Comparison of Different Wireless Protocols for a Network using NS-2

Shalini V S[1], Ajay N A[2], Shivaraju N[3], Santhoshkumar D M[4],
Asst. Professor, Department of Electronics & Communication, ATME College of Engineering, Mysuru.
UG students(BE) Department of Electronics & Communication, ATME College of Engineering, Mysuru,

***Abstract*— Routing is the necessary for data transmission in ad hoc network. Due to mobility of nodes, Bandwidth and energy constraints are limited and it is very challenging task for this kind of network to transfer data packets towards proper destination. Comparison of Efficiency, End to End delay and Throughput of different wireless protocols like Adhoc on demand Distance vector (AODV), Dynamic Source Routing (DSR) and Destination Sequence Distance Vector (DSDV) for a network is analyzed. Simulations are performed using Network Simulator-2.**

Keywords—AODV,DSR ,DSDV and NS-2

I. INTRODUCTION

A network is defined as set of corrected computer to share the information or services. There are two types one is wired and another is wireless. In wireless networking there is no physical connectivity between nodes. They use radio frequencies for data transmission [1].wireless network can be categorized into two types they are centralized wireless network and decentralized wireless network. In centralized network a mobile node can communicate with a base station within its communication range. Base station is fixed while nodes are mobile. Where as in decentralized network all mobile nodes dynamically connected arbitrarily. Here each nodes act as a router. In Ad-hoc networks are basically self-organizing and self-configuring multi-hop mobile wireless network in which the information packets are transmitted in a store and forward manner from a source to an arbitrary destination via intermediate nodes. In this paper, an attempt has been made to evaluate the performance of three well-known wireless routing protocols such as AODV, DSDV, and DSR by using three performance metrics such as throughput, packet delivery ratio and end to end delay. The Performance evaluation has been done by using simulation tool NS2 (Network Simulator).

II. LITERATURE REVIEW

In paper [3] the authors analyses reverse AODV which tries multiple route replies. The Extended AODV is called reverse AODV (R-AODV), which has a novel aspect compared to other on-demand routing protocols on Ad-hoc Networks. Authors design the R-AODV Protocol and implement simulation models using NS-2. Simulation results show that the Reverse AODV provides good experimental results on packet delivery ratio, power Consumption and communication delay.

In paper [4] the authors analyses the performance differentials to compare the Above-mentioned commonly used ad hoc network routing protocols. Authors report the Simulation results of three different protocols for wireless ad hoc networks having ten Nodes. Data rate 2Mbps and simulation time 20 minutes were taken. For this above Simulation environment, AODV shows better performance over the other two on-demand Protocols that is, DSR and DSDV.

In paper [5] authors analyses the message exchange scheme for its invalid route reconstruction is being used. Two protocols AODV and DSDV simulated using NS-2 package and were compared in terms throughput, end to end delay and packet faction delivery varying number of nodes, speed and time. Simulation results show that DSDV compared with AODV, DSDV Routing protocol consumes more bandwidth, because of the frequent broadcasting of Routing updates. AODV also performs better under high mobility simulations than DSDV.

In paper [6] authors analyses Distance sequence vector DSDV, is a proactive routing protocol, which is a conventional modification of Bellmondford routing algorithm to calculate the shortest-path. DSDV proposed to be used in multi-hop mobile Ad-hoc networks. Each node maintains the routing table with all possible destinations within the network and the number of required hops to reach the destination is also maintained in the table. The sequence number is assigns for each destination to distinguish out stale routes and prevent routing loops. The stations periodically transmit their routing tables to their immediate neighbors. A station also transmits its routing table if a significant change has occurred in its table from the last update sent. So, the update is both time-driven and event-driven. The routing table updates can be sent in two ways: a ”full dump” or an ”incremental” update.

In paper [7] authors analyses Dynamic Source Routing (DSR): DSR is an simple efficient routing protocol proposed specifically for use in multi-hop mobile Ad-hoc network. like AODV is characterized by two main steps including route discovery and route maintenance, these two phase help node to continuously evaluate the best route to destination. In the case a route is found, the source node uses this routing information to the destination. Otherwise, node caches the packet and finds the routing information’s to the destination by initiating the route discovery.

III. METHODOLOGY

For different wireless protocols such as AODV, DSDV and DSR the Packet Delivery Ratio, end to end delay and throughput parameters are checked for a network consisting of 30 nodes.

A. AODV

Ad hoc on demand distance vector is also known as vector routing for mobile ad hoc networks, so it create and maintain route on demand, it means when they need. These protocols create routes between nodes only desire sources nodes and maintain that route until they are needed by sources. The protocol is self-starting and scale large numbers of nodes. The AODV use some of basic features from DSR which are route creation and maintenance, sequence number and hop routing from DSDV. Route can build using these packets route request, route replay and query cycle. The route request packet is used when source want a route to a destination which is not already exits.

The RREQ packet is broadcasted across the network; the packet contains the source, destination IP addresses and some other related information. As node receives RREQ packet, if the destination address matched, it sends replay back and if IP does not matched, it increments the broadcast ID and initiate RREQ again. Timeliness of packet can be determined from sequence number. The process is repeated until required destination has been found. As the RREQ packet reached to correct destination node, a replay packet generates, which is route replay packet (RREP) to reverse of the path. The route replay packet is Unicast from destination to source, when source received the RREP packet start communication on best route from the available routes. RERR is generated when the route is broken and sends form destination to source.

AODV protocol builds routes between nodes only if they are requested by source nodes. AODV is therefore considered an on-demand algorithm and does not create any extra traffic for communication along links. The routes are maintained as long as they are required by the sources. They also form trees to connect multicast group members. AODV makes use of sequence numbers to ensure route freshness. They are self-starting and loop-free besides scaling to numerous mobile nodes.

In AODV, networks are silent until connections are established. Network nodes that need connections broadcast a request for connection. The remaining AODV nodes forward the message and record the node that requested a connection. Thus, they create a series of temporary routes back to the requesting node. A node that receives such messages and holds a route to a desired node sends a backward message through temporary routes to the requesting node. The node that initiated the request uses the route containing the least number of hops through other nodes. The entries that are not used in routing tables are recycled after some time. If a link fails, the routing error is passed back to the transmitting node and the process is repeated

B. DSR

Dynamic Source Routing (DSR) is routing protocol for wireless mesh networks. It is similar to AODV in that it forms a route on-demand when a transmitting node requests one. However, it uses source routing instead of relying on the routing table at each intermediate device. Determining source route requires accumulating the address of each device between the source and destination during route discovery. The accumulated path information is cached by nodes processing the route discovery packets. The learned paths are used to route packets. To accomplish source routing, the routed packets contain the address of each device the packet will traverse. This may result in high overhead for long paths or large addresses, like IPv6. To avoid using source routing, DSR optionally defines a flow id option that allows packets to be forwarded on a hop-by-hop basis.

This protocol is truly based on source routing whereby all the routing information is maintained (continually updated) at mobile nodes. It has only two major phases, which are Route Discovery and Route Maintenance. Route Reply would only be generated if the message has reached the intended destination node (route record which is initially contained in Route Request would be inserted into the Route Reply).

To return the Route Reply, the destination node must have a route to the source node. If the route is in the Destination Node's route cache, the route would be used. Otherwise, the node will reverse the route based on the route record in the Route Request message header (this requires that all links are symmetric). In the event of fatal transmission, the Route Maintenance Phase is initiated whereby the Route Error packets are generated at a node. The erroneous hop will be removed from the node's route cache; all routes containing the hop are truncated at that point. Again, the Route Discovery Phase is initiated to determine the most viable route.

C. DSDV

DSDV Protocol Destination sequenced distance vector routing (DSDV) is adapted from the conventional Routing Information Protocol (RIP) to ad hoc networks routing. It adds a new attribute, sequence number, to each route table entry of the conventional RIP. Using the newly added sequence number, the mobile nodes can distinguish stale route information from the new and thus prevent the formation of routing loops. Packet Routing and Routing Table Management In DSDV, each mobile node of an ad hoc network maintains a routing table, which lists all available destinations, the metric and next hop to each destination and a sequence number generated by the destination node. Using such routing table stored in each mobile node, the packets are transmitted between the nodes of an ad hoc network.

Each node of the ad hoc network updates the routing table with advertisement periodically or when significant new information is available to maintain the consistency of the

routing table with the dynamically changing topology of the ad hoc network. Periodically or immediately when network topology changes are detected, each mobile node advertises routing information using broadcasting or multicasting a routing table update packet. The update packet starts out with a metric of one to direct connected nodes. This indicates that each receiving neighbor is one metric (hop) away from the node. It is different from that of the conventional routing algorithms.

After receiving the update packet, the neighbors update their routing table with incrementing the metric by one and retransmit the update packet to the corresponding neighbors of each of them. The process will be repeated until all the nodes in the ad hoc network have received a copy of the update packet with a corresponding metric. The update data is also kept for a while to wait for the arrival of the best route for each particular destination node in each node before updating its routing table and retransmitting the update packet. If a node receives multiple update packets for a same destination during the waiting time period, the routes with more recent sequence numbers are always preferred as the basis for packet forwarding decisions, but the routing information is not necessarily advertised immediately, if only the sequence numbers have been changed.

If the update packets have the same sequence number with the same node, the update packet with the smallest metric will be used and the existing route will be discarded or stored as a less preferable route. In this case, the update packet will be propagated with the sequence number to all mobile nodes in the ad hoc network. The advertisements of routes that are about to change may be delayed until the best routes have been found. Delaying the advertisement of possibly unstable route can damp the fluctuations of the routing table and reduce the number of rebroadcasts of possible route entries that arrive with the same sequence number. The elements in the routing table of each mobile node change dynamically to keep consistency with dynamically changing topology of an ad hoc network. To reach this consistency, the routing information advertisement must be frequent or quick enough to ensure that each mobile node can almost always locate all the other mobile nodes in the dynamic ad hoc network. Upon the updated routing information, each node has to relay data packet to other nodes upon request in the dynamically created ad hoc network.

IV. ALGORITHM AND PROPOSED NETWORK

In order to implement algorithm it requires the following steps.

- New simulator is created.
- Nam and trace files are opened to store simulation results.
- Nodes are created such as-n0, n1 to n29.
- Transport agents are created for the transmission of packets from source to destination.
- Packet generators are created.
- Finish procedure is written to close the opened files and to save all the simulation results.
- Simulation time in which start time and stop time of transmission is specified.
- Network is simulated to obtain the desired output.

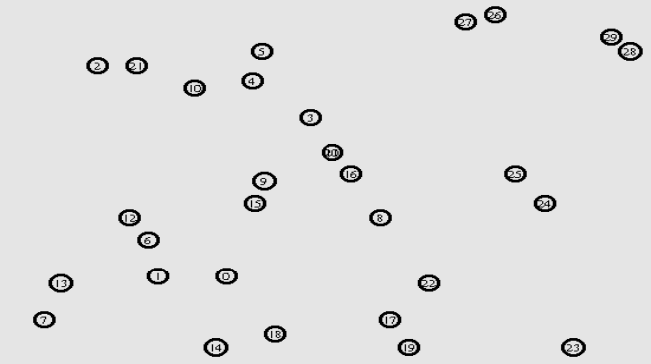

Fig. 1: Wireless Propose Network using NS-2

The fig. 1 shows the wireless proposed network using ns2. In the wireless channel a network is created and it has thirty nodes. The receiving agency is n29 and transmitting agency is n0. The node n0 act as source and n29 are act as destination. The n1 to n28 acts as router. Packets are transmitted from n0 to n29 in the wireless media.

Different wireless protocols such as AODV, DSR, and DSDV are used for transmission and each protocol are used in the network separately to find throughput, end to end delay and Packet Delivery Ratio and packet drop of the network. Simulation is carried out for 150 sec using simulation tool NS2.

V. DEFINITION OF PERFORMANCE METRICS USED IN SIMULATION

1. Throughput: Throughput is defined by the amount of received data by the destination nodes in a period of time.
2. Average End-to-End Delay (E to E Delay): The time which is spent by the packets to reach to the destination. The average end-to-end delay is calculated by adding all the times taken by all received packets divided by their total numbers. This rate is preferred to decrease.
3. Packet Delivery Ratio (PDR): This is the ratio of the number of data packets successfully delivered to the destinations to those generated by sources PDR = ((received packets/sent packets) * 100).
4. Packet Drop: The difference between packets sent to packets received.

RESULTS OBTAINED

1. Throughput in Kbps

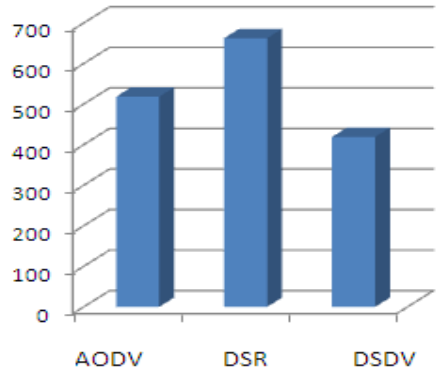

Fig 2: Throughput of DSR, AODV and DSDV

2 Efficiency in percentage

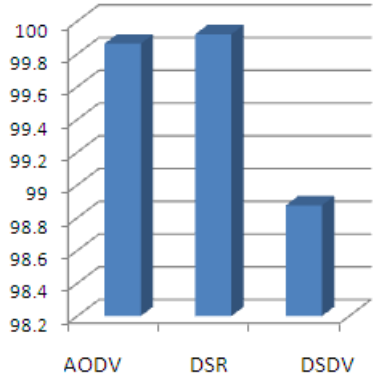

Fig 3: Efficiencies of DSR, AODV and DSDV

3 End to End delay in ms

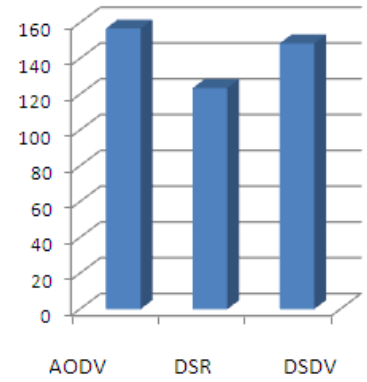

Fig 4: End to End delay of DSR, AODV and DSDV

4 Packet Drop in number

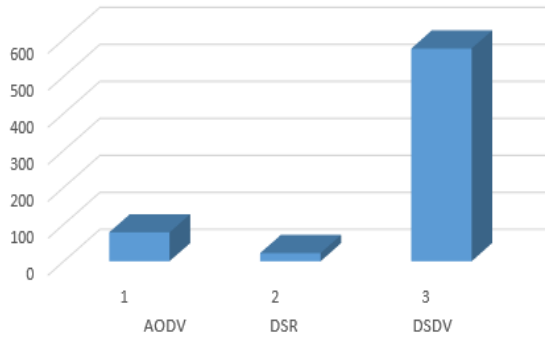

Fig 5: Packet drops of DSR, AODV and DSDV

CONCLUSION

For a network consisting a number of 30 nodes, comparison of different wireless protocol such as DSR, DSDV, AODV using NS2 have been evaluated. The analysis depends on number of packet delivered ratio, throughput, End to end Delay, Packet drop. AODV is better than the remaining two protocols.

FUTURE WORK

In the future, extensive complex simulations could be carried out using this project code by increasing the number of nodes, in order to gain a more in-depth performance analysis of the ad hoc routing protocols. TORA protocol performance could be studied too.

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