International Journal of Current Engineering and Technology
ISSN 2277 - 4106

Available at http://inpressco.com/category/ijcet

Research Article

Performance Analysis of DSR, DYMO, OLSR and RIP Protocols of Manet using CBR and VBR Transmission Traffic Mode

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Accepted 10 October 2013, Available online 21 October 2013, **Vol.3, No.4 (October 2013)**

Abstract

A Mobile adhoc network is a collection of nodes by wireless link without using any pre-existing infrastructure like base station, access point, etc and allowing portable device to establish communication in MANET. Many protocols are developed in MANET but it is not decided which one is best. In this paper we present the behavior of four routing protocols DSR, DYMO (Reactive Routing Protocol) and OLSR, RIP (Proactive Routing Protocol). We have used 802.11n network with 802.11e MAC protocol which is also called as Wi-Fi. The performance analysis is based on different network matrices such as First message received, Last message received, Total message received, End to End delay, Throughput, Average Jitter, Average Delay and Energy Consumption. QualNet6.1 is used as a simulation tool to evaluate the performance of these protocols using both the transmission traffic modes CBR and VBR.

Keywords: *MANET, DSR, DYMO, OLSR, RIP, CBR, VBR, QualNet6.1.*

1. Introduction

A Mobile Adhoc Network (MANET) is a collection of wireless mobile nodes with dynamic topology which can dynamically self-organize and central administration in to arbitrary and temporary network topologies. In this type of network, nodes do not have promoted knowledge about topology which is used in the network. MANETs are very useful for many applications (Al-Ani. R 2011). Wireless networks are play important role in the area of wireless network and provide the lots of flexibility for several type of application due to its feature like they allow the establishment of temporary communication without any pre existing infrastructure. The initial requirement of MANET, how to deliver the message efficiently from source to destination nodes because nodes topology changes frequently this makes routing very problematic. MANETs have also low bandwidth and limited energy capacity. In MANET every nodes act as a router in the network. The major challenge of adhoc network is the development of routing protocols that can efficiently find routes between two communicating nodes (Wieselthier J. E et al 2005). Routing protocols are classified into three categories: (1) Reactive Routing Protocol (2) Proactive Routing Protocol (3) Hybrid Routing Protocol. Here we will discuss two routing protocols Reactive and proactive Routing Protocols.

1a. Reactive Routing Protocol: Reactive routing protocol also known as On-Demand Routing Protocol.

Reactive routing protocol creates routes only when it is desired by the source node (Kumar, G. V et al 2011). Route discovery invokes a route determination procedure. The procedure is terminated when (a) A route has been found. (b) No route is found after all route permutations are examined. Reactive routing protocol do not maintain routing table frequently or constantly change their routing table with the latest routing topology in the network. Reactive routing protocol is considered efficient when the route discovery process is completed and less then the data transmission. As compared to the total available communication bandwidth, the network traffic generator caused by the route discovery mechanism is less. One main advantage of Reactive routing protocol is good for light load but collapse in large loads and this protocol has one main drawback, it is very time taking process.

1b. Proactive Routing Protocol: Proactive routing protocol is continuously evaluate the route and attempting to maintain consistent, up-to-date routing information, so when a route is needed one may be ready immediately (Gupta. N et al 2010). In proactive routing protocol when the network topology change then protocol responds by propagating update through the network to maintain a consistent view. In this protocol each and every nodes maintain the routing table which contain the routing information in the network about topology an update the routing table periodically through periodic exchange of control message between nodes because each and every

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nodes should have latest information about any topology change in the network. Proactive routing protocol is not appropriate for large network because they need to maintain node entries for each and every node in routing table of every node.

The rest of paper is classified as follows: in section 2 we present types of routing protocols. Section 3 presents related works. Section 4 presents simulation setup. Section 5 presents performance metrics. Section 6 presents conclusion.

2. Routing Protocols Taken Into Consideration

A. Dynamic Source Routing (DSR)

DSR protocol is efficient routing protocol and design for use in multihop adhoc network. (Johnson David B at al, 2009) In DSR each data packet send carries complete, order list of node through which packet will pass, and allowing packet routing to be trivially loop free and avoiding the need for up to date routing information in the intermediate node . DSR allows every node to dynamically determine the route from source node to destination node. It provides the asymmetric routes and unidirectional links. When source node wants to communicate to the destination node then first of all check it routing table to find the appropriate route. If source node find out the appropriate route then communication start immediately for reaching the destination node. DSR is classified into two mechanisms.

(a). **Route discovery mechanism:** Route discovery mechanism is a way by which source node wants to send a packet to the destination node obtains a source route to the destination. If a node saw the packet before, discards a route to it. Otherwise, if the route is not found then packet stats communication again in the network, the route looks up its route caches to look for a route to destination (Nand Parma et al, 2011). If source node finds route in its route cache, send a route reply packet, which is send to the source by route discovery.

(b). **Route maintenance:** In this phase when source node sends a message to the destination node then it must verify that the next hop correctly receives the message. If next hop is not correctly receives the message then node must send route error to the node responsible for generating this route header and source start the route discovery again.

B. Dynamic Manet On –Demand (DYMO)

The DYMO protocol uses source routing and intended for use by mobile node in wireless networks. It offers adaptation to changing network topology and determines unicast route between nodes within the network (Nand Parma et al, 2011). When the node wants to communicate with another node then it searches the route in its cache otherwise it broadcast the route request message for determining the route for the destination node in the network. The route request message forwarded by intermediate node one by one to their neighbor till it reaches to its destination point. DYMO is classified into two categories.

(a) Route discovery: In the DYMO route discovery process, if the source point has not route entry to the destination point, it broadcast a route request message to its every intermediate neighbors. If neighbor has an entry to the destination, then it replies with route reply message else it broadcast the route request message. While broadcasting the route request message, the intermediate node attaches its address of the message. One of the special advantages of DYMO is that, it is energy efficient. If any node has low energy, it has choice to not participate in the route discovery process. In this case the node does not forward any of the incoming route request message (MIAO Quan-xing et al, 2010). It is analyze the incoming message and update its routing table for using the next time.

(b) Route Management*:* In the route maintenance process during the route operation each node is to continuously observes the status of link and maintain the routing table with the latest information in the network, route maintenance process is needed when any route error message are occurs, route error message produce by a node when link to any other node brakes. Then generating node broadcast the route error message to only that node which is involved with the link failure then routing table is update and delete to the entry of broken link. If any nodes face a packet to the same destination after deletion of route entry then route discovery process needs to be being again.

C. Optimized Linked State Routing (OLSR)

OLSR is a proactive link state routing protocol where the routes are always available when needed. It maintains routing information by sending link state information to selective nodes after exchanging topology information with other node of the network regularly (Ali, S et al, 2010). In this protocol two concept are used -

(a) **Multi Point Relays:** OLSR based on multi point relays. Multi point relays minimize flooding and selected nodes which forward broadcast message during the flooding process. It is reduces the information overhead as compare to the flooding. In the flooding mechanism every node transmits each message again and again when it is receive the first copy of the message. In OLSR, link state information is generating only by the node which is selects as multi point relays.

(b) **Optimized link state:** Optimization is accomplished by minimizing the number of control message flooding in the networks(Ali, S et al, 2010). OLSR supply optimal route to the hops. This protocol is good for a large and dense network. OLSR has two types of control messages.

- **Neighbor sensing:** Each node periodically broadcast its Hello message for containing the information about its neighbors and their link status. Hello message are received by all one hop neighbor. Hello message contains list of address of the neighbors to which there exists a valid bi-directional link and list of address of the neighbor which is heard by nodes. Hello message serves link sensing, neighbor detecting, Multi point

relays selection signaling and selected multi point relays.

- **Topology control:** This message is forwarded like usual broadcast message and message might not be sent if there are not updates. It contains multi point relays selector and sequence number. Each and every node maintains a routing table according to the topology control message.

D. Routing Information Protocol (RIP)

RIP is a routing protocol for exchanging routing table information between routers (Malkin G et al, 2008). Routing updates must be passed between routers so that they can make the proper choice on how to routes a packet. RIP is a simple intra domain protocol and straightforward Implementation of Distance Vector Routing. Each router advertises its Distance Vector every 30 seconds to all of its neighbors. RIP always uses 1 as link Metris. Routers are timeout after 13 minute if they are not updated.

3. Related Works

In this paper we are compare four routing protocol DSR, DYMO (Reactive Routing Protocol) OLSR, LAR (Proactive Routing Protocol) using two transmission traffic mode CBR (constant bit rate) and VBR (variable bit rate) and try to find out which one is best for which routing protocol and analyzing the performance of First Message Received, Last Message Received, Total Message Received, End to End Delay, Throughput on application layer. Average Jitter and Average Delay on network layer. Energy consumption in transmit mode, receive mode and idle mode on physical layer. Below explain the CBR and VBR in detail.

(A) Constant Bit Rate (CBR): The constant bit rate (CBR) traffic generator generates at the constant rate by transmitting generic multimedia traffic packets of fixed size at a fixed rate. It is generally used to provide background traffic that the performance of other application being analyzed or to simulate. CBR application includes services such as video-conferencing and telephone.

(B) Variable Bit Rate (VBR): The Variable bit rate is generally used to fill in background traffic in order to affect the performance of other application being analyzed or to simulate the performance of generic multimedia traffic. The VBR is used for connections that transport traffic at variable rate:

(a). Traffic that relies on accurate timing between traffic source and destination.

(b). Traffic for which there is no inherent reliance on time synchronization between the traffic source and destination but there is a need for an attempt at a guaranteed bandwidth or latency e.g. Frame Relay Interworking.

Presented below is a brief review of some of the latest research works in the related field:

Charu Wahi et al (February, 2013): In MANET, the limited transmission range of wireless nodes, multiple "hops" may be needed for effective communication across the network. Consequently, many routing algorithm have come into existence to satisfy the needs of communication in such network. Main objective of this paper is that how scalability and mobility of nodes together, affect the routing protocol by simulating two routing protocol AODV and DSR using QualNet and it compares on the basis of throughput and end-to-end delay and show that the throughput of DSR increases as compared to AODV with increase in number of nodes and pause time, whereas average delay for AODV decreases with mobility and scalability.

Priyanka Jangir and Saurabh Mishra (2013): The performance of an Ad-Hoc network depends on the kind of routing protocol. Therefore high efficient routing is must for better communication. Important observation of this paper, comparison is made between Table Driven (Proactive) and On Demand (Reactive) protocol which can be differentiated on the basis of their routing information update mechanism. In this paper used QualNet which is most accurate and time efficient.

J Kumar (Dec, 2010): In MANET, due to mobility of nodes network topology changes frequently and thus, routing becomes a challenging task. A variety of routing protocol with varying network conditions is analyzed to find an optimized rout from source to some destination. Main objective of this paper is to performance comparison of five popular mobile adhoc networks routing protocols i.e. DSR, DYMO, AODV, ZRP and OLSR in variable pause time with network simulator QualNet from scalable networks to evaluate the performance of these protocols.

Swati Bhasin et al (July, 2012): The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic. This challenge sets a new demands on MANET routing protocol. Main objective of this paper compares the performance based on jitter present in transmission of packet in a MANET by using different types of protocols viz: Proactive, Reactive, Hybrid. This system is developed for IEEE 802.11b based Wireless network and simulated through QualNet 5.0. Packet size and No. of users are the two parameters in this paper which helps to find out the suitable type of traffic that can be used in a MANET.

Niranjan Kumar Ray et al (June, 2012): In MANET, multi – hop wireless network, proper utilization of battery power is very much necessary to maintain network connectivity. If the battery power of nodes drains quickly then its connectivity in its neighborhood will be lost. Important observation of this paper is to present network lifetime is very much crucial as compared to other network parameters and find out the network lifetime at different node mobility and at different network load using different type of routing protocol.

Dr. Ritika and Dr. Nupur (2012): In MANET routing protocol helps to establish the communication between source node and destination node by sending and receiving packet. Lots of protocols are developed in this area but not easier to decide which one is the good. In it presents the behavior of some protocol based on CSMA/CA MAC

protocol are analyzed and compare on the basis of some performance matrices like that energy consumption in transmit mode and receive mode and also test competence and effectiveness of some protocol under diverse network scenarios costing is done by means varying load by varying CBR data traffic load change number of nodes and mobility.

Nilesh P. Bobade and Nitiket N. Mhala (February, 2012): In MANET different method and simulation environments give different result. It is not clear how these different protocols perform under different environment. One protocol may be the best in on network configuration but the worst in another. Main objective of this paper is that to compare the performance of two reactive routing protocols. As per finding the differences in the protocol mechanics lead to significant performance differentials for both of these protocols. Always the network protocols were simulated as a function of mobility, but not as a function of network density.

Mohammad Ali Mostafavi et al (Oct, 2012): In Mobile Ad-Hoc network nodes can join or disconnect from the network any time and transfer packet in peer to peer mode or a multicast mode. Nodes are connected by way of wireless link and from a random topology graph. Multi hops can locate between diversity of nodes route as a consequence from the communication. Main objective of this paper is the performance evaluation of three well-known MANET routing protocols: AODV, DSR and OLSR.

4. Simulation Setup

(A) Simulation Tools Used: In this paper we are using the QualNet6.1 simulation tool. The QualNet communication simulation platform a planning, testing and training tool

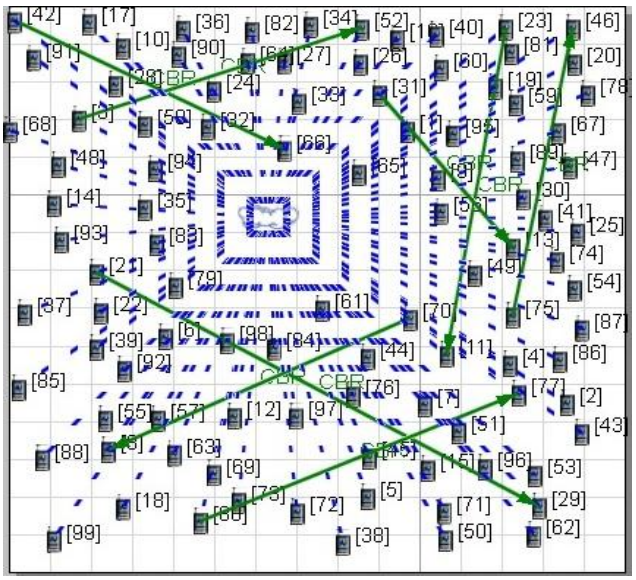


Fig (a) Simulation scenario of 100 nodes with 8 CBR transmission traffic modes.

that mimics the behavior of real communication network, simulation is a cost effective method for developing, deploying and managing network centric system throughout their entire life cycle. User can evaluate the behavior of the network and test combination of network features that are likely to work. QualNet provides a comprehensive environment for designing protocols, creating and animating network scenario and analyzing their performance.

(B) Snapshots: The snapshot of the simulation environment is shown in fig (a)

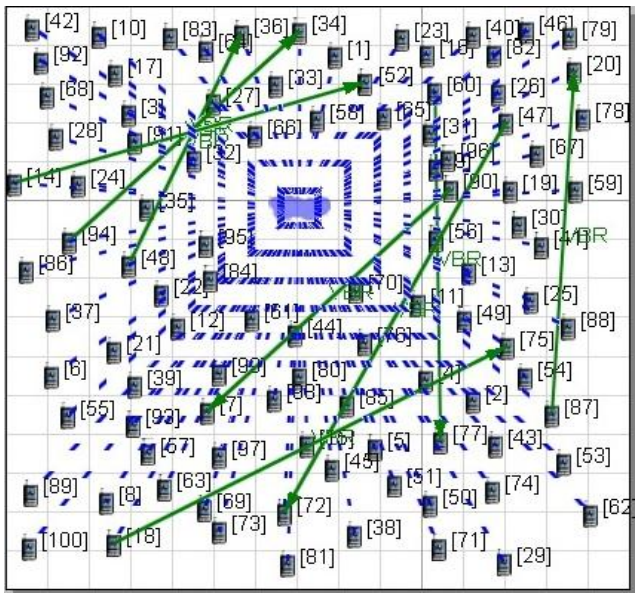


Fig (b) Simulation scenario of 100 nodes with 8 VBR transmission traffic modes.

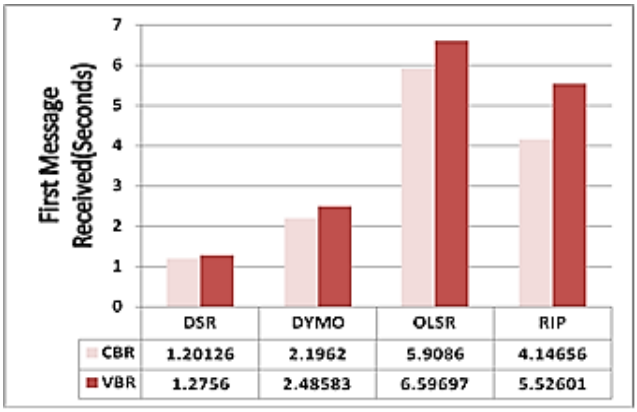
(C) Simulation Parameters

Table 1 simulation parameters which is considered for simulation setup-

Parameter	**Value**
Simulator	QualNet6.1
Routing Protocol	DSR, DYMO, OLSR, LAR
Number of Nodes	100
Transmission Power	20dBm
Simulation Time	30s
Simulation Area	1500X1500
Mobility Model	Random Way Point
Traffic Type	CBR, VBR
Size of Packet	512bytes
Node Placement	Random
Energy Model	Generic
MAC Protocol	IEEE 802.11e
Physical Layer Model	IEEEE 802.11n

5. Performance Matrices

A. First Message Received: Time when first message is received in second. Below fig (A) presents the performance of first packet receives using different type of routing protocols with CBR and VBR.



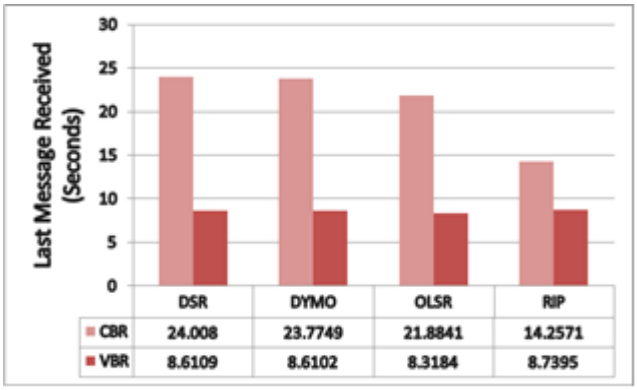
When we using CBR traffic mode from fig(A)

- OLSR receives maximum number of first message on the server side followed by RIP, DYMO and DSR.

When we using VBR traffic mode from fig (A)

- OLSR receives maximum number of first message on the server side followed by RIP, DYMO and DSR.

B. Last Message Received: Time when last message is receives in second. Below fig (B) presents the performance of last packet receives using different type of routing protocols with CBR and VBR.



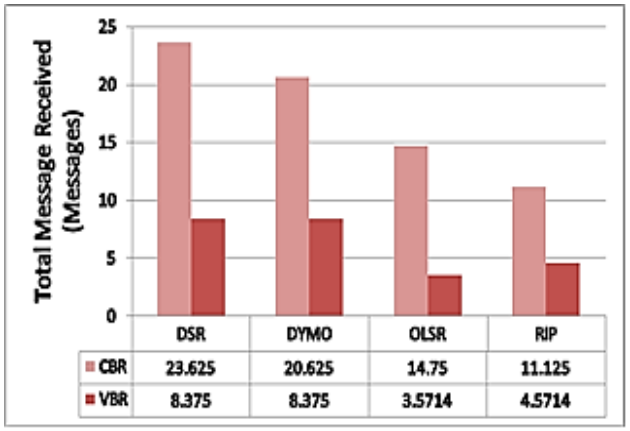
When we using CBR traffic mode from fig (B)

- DSR receives the maximum number of last message on the server side followed by DYMO, OLSR and RIP.

When we using VBR traffic mode from (B)

- RIP receives the maximum number of last message on server side followed by DSR, DYMO and OLSR.

C. Total Message Received: Time when total number of packet receives in second at server side. Below fig (C) presents the performance of total packet receives using different type of routing protocols with CBR and VBR.



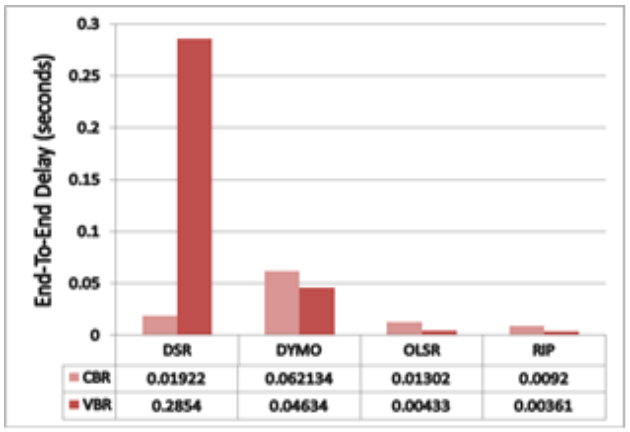
When we using CBR traffic mode from fig (C)

- DSR receives the maximum number of total message at server side followed by DYMO, OLSR and RIP.

When we using VBR traffic mode from fig (C)

- DSR and DYMO both protocol receives maximum number of total message at the server side followed by RIP and OLSR.

D. End To End Delay: End to End delay is the average time due to the route discovery, queuing, propagation and transfer time. It takes data packet to reach the destination point. Below fig (D) presents the performance of End to End delay using different type of routing protocols with CBR and VBR.



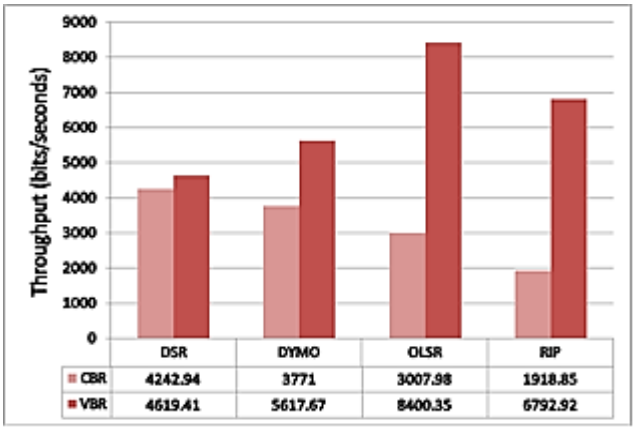
When we using CBR traffic mode from fig (D)

- RIP has minimum value of End to End delay at server side followed by OLSR, DSR and DYMO.

When we using VBR traffic mode from fig (D)

- RIP has minimum value of End to End Delay at server side followed by OLSR, DSR and DYMO.

E. Throughput: Throughput of routing protocol means that average rate of successful message deliver over the communication channel from source to destination. It is measure in bit per second. Below fig (E) presents the performance of throughput using different type of routing protocol with CBR and VBR.



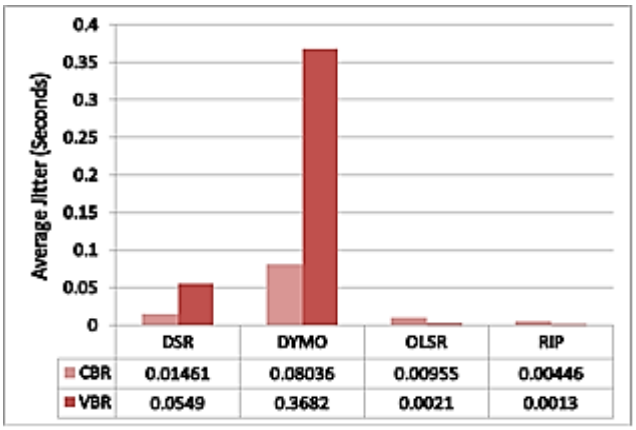
When we using CBR traffic mode from fig (E)

- DSR has maximum value of throughput at the server side followed by DYMO, OLSR and RIP.

When we using VBR traffic mode from fig (E)

- OLSR has maximum value of throughput at the server side followed by RIP, DYMO and DSR.

F. Average Jitter: The Jitter refers to subtracting time at which packet was transmitted from source at the time to destination at the time. It include all possible delay variation between each receives data packets at sever side. Below fig (F) presents the performance of average jitter using different type of routing protocol with CBR and VBR.



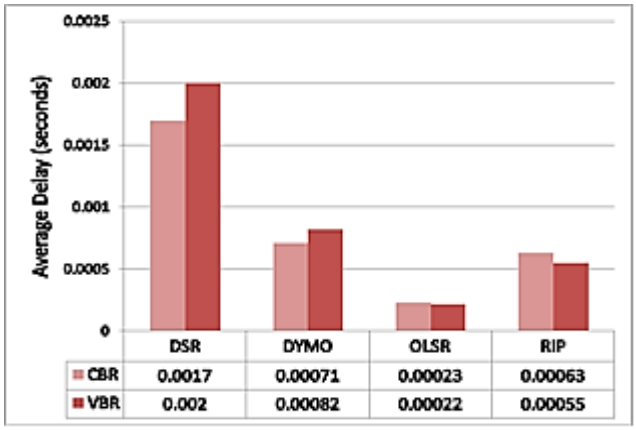
When we using CBR traffic mode from fig (F)

- RIP has minimum value of average jitter at the server side followed by DYMO, DSR and OLSR.

When we using VBR traffic mode from fig (F)

- RIP has minimum value of throughput at the server side followed by DYMO, DSR and OLSR.

G. Average Delay: The delay refers to the amount of time taken by a bit of data to travel across the network from source to destination. It is measured in seconds. Below fig (G) presents the performance of average delay using different type of routing protocols with CBR and VBR.



When we using CBR application from fig (G)

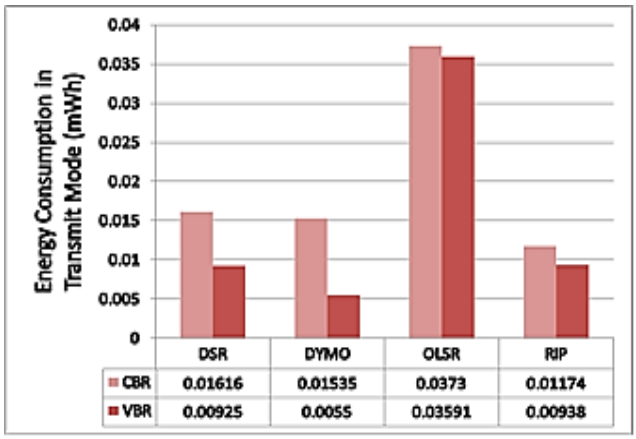
- OLSR has minimum value of average delay at the server side followed by RIP, DYMO, and DSR.

When we using VBR traffic mode from fig (G)

- OLSR has minimum value of average at the server side followed by RIP, DYMO and DSR.

H. Energy Consumption: Energy consumes when node transmits and receives the packets. Energy also consumes in idle state. Energy consumption of every node depends on the state of mobile node. The message sending scheme and carrier sensing method plays a major role on energy consumption. It is measure in mWh. Below fig (H1), fig (H2) and fig (H3) presents the performance of energy consumption using different type of routing protocols with CBR and VBR.

H1. In Transmits Mode:



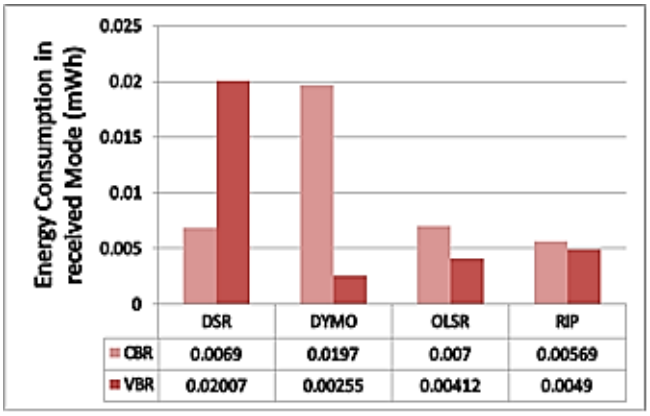
When we using CBR traffic mode from fig (H1)

- OLSR consumes maximum energy at the transmit mode followed by DSR, DYMO and RIP.

When we using VBR traffic mode from fig (H1)

- OLSR consumes maximum energy at the transmit mode followed by RIP, DSR and DYMO.

H2. In Receive Mode



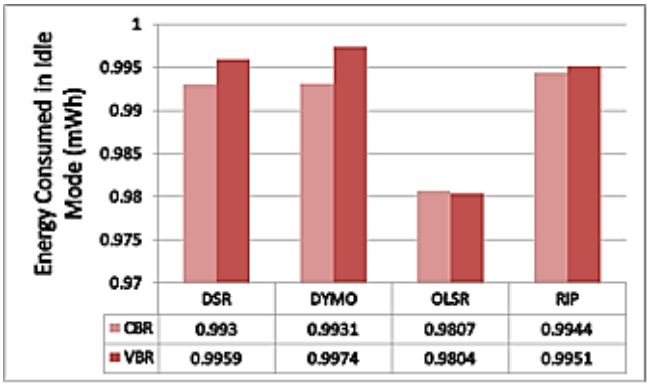
When we using CBR traffic mode from fig (H2)

- OLSR consumes maximum energy at the receiver mode followed by DSR, DYMO and RIP.

When we using VBR traffic mode from fig (H2)

- OLSR consumes maximum energy at the receiver mode followed by RIP, DSR and DYMO.

H3. In Idle Mode



When we using CBR traffic mode from fig (H3)

- RIP consumes maximum energy at the idle mode followed by DYMO, DSR and OLSR.

When we using VBR traffic mode from fig (H3)

- DYMO consumes maximum energy at the idle mode followed by DSR, RIP and OLSR.

6. Conclusion

In this paper we have analyzed the impact of two transmission traffic mode CBR and VBR on Reactive and Proactive (DSR, DYMO, OLSR and RIP) in mobile adhoc network. We are analyzing First Message Received, Last Message Received, Total Message Received, End-To-End Delay and Throughput on application layer. Average jitter and average delay on network layer. Energy consumption in Transmit Mode, Received Mode and Idle Mode on physical layer. The following result were obtained by the simulation-

- OLSR receives the maximum number of First Message Received for both transmission traffic mode but with VBR transmission traffic mode, OLSR receives maximum number of First Message Received in comparison to the CBR traffic mode.
- DSR receives maximum number of Last Message Received with CBR transmission traffic mode but for VBR transmission traffic mode RIP receives maximum number of Last Message Received.
- DSR receives maximum number of Total Message Received with CBR transmission traffic mode but for VBR transmission traffic mode, DSR and DYMO are equally receive maximum number of Total Message Received.
- RIP gives the best End-To- End delay for both transmission traffic mode but VBR transmission traffic mode, RIP gives best End-To-End Delay in comparison to the CBR transmission traffic mode.
- DSR gives best throughput with CBR transmission traffic mode but for VBR transmission traffic mode OLSR gives best throughput.
- RIP gives the best Average Jitter for both transmission traffic mode but for VBR gives the best Average Jitter in comparison to CBR.
- OLSR gives the maximum Average Delay for both transmission traffic modes.
- Energy Consumption of OLSR protocol consumes maximum energy in Transmit Mode for both transmission traffic modes for CBR and VBR.

While OLSR consumes maximum energy in Received Mode for both transmission traffic modes but for VBR traffic mode OLSR consumes maximum energy in comparison to CBR traffic mode.

In case of energy consumption in idle mode RIP consumes maximum energy in Idle Mode for CBR transmission traffic mode and for VBR traffic mode DYMO consumes maximum energy in Idle Mode.

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