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Comparative analysis of AODV, DSR, DSDV varying pause time.

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Abstract: A Wireless ad-hoc network is a decentralized type of wireless network. The network is ad-hoc because it does not rely on pre-existing infrastructure such as routers in wired network or access points in managed wireless networks. A wireless system appears to be a promising approach to resolving critical networking limitations prevalent in a centralized wired topology. Information is routed through intermediary nodes to reach its destination. An effective way to reduce congestion is to efficiently route packets through the network maze. However the choices grow exponentially due to the combinatorial nature of this topology. Routing protocols must be carefully designed to maximize network efficiency. We have considered AODV, DSR and DSDV routing protocols and simulation is done using NS-2 (version NS-2.33).

Keywords: Routing Protocols, Packets, Simulation, Performance, Bandwidth, Analysis.

I. INTRODUCTION

In this work, we analyzed and compared three routing protocols (AODV, DSDV and DSR) implemented in ns-2 (version 2.33). The protocols are simulated in a wireless environment with routing protocols, number of nodes and pause time as varying parameters. We found that DSR required the most nodal overhead due to the storage of all possible routes to all destinations in its cache. DSDV introduced most traffic into the network due to its periodic update of the entire network from every node. When the network is small, we found that DSDV is most efficient in delivering data packets to destinations. When the network is large, the network should utilize AODV or DSR to avoid excessive forwarding of data packets. This is also the case with total number of dropped packets. Data packets in a network utilizing DSDV are being dropped more frequently than AODV and DSDV, regardless of size of the network. This difference grows exponentially as the network grew larger. However, on average, data packets routed using DSDV experienced least End-to-End delay, regardless of the size of the network. Therefore, we concluded that AODV and DSR are more reliable routing protocols while DSDV minimized End-to-End delay and maximized throughput [1].

II. ROUTING PROTOCOLS

DSR:

DSR is a source routing protocol. This means that the source node adds the whole route up to the destination node to the packets header (Figure 1). As this is the case with most reactive ad hoc routing protocols, DSR is based on the two basic mechanisms namely route discovery and route maintenance. During the route discovery a route is set up on-demand. The route maintenance monitors an established connection during a communication between nodes [2]. DSR is able to operate on networks containing unidirectional links but it works optimal in a network with bidirectional links.

AODV:

AODV protocol is defined by the RFC 3561, written by Charles Perkins and Elizabeth [3]. AODV has some similar features as the Bellman-Ford distant vector algorithm, but it has been improved to work in a mobile environment [4]. AODV uses hop-by-hop routing. Every node forwards data packets towards a destination node according to its routing table. The routes in the AODV routing table are kept up to date as long as they are needed by the source. AODV maintains a single path per a destination. The routing is divided into two basic mechanisms. The first one is the route discovery. It is responsible for finding a route to the destination if none is currently available in the routing table of the node. The second one is the route maintenance which keeps the routes up-to-date, e.g. removes broken paths. AODV protocol also works in a network where the communication links are bidirectional because if an (intermediate) node receives either a Route REQuest (RREQ) packet or a Route REPly (RREP) packet, it caches the previous node in its routing table.

DSDV:

The Destination-Sequenced Distance-Vector (DSDV) Routing Algorithm is based on the idea of the classical Bellman-Ford Routing Algorithm with certain improvements. Each node maintains a list of all destinations and number of hops to each destination. Each entry is marked with a sequence number. It uses full dump or incremental update to reduce network traffic generated by rout updates [5]. The broadcast of route updates is delayed by settling time. The only improvement made here is avoidance of routing loops in a mobile network of routers. With this improvement, routing information can always be readily available, regardless of whether the source node requires the information or not. DSDV solve the problem of routing loops and count to infinity by associating each route entry with a sequence number indicating its freshness. In DSDV, a sequence number is linked to a destination node, and usually is originated by that node (the owner). The only case that a non-owner node updates a sequence number of a route is when it detects a link break on that route. An owner node always uses even-numbers as sequence numbers, and a non-owner node always uses odd-numbers. With the addition of sequence numbers, routes for the same destination are selected based on the following rules:

1) A route with a newer sequence number is preferred;
2) In the case that two routes have a same sequence number, the one with a better cost metric is preferred.

III. PARAMETER SELECTION

Communication Model:

In our simulation, we use constant bit rate (CBR) traffic sources. When defining the parameters of the Communication model, we experimented with 50 and 100 nodes; the sending rate used was 4 packets per second, and the network contains 10 CBR sources.

Parameter	Value
Traffic type	CBR
Number of nodes	50 and 100 nodes
Number of data sources	10 connections
Transmission rate	4 packets/second

Table 1: Parameters of communication model

Parameter	Value
Simulator	Ns-2 (Version 2.33)
Simulation time	300 seconds
Area of the network	1000m x 1000m
Number of nodes	50 and 100 nodes
Pause time	10 to 100 (in step of 10), 150, 200, 250 and 300 seconds
Maximum speed of nodes	10
Transmission range	250 m
Mobility model	Random waypoint

Table 2: Parameters used in the movement model

Movement Model:

In our simulations, we use the random waypoint model where each node begins the simulation by remaining stationary for pause time seconds. It then selects a random destination in the 1000m x 1000m space and moves to that destination at a specified maximum speed. Upon reaching the destination, the node pauses again for pause time seconds, selects another destination, and proceeds there as previously described, repeating this behavior for the duration of the simulation. We fix the area to be 1000 x 1000 meters, and the simulation time to be 300 seconds. Meanwhile, we vary the number of nodes to compare the protocols performance for low and high density, pause times varies from 10 to 100 (in step of 10), 150, 200, 250 and 300 seconds and speed of nodes kept at 10 m/sec. Table 2 lists the movement parameters of the simulations.

IV. PERFORMANCE METRIC

For network simulation, there are several performance metrics which is used to evaluate the performance. In simulation purpose we have used three performance metrics.

Three types of network scenario for different number of nodes are generated.

1. Wireless scenario with fixed position of nodes.
2. Wireless scenario with movable nodes (traffic generated by cbrgen and setdest).
3. Wireless scenario with movable nodes giving time slices for communication.

3.1 Packet Delivery Ratio

Packet delivery ratio is the ratio of number of packets received at the destination to the number of packets sent from the source. The performance is better when packet delivery ratio is high.

AODV performance is high even in high load (50 & 100 nodes) with varying pause time scenario (Figure 4 & 5).

Figure 4: Packet delivery ratio with 50 nodes

Figure 5: Packet delivery ratio with 100 nodes

3.2 Average End-to-End Delay

This is the average time delay for data packets from the source node to the destination node. To find out the end-to end delay the difference of packet sent and received time was stored and then dividing the total time difference over the total number of packet received gave the average end-to end delay for the received packets. The performance is better when packet end-to-end delay is low.

Figure 6: End to End Delay with 50 nodes

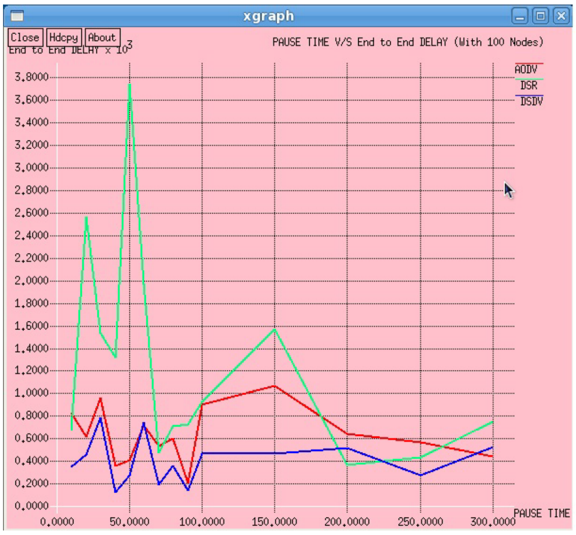

Figure 7: End to End Delay with 100 nodes

DSDV shows better performance (Figure 6 & 7).

3.3 Normalized Routing Load

Number of routing packets “transmitted” per data packet “delivered” at destination. Each hop-wise transmission of a routing is counted as one transmission. It is the sum of all control packet sent by all node in network to discover and maintain route (Figure 8 & 9).

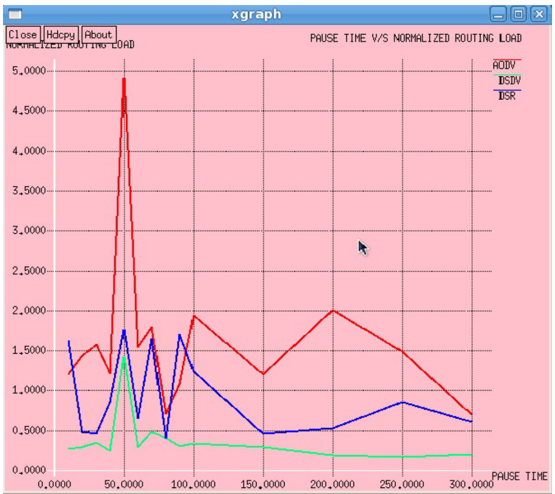

Figure 8: Normalized routing load with 50 nodes

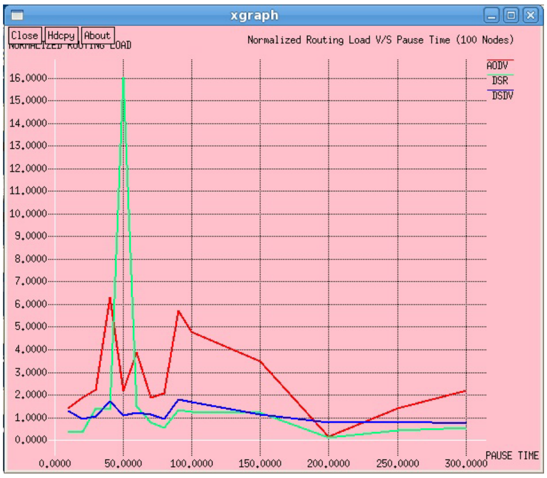

Figure 9: Normalized routing load with 100 nodes

NRL = Routing Packet/Received Packets.

3.4 Average Throughput

It is defined as the ratio of total packets received to the simulation time. [6] The simulations were performed using Network Simulator Ns-2 (www.isi.edu/nsnam/ns), popular in the ad- hoc networking community. The mobility model used is Random Way point Model. The traffic sources are CBR (continuous bit –rate), number of data connections is 10, data packet size is 512 byte and data sending rate is 4 packet/second. The source-destination pairs are spread randomly over the network in a rectangular filed of 1000 m X 1000 m. During the simulation, each node starts its journey from a random spot to a random chosen destination. Once the destination is reached, the node takes a rest period of time in second and another random destination is chosen after that pause time. This process repeats throughout the simulation, causing continuous changes in the topology of the underlying network. The simulation time is 300 seconds and maximum speed of nodes is 10 m/sec. The interface queue is 150- packet drop-tail priority queue, pause time varies according to table2.

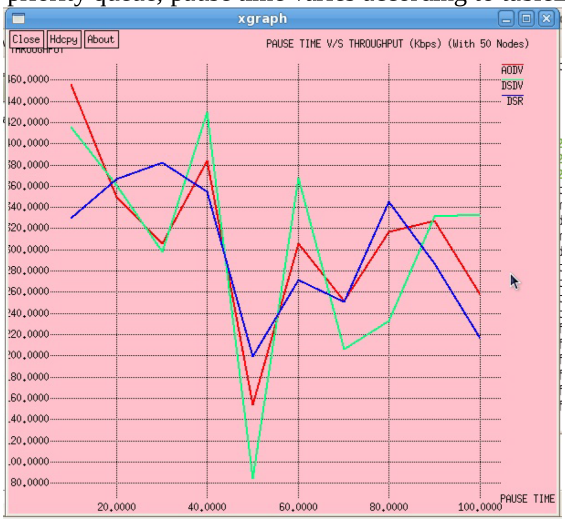

Figure10: Throughput with 50 nodes

Figure 11: Throughput with 100 nodes

V. REFERENCES

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