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RESEARCH ARTICLE

Impact of CBR, FTP Traffic Patterns and Varying node density on Performance of Routing Protocols in MANETs

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Abstract:

An ad hoc network is a collection of wireless mobile nodes forming a temporary network without the use of any preexisting topology, network infrastructure, or centralized administration. Every node in ad hoc network acts as a router, work as hop and forward data packets for other nodes. Routing is the key challenge in mobile ad hoc networks and challenge becomes more difficult and complicated when the type of traffic patterns and size of network changed. The main issue is to compare the existing routing protocol and finding the best one as in the different type of environment and traffic scenarios these protocols gives varying results. The scope of this study is to test routing performance of three different routing protocols (AODV, DSDV, and Dymo) with respect to CBR and FTP traffic pattern. The Random Waypoint mobility model was used for mobility generation. The QualNet 5.0.2 simulator has been used to conduct the simulation. Performance analysis of AODV, DSR and Dymo is evaluated based on Average end to end delay(s), Average Jitters(s), and throughput (bits/s) in Mobile ad hoc networks.

Keywords: MANETs, Routing Protocols, RWP mobility model, QualNet 5.0.2 network simulator.

Introduction:

MANETs were traditionally developed for networks; A MANET is a dynamic wireless network Nodes are free to move and organize them-selves in an arbitrary manner thus the network topology may change dynamically and unpredictably. Each node may communicate directly with any node. Communication with far nodes or out of range node is done via using intermediate nodes to transmit messages in a hop by hop i.e. a route may include multiple hops. Each proposed routing protocol have unique characteristics and hence the results of a protocol may widely differ from other protocol. Hence in order to find out the most adaptive and efficient routing protocol for the highly dynamic topology in ad-hoc network, the routing protocols behavior has to be analyzed with different node density, traffic patterns etc.

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(Fig1. Mobile Ad-hoc Network)

Related work:

Several researchers have done the performance comparison of Ad hoc routing protocols with different network performance parameters. Also they have used different simulators for this purpose.

Most of the related work available in the literature of MANET includes its challenges and applications as it directs the future of this technology [1, 2, 3, 4]. In [5] the authors compared the CBR performance in different mobile scenarios under random way point mobility model. In their performance analysis, they used only two performance metrics drop ratio and end-to-end delay. QualNet network simulator was used in their simulation with topology of 500m * 500m and simulation time of 200s. They applied different speeds, pause time and traffic pattern in their simulation. They founded that as the number of connection is increased, end-to-end delay increases in DSDV. In their paper they founded that AODV outperform DSDV in CBR traffic and it's more stable when mobility is low. They had not represented high mobility scenario in the study.

In [6] the impact of Cbr and Ftp traffic patterns on the performance of Aodv, Dsr and Wrp routing protocols in MANET were evaluated. The simulation results of this study indicated that AODV perform very well as compare to DSR and WRP for both traffic pattern CBR and FTP. They also found that the performance of AODV is higher with FTP traffic pattern as compare to CBR.

In [7] the authors evaluated the performance of proactive routing protocols, DSDV and reactive protocol, AODV with CBR traffic. They used RWPM to analyze the behavior of these protocols. They have used throughput, normalized routing load, average end-to-end delay matrices in the study. The simulation results indicated that the protocols they used in their simulation have distance vector characteristics in common but their performance differs with mobility because of the way each protocol works.

The current trends as mentioned by some authors in this field suggest the researchers to study the role of MANET in the evolution of future wireless technologies [8, 9].

Routing Protocols:

The main problem with ad-hoc network is how to send a message from one node to another with no direct link as routing is a process which exchange information from one node to the other node in a network [10]. The nodes are moving around unpredictable and it is very challenging, which nodes that are directly linked together, The Topology of an ad-hoc network is dynamically changing and it is very difficult for routing process. In MANET each node can be used as either as endpoint or as a router to forward packet to next node [11]. A routing protocol is needed because it has to pass several hops (multi-hop) to ensure that a packet reaches the destination [12]. There are many

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routing protocols available for ad-hoc networks such as AODV, DSDV, DSR, DYMO, FSR, OLSR, STAR, and TORA etc. Routing protocols for mobile ad-hoc networks can be classified into reactive, proactive and hybrid categories, based on the routing information update mechanism. In this paper we study three routing protocols: AODV, DSR and Dymo and evaluated the performance of these three routing protocol with CBR and FTP traffic patterns.

Performance Metrics

Different performance metrics are used in the evaluation of routing protocols. They represent different characteristics of the overall network performance [6]. In this report, we evaluate two metrics used in our comparisons to study their effect on the overall network performance. The following performance matrices are used to evaluate the performance of routing protocols:

i. **Average End-to-End Delay**
   Average End-to-End performance metrics is used to measure the time taken by a packet to travel across a network from a source node to the destination node.
ii. **Average Jitter**
   Average jitter is a performance characteristics used to measure deviation from true periodicity eventually of inactivity in packet across a specific network.
iii. **Throughput**
   Throughput is measured in terms of successful delivery of data packet within the threshold time. Mathematically,

Random Way Point Mobility Model

Mobility model [13] emulates the real life movement of mobile nodes with respect to their location, velocity and direction of motion as a function of time. In this study Random Way Point mobility mode have used. Random Way Point (RWP) [14] model is a commonly used synthetic model for node mobility in Ad Hoc networks. It is an elementary model which describes the movement pattern of independent nodes in simple terms. The characteristics of RWP are briefly summarized below:

i. Each node moves along a straight line in a zigzag fashion from one waypoint to the next.

ii. The waypoints are uniformly distributed over the deployment area.

iii. The node velocities are randomly selected from a given range.

iv. Optionally, the nodes may have so called "thinking times" by which when they reach a waypoint they choose a random pausing time independent of each other before continuing to the next one.

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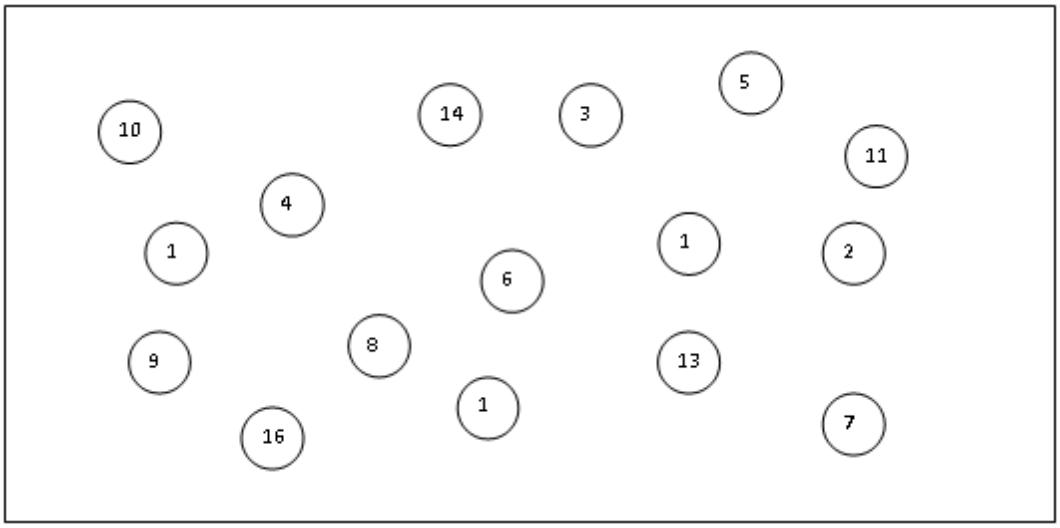

(Fig.1Random Way Point Mobility Model)

Simulation Scenario:

The three routing protocols: AODV, DSR, and Dymo were simulated to evaluate their performance in accordance with CBR, FTP traffic patterns and varying node density using Random way point mobility model on QualNet 5.0.2 network simulator. The wireless network consists of node density 20, 40, 80, 120 and 150 which are distributed randomly in terrain size of 1000mx1000m. The data packet size is of 2048 bytes used. The simulation time is 220sec.

RESULTS AND DISCUSSION

In this section, the performance metrics are used for measuring the performance of AODV, DSR and Dymo routing protocol. The simulation results are shown in the form of graph that represents (i) Throughput (bits/s) (ii) Average End to End Delay (s) and (iii) Average-Jitter(s)

(i) Average Throughput of CBR and FTP traffic patterns with Varying Node Density

The figure 2, figure3 and figure4 show the graphs of average throughput (bits/s) for CBR and FTP traffic patterns with varying node density. From the graph it is clearly indicated that the AODV perform better in both cases while DSR perform worst in case of FTP while it gives better results for low node density in case of CBR traffic. At other hand Dymo shows much stable results in case of FTP traffic in comparison to CBR traffic.

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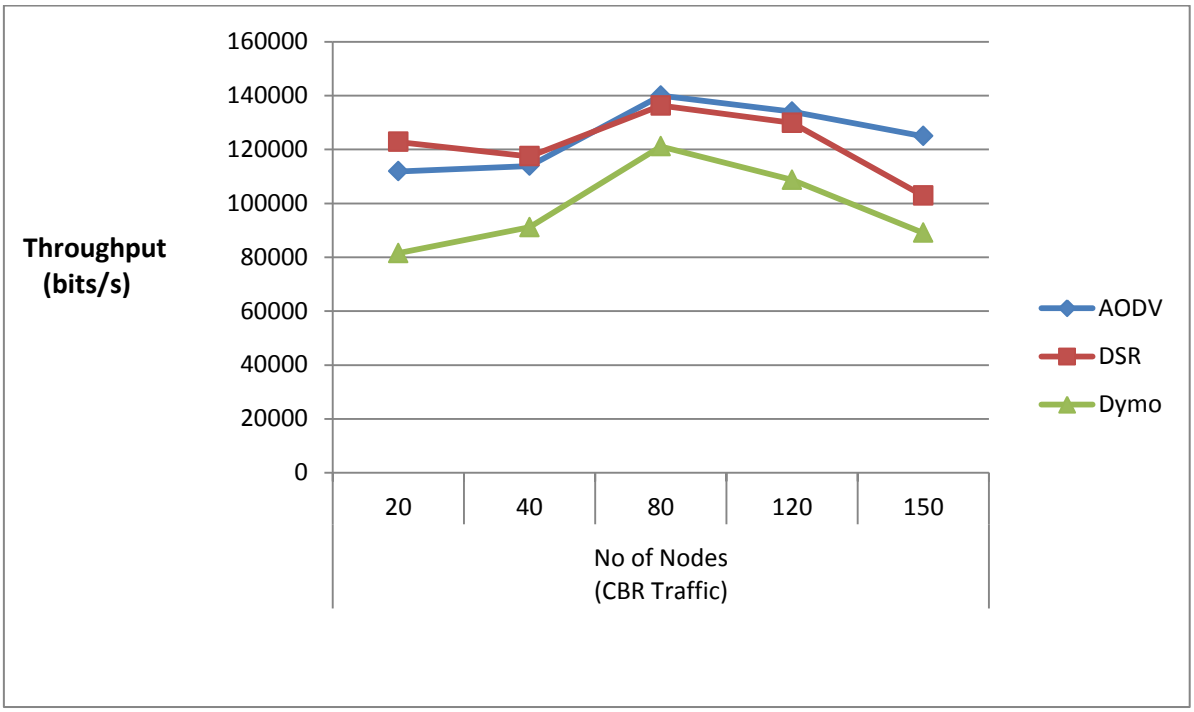
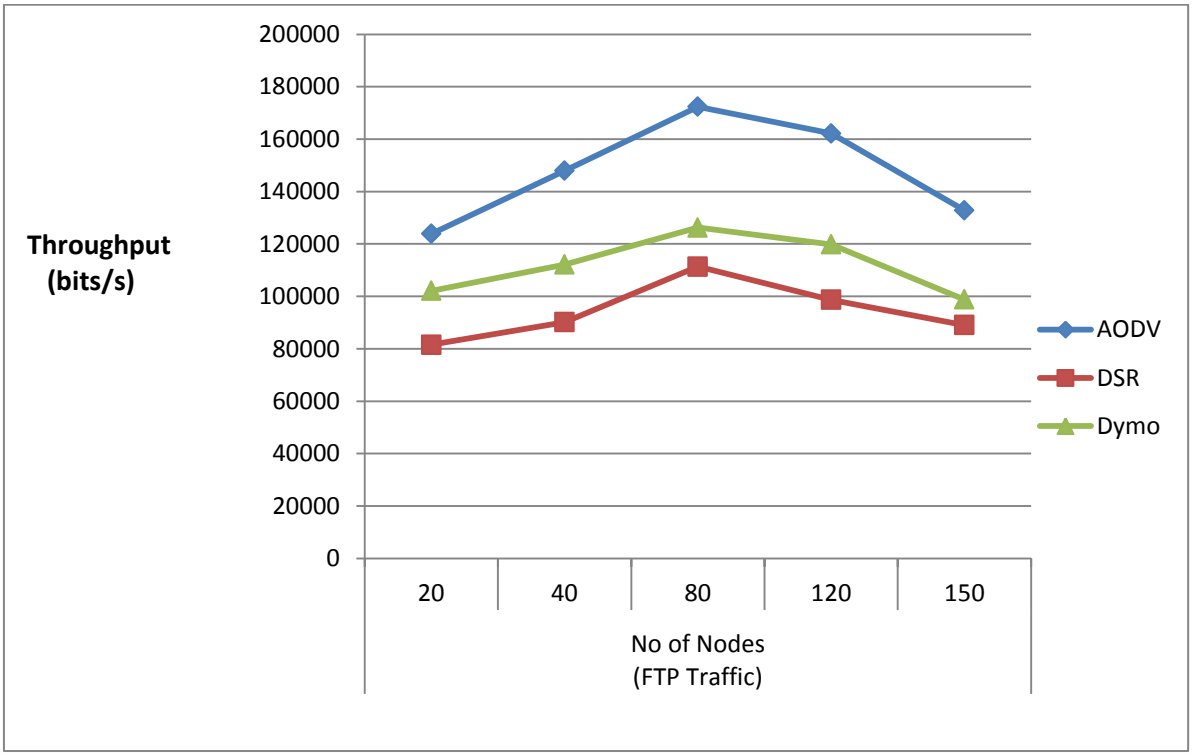


(Fig.2 Throughput Vs No. of Nodes for CBR Traffic)



(Fig.3 Throughput Vs No. of Nodes for FTP Traffic)

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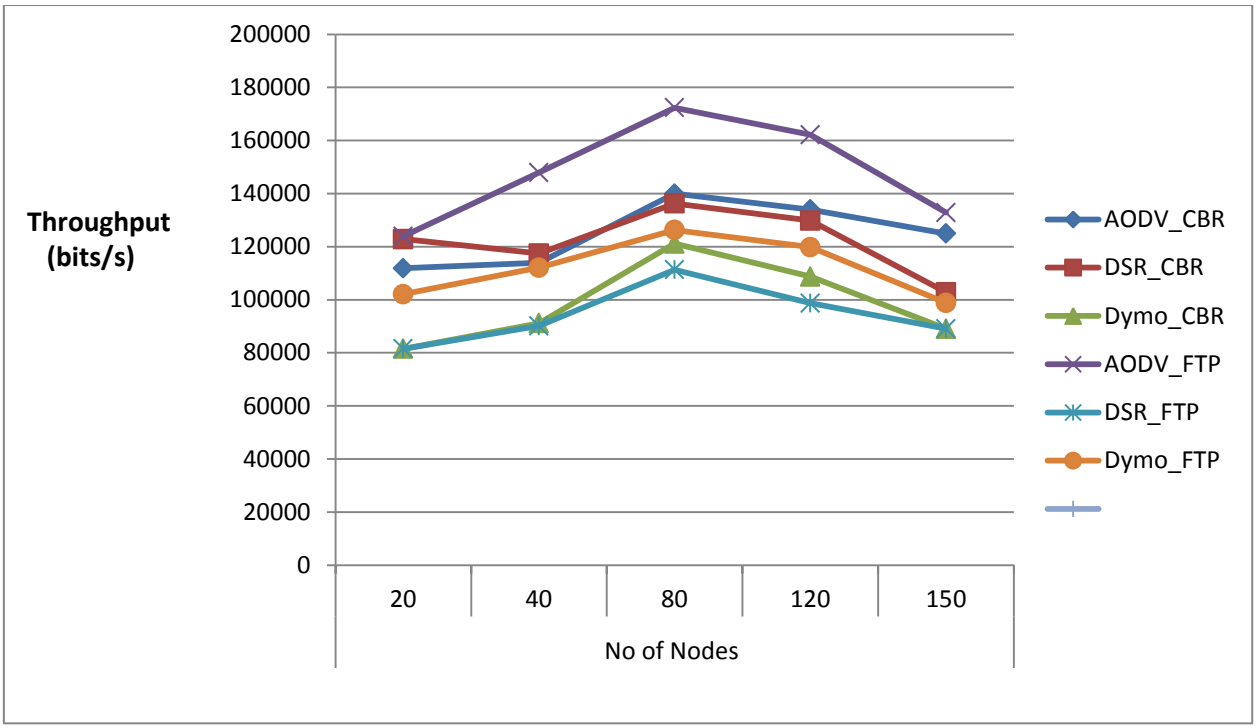
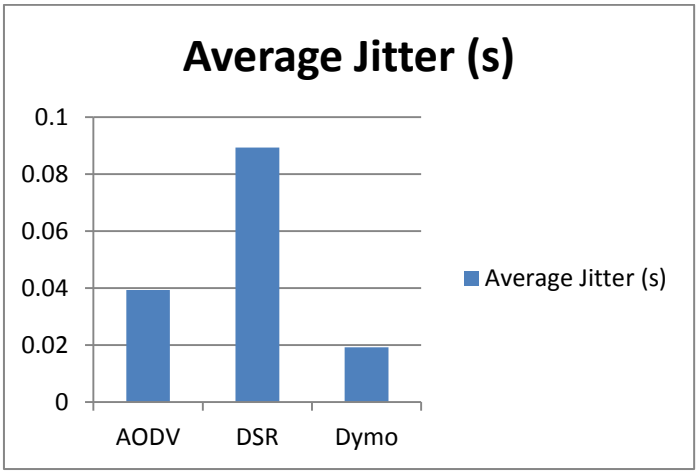


(Fig. 4 Comparison of CBR and FTP Traffic Throughput)

(ii). Average Jitter(s): The figure 4 shows the graph of AODV, DSR and Dymo routing protocols average jitter. The DSR is showing highest average jitter in comparison of both AODV and Dymo routing protocol.



(Fig.5 Average Jitter(s) for AODV, DSR and Dymo)

(ii) Average End-to-End Delay: Figure 5 shows the graph of AODV, DSR and Dymo routing protocol for average end-to-end delay. End-to-end delay includes the delay in the send buffer, the delay in the interface queue, the bandwidth contention delay at the MAC, and the propagation delay. The DSR routing protocol shows the highest average end-to-end delay in comparison of AODV and Dymo routing protocol.

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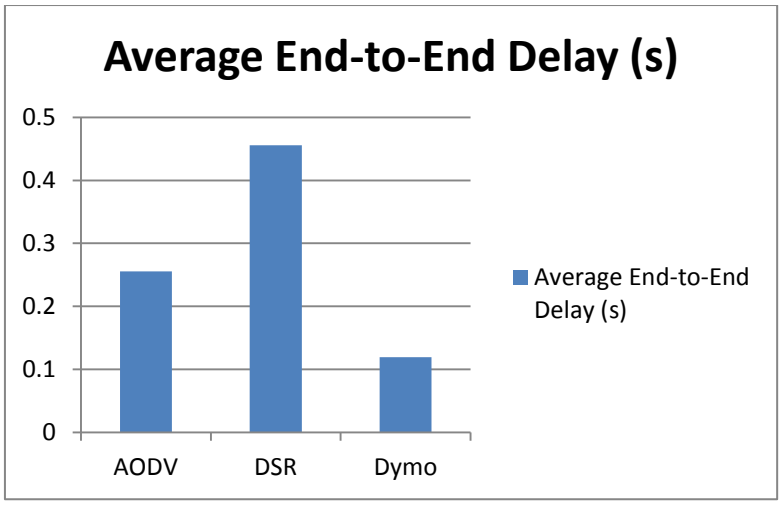

(Fig.6 Average End-to-End Delay(s) for AODV, DSR and Dymo)

Conclusion:

From the above analysis it can be concluded that if MANET is to be setup than the selection of routing protocol must be done very carefully. As the AODV and DSR both perform significantly well in case of CBR traffic while DSR is not showing good results for FTP traffic. Overall AODV gives higher performance in both cases in comparison of DSR and Dymo routing protocols. AODV perform better in case of FTP traffic than CBR traffic. Dymo shows low average-end-to-end delay and average jitter rate in comparison of AODV and DSR. Overall it can be concluded that if MANET is need to be setup for large terrain size, then AODV must be prefer due to its optimum performance in both type of traffic patterns.

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