemes in wireless sensor network [2]. Now a day QUALNET is very useful software in research fields.

The QUALNET usability can be divided into four main steps.
- The QUALNET first step is the modeling or scenarios, it means to create network model.
- The sec step is to choose and select statistics like CBR, FTP etc.
- Third step is to simulate the network.
- Fourth and last step is to view and analyze results.
- All these steps are shown schematically in the below figure 1.
- In figure 2 and 3 showing the nodes placement and animation view of the scenarious.
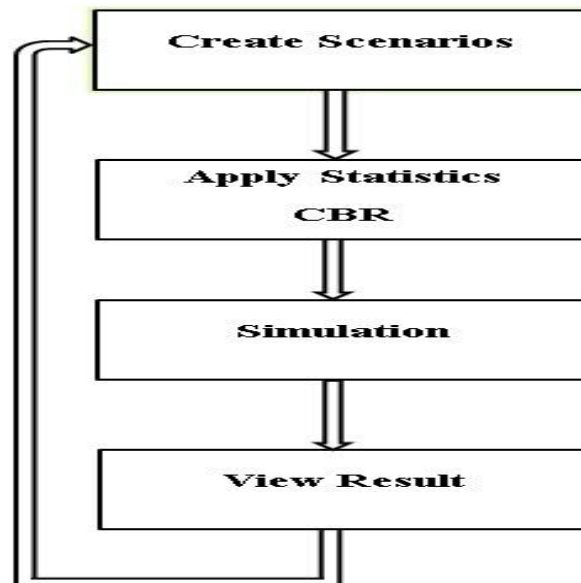- In table 1 and table 2 showing the parameters setup and performance metrics.
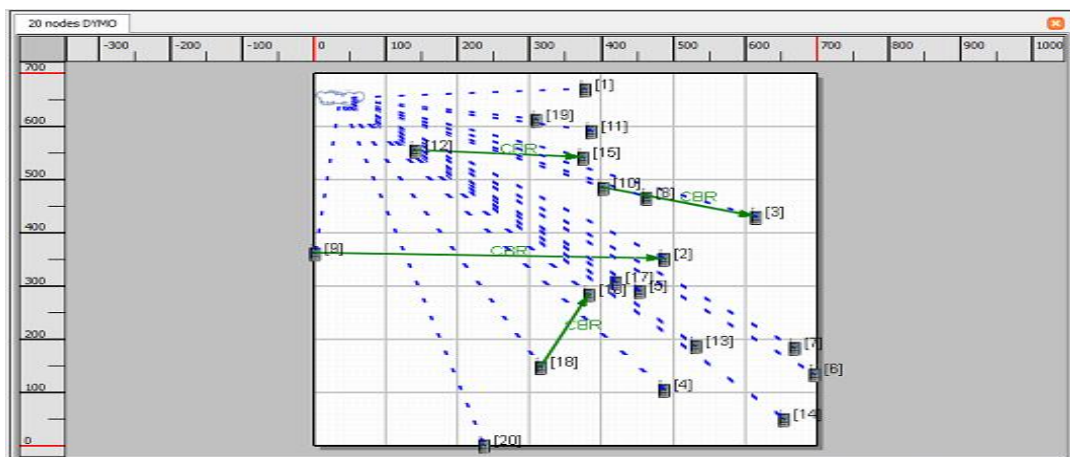
Figure 1 Flow Chart of QUALNET 5.0.2

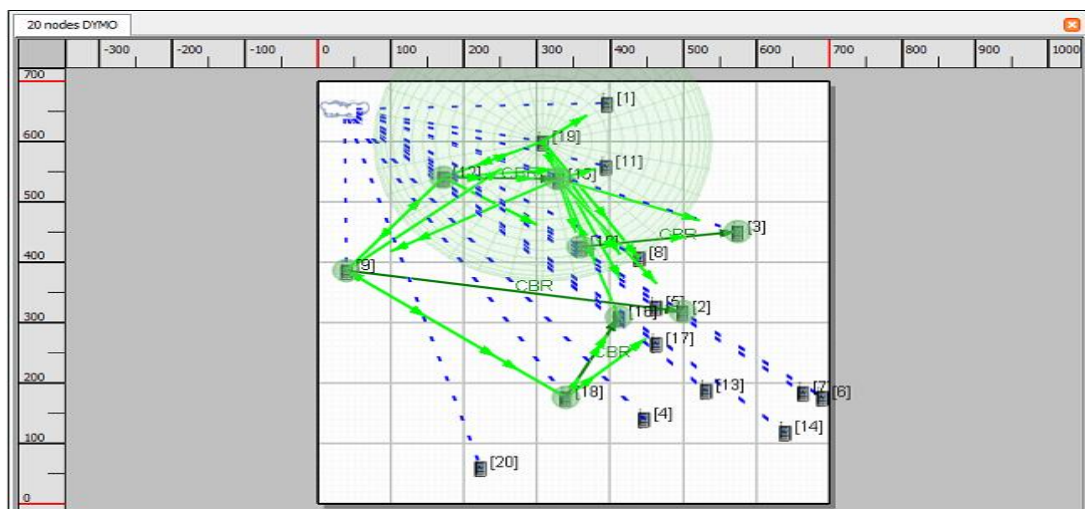Figure 2: Nodes Placement Scenarios for Dynamic MANET On demand in 802.11 DCF

Figure 2: Animation View of Dynamic MANET On demand in 802.11 DCF

Table 1: *Parameters Setup*

Parameters	Values
No of Nodes	20
Area	700m*700m
Routing Protocols	DYMO
Fading Model	Rayleigh
Energy Model	Mica Motes
Battery Model	Simple linear
Terrain File	DEM
Node Placement	Random node placement
Simulation time	180 sec
Channel frequency	2.4Ghz
Traffic Source	CBR
Data rate	2 Mbps
Path loss-model	Two ray model
Antenna-model	Omni directional
PHY-Model	PHY802.11b

Table 2: Performance Meterics [10, 13, 14]

Metrics	Description
Broadcasts sent	Packets broadcast to all radios with CBR within transmission range of the specific network.
Broadcasts received	Successfully packet received by this radio with specific given network destination for all radios.
Uni-casts sent	Packets with a specific destination address transmitted on the channel with transmission range.
Uni-casts received	Packets destined for this specific radio and successfully received by radios.
CTS packet sent	Specific Packets rescheduled for transmission due to lack of clear to send response to request to send transmission in given specific time duration of the packet.
Packet drops due to retransmissions limit	Packets not rescheduled after exceeding The maximum number of unsuccessfully delivered fragments
RTS packet sent	Request to sent packet from source to destination by proper channel of the networks.
ACK packet sent	Packet received successfully**.**
RTS retransmissions due to time out	Packets rescheduled due to lack of ACK Response to packet transmission due to time out of the packet interval.
Packet retransmissions due to ACK timeout	Packets rescheduled due to lack of ACK Response to packet transmission due to time out of the packet interval.
Packet retransmissions due to ACK timeout	Packets rescheduled due to lack of ACK Response to packet transmission due to time out of the packet interval.

3. RESULTS AND ANALYSIS

In this section, it is explained the results of research 802.11 DCF based broadcast packet send and receive and at the same time is given the comprehensive discussion on the basic of performance metrics. Results showing in figures 3.1 Performance of 802.11 DCF: Broadcast Sent and Broadcast Received vs Nodes, 3.2 Performance of 802.11 DCF: Uni-casts Sent and Uni-casts Received vs Nodes (s), 3.3 Performance of 802.11 DCF: CTS packet sent, packet drops due to retransmissions limit, RTS packet sent vs Nodes (s) and 3.4 Performance of 802.11 DCF: CTS packet sent, packet drops due to retransmissions limit, RTS packet sent vs nodes (s).

3.1. Performance of 802.11 DCF: Broadcast Sent and Broadcast Received vs Nodes

Showing the below figure 3 is 802.11 DCF broadcast 20 packet sent starting from zero metric value at node 1, from node 2 to 8 with constant metric value is .5 and largest metric value of is 4 at the nodes 9 and 12 and received each Packets broadcast to all radios at node 1 metric value is 16, lower metric values is 4 at node 9 and largest metric values 22 at nodes 8 and 10but average metric value is 12 at various nodes like 4, 5,6,14 and 20.
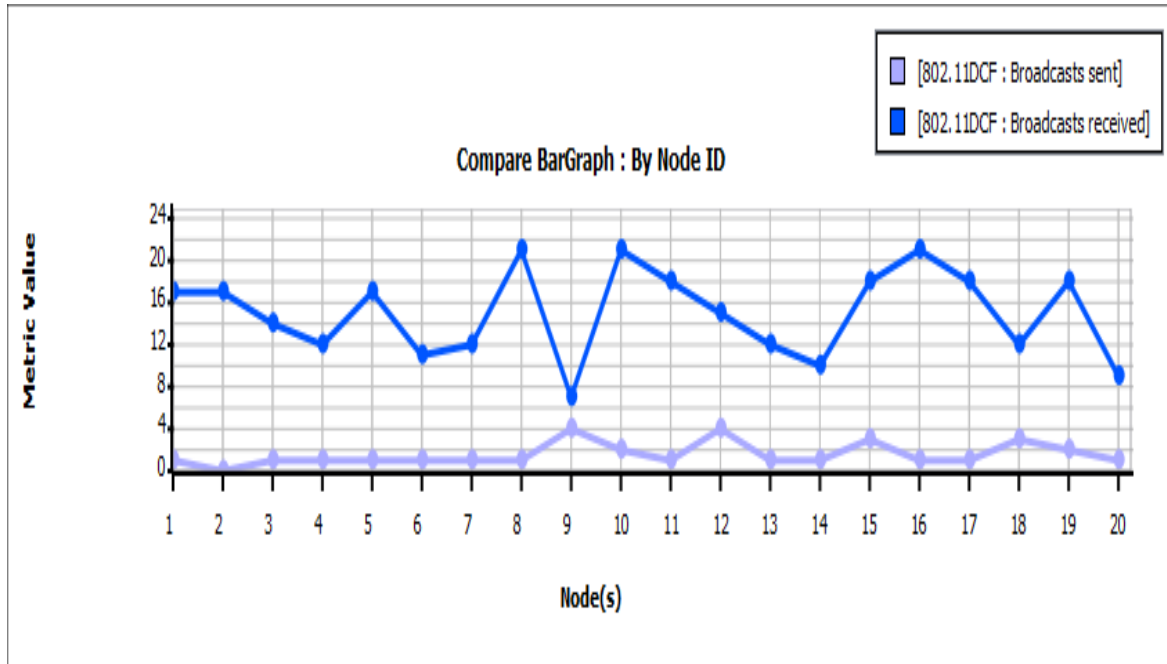

Figure 3: Showing the Performance of 802.11 DCF: Broadcasts sent and Broadcasts received Vs Nodes (s)

3.2. Performance of 802.11 DCF: Uni-casts Sent and Uni-casts Received vs Nodes (s)

Showing the below figure 4 is 802.11 DCF Uni-cast 20 packet sent starting from zero metric value at node 1, from node 4 to 8 with constant metric value is 0 and largest metric value of is 50 at the node 18 and average metric values is 22 at node 9 and received Packets broadcast to all radios at nodes 1,4,5,6,7,8,10,11,12,13,14,17,19,and 20 lower metric value is 0, at node 2,3, 15,16,18 largest metric value is 25 and average metric values 5 at nodes and 9 .
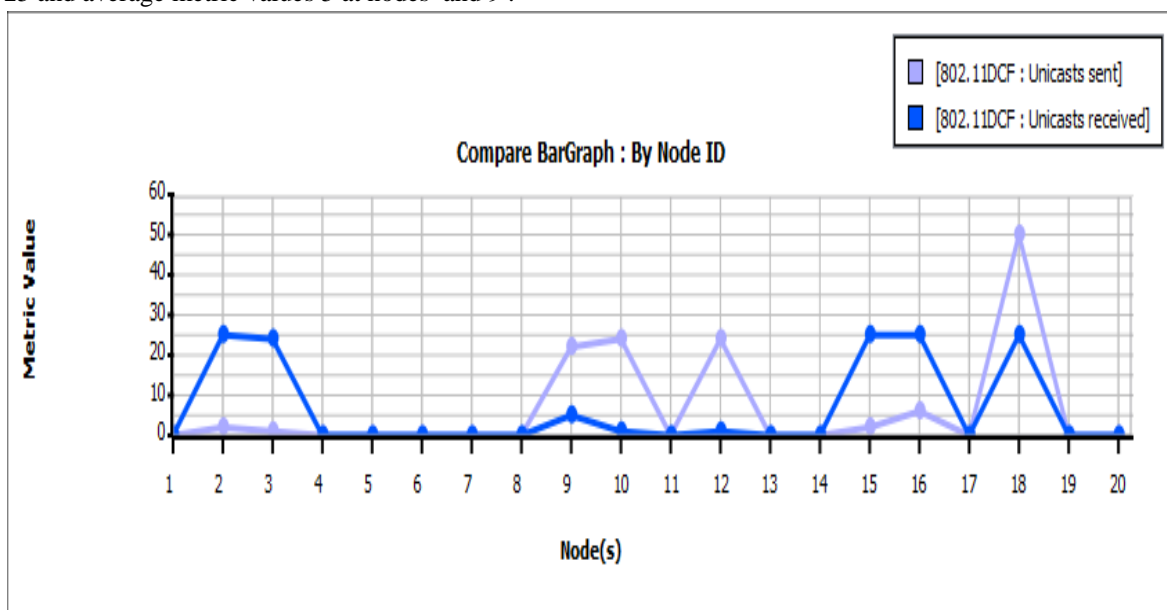

Figure 4: Showing the Performance of 802.11 DCF: Uni-casts sent and Uni-casts received Vs Nodes (s)

3.3 Performance of 802.11 DCF: CTS packet sent, packet drops due to retransmissions limit, RTS packet Sent vs Nodes (s)

Showing the below figure 5 is 802.11 DCF: CTS (Clear to Sent) packet sent at nodes 2,3,9,15,16,and 18 with metric values respectively 25,25,5,25,30, and 45 but packet drops due to retransmissions limit at node 1,3,4,5,6,7,8,10,11,1,2,13,14, 15, 16,17,18,19 and 20 with metric value is 0 and RTS (Request to Sent) packet at nodes 1,3,4,5,6,7,8,11,13,14,,17,19 and 20 with metric values 0 but in case of nodes 8 to node 11 metric value increase zero to 55 at node 9 and suddenly down metric value is zero at node 11 this process continue again from node 17 to 19 at middle node 18 metric value is 55.
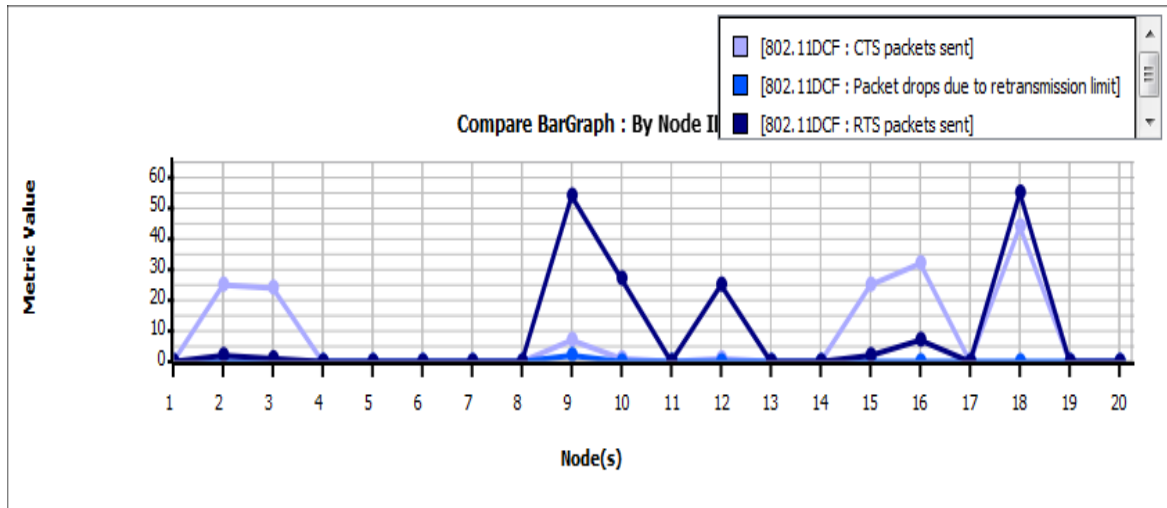

Figure 5: Showing the performance of 802.11: CTS packet sent, packet drops due to retransmissions limit, RTS packet sent Vs Nodes (s)

3.4 Performance of 802.11 DCF: ACK packet sent, RTS retransmissions due to timeout, packet retransmissions due to ACK timeout vs Nodes (s)

Showing the below figure 6 is 802.11DCF: CTS (Clear to Sent) packet sent at nodes 2,3,9,15,16,and 18 with metric values respectively 25,25,5,25,30, and 45 but packet drops due to retransmissions limit at node 1,3,4,5,6,7,8,10,11,1,2,13,14, 15, 16,17,18,19 and 20 with metric value is 0 and RTS (Request to Sent) packet at nodes 1,3,4,5,6,7,8,11,13,14,,17,19 and 20 with metric values 0 but in case of nodes 8 to node 11 metric value increase zero to 55 at node 9 and suddenly down metric value is zero at node 11 this process continue again from node 17 to 19 at middle node 18 metric value is 55
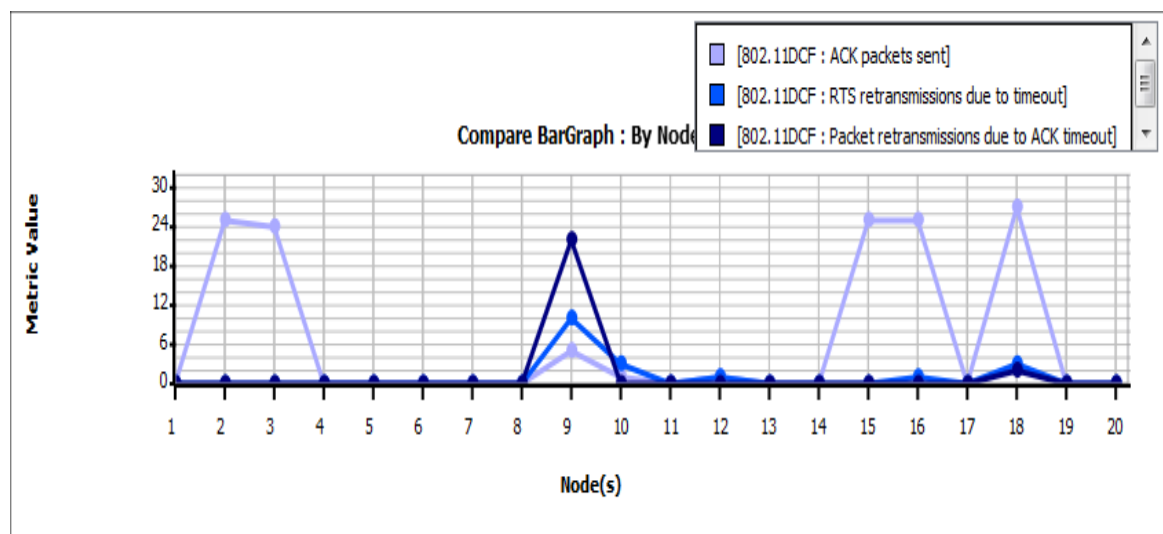

Figure 6: Performance of 802.11 DCF: ACK packet sent, RTS retransmissions due to timeout, Packet retransmissions due to ACK timeout Vs Nodes (s)

4. CONCLUSION

This article gives the 98% effective performance of 802.11Distributed Coordination function in Dynamic MANET on demand routing protocol on constant bit rate and using random waypoint model and showing the comparative performance of on performance metrics such as performance metrics such as 802.11 DCF: Broadcasts sent, Broadcasts received, Unicasts sent, Unicasts received, CTS packet sent, packet drops due to retransmissions limit, RTS packet sent, ACK packet sent, RTS retransmissions due to time out and packet retransmissions due to ACK timeout as compare to other routing protocol because Qualnet 5.0.2 simulation tools is faster. Its takes very less time for execution of the scenarious as compare to other simulators like NS2, OPNET and Glomosim.In future you can implement 802.11 MAC, different routing protocols; energy consumed in different mode and also takes more traffic sources.

ACKNOWLEDGEMENTS

REFERENCES

[1] C. E. Perkins and E. M. Royer, "*Ad Hoc On-demand Distance Vector Routing,*" In Proceedings of the 2nd IEEE Workshop on Mobile Computing Systems and Applications, New Orleans, LA, 90-100, 1999.

[2] C.Siva Rammurty and B.S. Manoj,"*Ad hoc wireless networks architectures and protocols*" ISBN 978-81-317-0688-6, 2011.

[3] Dinesh Singh, *et al*,"Comparative Performance Analysis of LANMAR, LAR1, DYMO and ZRP Routing Protocols in MANET using Random Waypoint Mobility Model", *IEEE*, PP 62-66, 2011.

[4] G.Vetrichelvi and Dr.G.Mohankumar," Performance Analysis of Load Minimization In AODV and FSR", *International Journal of Information & Network Security (IJINS)*, Vol.1, No.3, pp. 152~157 ISSN: 2089-3299, August 2012.

[5] Jogendra Kumar," Broadcasting Traffic Load Performance Analysis of 802.11 MAC in Mobile Ad hoc Networks (MANET) Using Random Waypoint Model (RWM)", *International Journal of Information & Network Security (IJINS)* Vol.1, No.3, pp223~227 ISSN: 2089-3299, August 2012.

[6] Jogendra Kumar," Effective Performance of Dynamic Source Routing Protocol on Random Waypoint Model (RWM) Using CBR", *International Journal of Information & Network Security (IJINS),* Vol.1, No.4, pp. 306~312 ISSN: 2089-3299, October 2012.

[7] M.L Sharma, *et al*, "Performance Evaluation of MANET Routing Protocols under CBR and FTP traffic classes *", Int. J. Comp. Tech*. Appl. Vol 2 (3), 393-400, 2011

[8] Parma Nand, Dr. S. C. Sharma, " Routing Load Analysis of Broadcast based Reactive Routing Protocols AODV, DSR and DYMO for MANET", *International journal of grid and distributed computing* vol.4, No.1, PP 81-92, March 2011

[9] QualNet documentation,"*QualNet 5.0 Model Library: Advanced Wireless*", http://www.scalablenetworks.com /products/Qualnet/download.php#doc.

[10] Rolf Ehrenreich Thorup "Implementing and Evaluating the DYMO," February 2007.

[11] Shaily Mittal and Prabhjot Kaur," *Performance Comparision of AODV, DSR and ZRP Routing Protocols in MANET'S,*" International Conference on Advances in Computing, Control, and Telecommunication Technologies , IEEE Computer Society. pp 165-168, 2009.

[12] Sree Ranga Raju and Jitendranath Mungara," Performance Evaluation of ZRP over AODV and DSR in Mobile Ad hoc Networks Using Qualnet", *European J Sci Res*, 45(4):658-674, 2010.

[13] The government standard is available at: Digital Elevation Model Standards." *U.S. Geological Survey*. http://rockyweb.cr.usgs.gov/nmpstds/demstds.html, 1998.

[14] The *Qualnet 5.0.2* simulator tools online available www.scalable-networks.com.

[15] Vivek Thaper, *et al*," performance analysis of adhoc routing protocols using random waypoint mobility model in wireless sensor networks", *IJCSE*, ISSN:0975-3397,Vol 3,8,pp 3059-3063, Augest 2011.

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