Evaluate AODV to DSR and Improving AODV

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Abstract

Networking is the core for computer science technology and it is incomplete without the presence of various routing protocols present, which help in data transfer throughout the vast network of millions of computers present globally.A group of wireless mobile nodes that dynamically form a short-lived network which doesn't use any established network infrastructure or centralized administration could be an ad hoc network. Depending upon various factors different protocols behave differently under various conditions, which is the reason for creation of this project. The project aims at comparing two ad hoc routing protocols i.e. "AODV (Ad-hoc on-demand distance vector) Routing and DSR (Dynamic Source Routing)". The two protocols being compared are used extensively as 'On demand routing protocols' for transfer of data.

Our main focus will be on the further improvement of AODV protocol using the local link repair mechanism.The comparison will be performed under the controlled conditions monitored by the 'Network Simulator-2'. It provides a perfectenvironment and appropriate set of tools for this kind of analysis.Various factors will be used for the comparison benchmark such as throughput, end to end delay, normalised routing load and packet delivery ratio.Also we will consider the cases for both static and dynamic networks and offer improvements on our behalf for the AODV protocol.

Introduction:

The idea of demand routing protocols arose when it was realised that other protocols when not sharing any data continue to waste bandwidth and increase network congestion unnecessarily creating many overheads. Many solutions came up in the form of advanced routing protocols such as 'ad hoc on demand routing' protocols which were called only when data transfer was required. Some of these protocols were AODV routing, DSR, DSDV and TORA (Temporally ordered routing algorithm).

The routes are initiated as appropriate within in the On-Demand routing protocols. This will only invoke the route discovery mechanisms which look for the path to the destination if a supply wants to pass to the destination.

As protocols cannot be perfect and each of them poses some newer challenges. In this paper we aim at comparing AODV to DSR and further improving AODV using advanced link repair mechanism.

The major purpose behind the comparison of AODV and DSR is to show that there is some further room for improvement in AODV protocol. The comparison acts as a reference base for our further study.

Ad Hoc On -Demand Distance Vector Routing (AODV)

AODV explores routes on an as-needed basis via a similar route exploration method. However, for retaining routing records, AODV adopts a rather different method. It uses conventional tables, i.e., one entry for routing per destination.Even though the same would be different with DSR, which will keep several route cache entries for each destination. AODV relies on routing table entries without source routing in order to transmit an RREP back to its source and to route data packets to their destination.To determine the accuracy of the routing information and to eliminate routing loops, AODV integrates routing information stored at each destination. These sequence numbers bear all the routing packets.

An essential aspect corresponds to AODV is to manage timer-based condition inside every node, cornering the use of specific Table entries for routing. An entry for the routing tableexpires if it is not used recently. A list of the previous nodes is preserved for the entry of the routing table, representing the array of adjacent nodes while using entry to route the data packets.With RERR packets, When the next-hop link is split, these nodes get updated. Each of the predecessor nodes, in response, dispatches the RERR to its own array of precursors, eventually erasing all routes by means of a broken connection. Unlike DSR, RERR packets in AODV are expected to signal all sources using a kink when a malfunction occurs.It is possible to envisage the propagation of route errors in AODV as a tree whose root is the node of the failure point, while all sources exercise the failed connection as their leaves.

Dynamic Source Routing (DSR)

The primary distinguishing characteristic of the DSR is that the use of source routing. That is, the sender knows the by-hop trajectory of the full hop to the destination. These routes are held in a path cache. Data packets carry the source route in the packet header.When an ad hoc network node intends to transfer a data packet to a destination for which the path is not still known, a path discovery algorithm randomly establishes this very path. Path discovery works by extracting network packets by route request (RREQ).Regardless of whether it is a destination or whether it has a path to the destination in its route cache, any node receiving an RREQ will retransmit it. This node responds to the RREQ with the packets of route reply (RREP) which is routed back to the source. RREQ and RREP packets are routed from the source as well.

The RREQ constructs the route the network crosses by moving backwards in this direction.By traversing this direction backwards, the RREP routes itself back towards its origin. The path enclosed by the RREP packet is cached at the source for future use.

A route error (RERR) packet is being utilized to alert the source node if it interrupts any connection on the source route.The source removes from its cache any route that uses this connection,If this route is still desired, the source must commence a new path discovery process. At its source, the RREP packet is cached. DSR makes use of source routing and path caching very actively.

PERFORMANCE ANALYSIS

Simulation Parameters

On Linux, the simulation experiment is performed. For the evaluation, the on-network simulator-2 (version 2.30) is used and this robust simulation model is adopted.To build a statistical data track file and configure its service source and the receiver, the NS command could be used to describe the overall network structure as well as the motion mode of all its nodes.

The simulation experiment is executed in Linux. Detailed simulation model is carried out on the on-network simulator-2 (version 2.30), which is utilised for the evaluation. In order to create the statistical data track file and to configure the service source and the receiver, NS instructions can be utilised to characterise the topology structure of network and the motion mode of its nodes.

As the comparison is being done in both static as well as dynamic (varying node count and packet size) conditions so the parameters will also vary accordingly. The major difference will be in the network type and the packet size being used under different conditions.

Continuous bit rate traffic source will be used and any random source-destination nodes will be chosen for the data transfer process.

Metrics Used

Packet delivery ratio:

This is the ratio between the number of packets from the source and the number of packets received at the final destination by the sink.

End to end delay: The delay involved in transfer of packets from one end to other, i.e. the time consumed for transfer of data from source to the destination.End to end delay normally depends upon factors like packet size, protocol being used, congestion in the network and distance to be covered.Lower the delay better will be the routing protocol.

Normalised routing load:

The number of transmitted routing packets per data packet sent to the destination. Each hop-wise transmission is counted as one transmission of a routing packet

Throughput: It is the ratio of the total no. of packets delivered to the total no. of packets involved in the process.

COMPARISON RESULTS

After extensive comparison in ns-2 with random topologies, AODV proves to be the dominating protocol over DSR especially in case of overall throughput.

Under following conditions, the results obtained were: -

For static networks:

Packet Delivery ratio: AODV better

End to end delay: DSR better

Normalised routing load: DSR better

Throughput: DSR better

For dynamic networks with varying node count:

Packet Delivery ratio: AODV better

End to end delay: DSR better

Normalised routing load: DSR better

Throughput: AODV better

For dynamic networks with varying packet size:

Packet Delivery ratio: AODV better

End to end delay: DSR better

Normalised routing load: DSR better

Throughput: AODV better

But the difference among two is not comprehensive enough so as to get maximum results out of AODV. Hence this paves way for improvement in the AODV protocol using the link repair mechanism.

IMPROVED AODV

Link repair mechanism incorporated

Under this if due to some reason the link is broken while transaction of packets from one end to other, the transaction will start again from the node where the link was broken unlike the previous unimproved versions in which the whole transaction had to restart from the very beginning.

The dynamic nature of Ad-hoc characterized with the node mobility results in breaking of the connections due to the ever-evolving topology of the nodes. More link errors are likely to take place as the degree of mobility of the wireless network increases considerably. Usually, route repair is done to create a new route when this occurs.

The dynamic architecture of the Ad-hoc networks, coupled with the movement of the nodes, leads to the interruption of the connections attributed to the evolving topology of nodes. More link failures are likely to occur as the mobility of the wireless network increases dramatically.Usually, route repair is done to create a new route whenever this develops. This route repair mechanisms suffer from problems such as high overhead control and Long Delay of Packet, rendering them ineffective Due to regular intermediate connection faults in end-to-end connectivityIf there is a breakage in the intermediate route, it is effective to discover a new route locally without having to resort to an end-to-end route exploration..

We propose an enhanced AODV in this paper, i.e. algorithm based on the local route repair (LRR) that restricts the repair to the vicinity of the broken connection.

Figure 1 shows the transfer of packet from source node to destination node. Node 1 is source node and Node 11 is destination node. During transmission there is a link break between Node 6 and Node 10. This stops the transmission of data through this route.

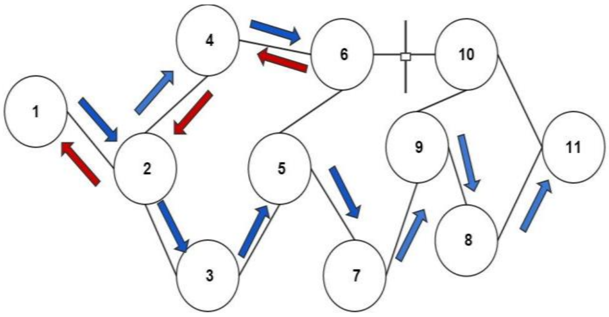

Figure-1 Link Repair in AODV

Figure 2 shows how the link repair takes place in improved AODV. In this case the intermediate node i.e. Node 6 itself does the link repair. In improved AODV the intermediate node i.e. Node 6 sends out a broadcast request to search a new path. If the new path is available then the route table is updated with this new node and sends the data through this new route as shown in figure.

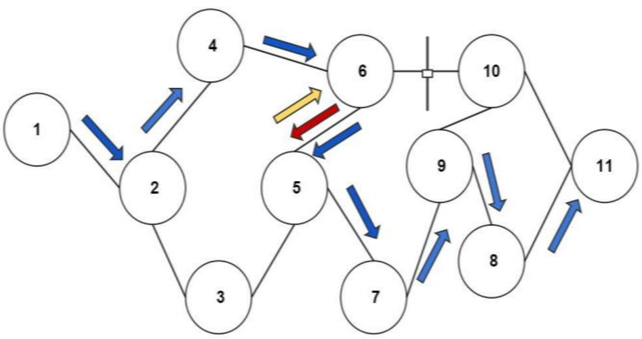

Figure-2. Local link Repair in improved AODV

Further we see how the link repair takes place in AODV. In this the Node 6 sends Error Request to the source node i.e. Node 1. Now source node finds a new route and then remove old path and insert new path in the route table. Node 1 then sends data through new path as shown in figure above.

Thus, after these changes have been made to the low performance AODV we see that a significant improvement is seen in following factors.

- Reduces network congestion
- Increases overall throughput
- Reduces end to end delay
- Improves packet delivery ratio

Following are the graphs obtained after the comparison of the improved AODV with the older version of AODV.

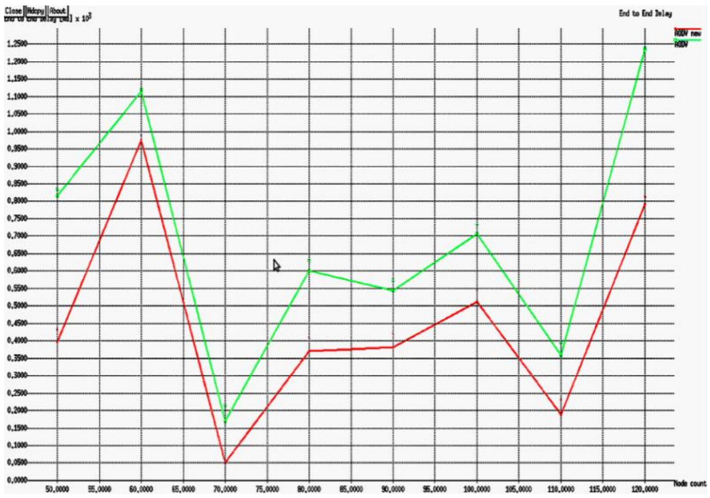

Figure-3. End to end delay graph

The end to end delay falls significantly in case of improved AODV(red) as compared to the older version of AODV (green). This change can be seen because of the presence of link repair mechanism as the link is repaired at the node involved itself instead of going back to the beginning, this saves a lot of transmission time.

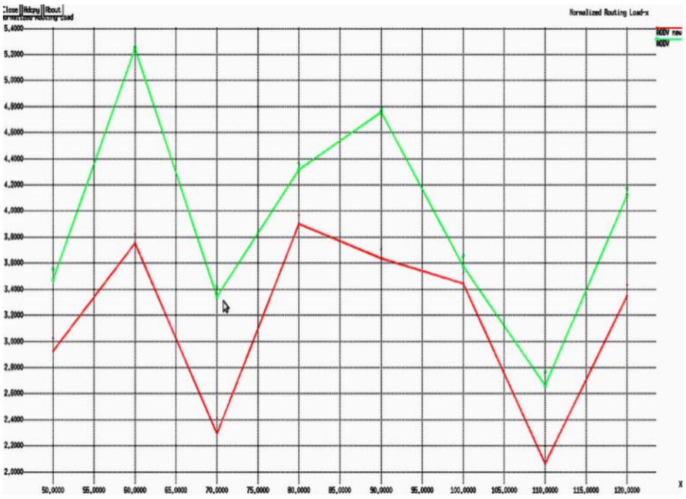

Figure-4. Normalised routing load

The normalised routing load also improves comprehensively for newer AODV represented in red.

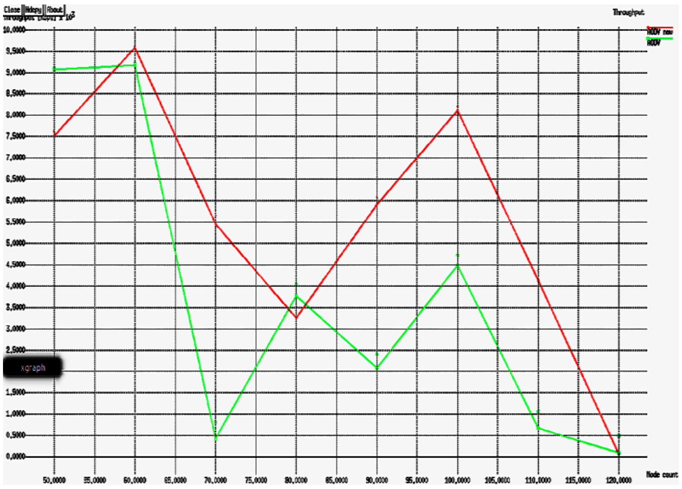

Figure-5. Packet delivery ratio

The packet delivery ratio increases in case of improvised AODV (red) as compared to older AODV (green). This happens primarily due to the presence of link repair mechanism which does not allow much wastage of data packets, because when the link is repaired, the collected/cached data is itself used for the process of further transmission instead of doing it all over again.

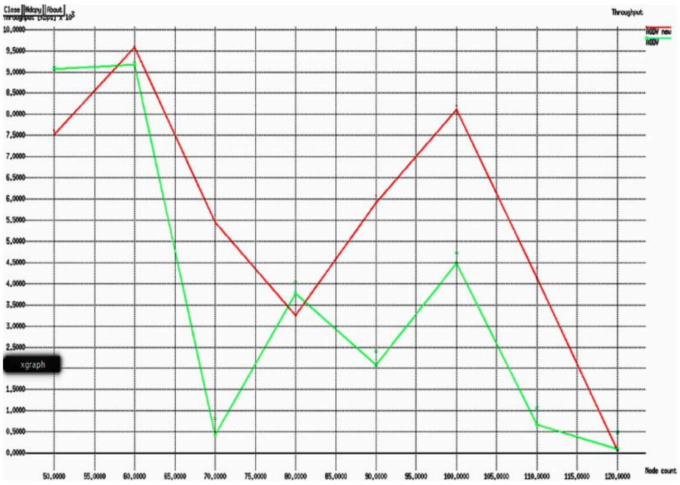

Figure-6. Throughput

The most important factor of all is the throughput. Higher the throughput better is the protocol. Thus we see that after the improvisations the newer AODV performs much better than the older AODV which proves the consistency in packet delivery for the newer AODV.

CONCLUSION

Except in the case of end-to-end latency, AODV was very good at both mobility rates and travel speeds. DSR works just as well as AODV, but also requires the transmission of multiple overhead routing packets. DSR is actually more costly at higher node mobility speeds than AODV.

After studying and working upon the link repair mechanism for AODV we notice that the improvised AODV outperforms other protocols.

In this paper, the connection repair strategy suggested by numerous researchers for local route repair has been identified and Modified in order to improve the efficacy of the traditional route selection and maintenance protocols used with the AODV protocol.Finally, we simulated the standard version of the AODV protocol to obtain a clear understanding of the behaviour of nodes in a Mobile Ad-Hoc Network.

References

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