Performance Improvement in Adaptive Routing Strategy in Mobile Adhoc Network

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Abstract: ***It has been a big challenge to develop a routing protocol that can meet different application needs and optimize routing paths according to the topology change in mobile adhoc networks. Based on their forwarding decisions only on the local topology, geographic routing protocols have drawn a lot of attention in recent years. In routing, nodes need to maintain up-to-date status of their immediate neighbors for making effective forwarding decisions. The periodic broadcasting of beacon packets that contain the geographical location coordinates of the nodes is a popular method used by most routing protocols to maintain neighbor status. Each node can determine and adjust the protocol parameter values independently according to different network environments, data traffic conditions and node's own requirements. The project offers the Adaptive Status Update strategy for routing, which dynamically adjusts the frequency of status updates based on the mobility dynamics of the guests and the forwarding patterns in the network based on nodes whose movements are harder to predict update their status more frequently, and nodes closer to forwarding paths update their Status more frequently.***

Keywords: Ad hoc On Demand Distance Vector (AODV), Distance Source Routing (DSR), Mobile Ad Hoc Network (MANET)\

1. Introduction

Ad hoc networks are a new archetype of wireless communication for mobile hosts (i.e. Nodes). In an ad hoc network, there is variable infrastructure such are base stations or mobile switching centers. Mobile nodes that communicate within each other's radio range directly via wireless links, while those that are far apart rely on other nodes to relay messages as routers. Node mobility in an ad hoc network causes frequent changes of the network topology.

In ad hoc networks all nodes are mobile and can be connected dynamically in an arbitrary manner. All nodes of these networks behave as routers and take part in the discovery and maintenance of routes to other nodes in the mesh. Ad hoc networks are really useful in emergency search-and-rescue operations, meetings or conventions in which persons wish to rapidly share information, and data acquisition operations in inhospitable terrain.

Nevertheless, in situations where nodes are mobile or when nodes often switch off and on, the local topology rarely remains still. Hence, it is necessary that each node periodically sends its updated location information to all of its neighbors. These location update packets are usually brought up as beacons. Status updates are costly in many ways. Each update consumes node energy, wireless bandwidth, and increases the risk of packet collision at the medium access control (MAC) layer. Packet collisions cause packet loss which in turn affects the routing performance due to decreased accuracy in specifying the correct local topology (a lost beacon broadcast is not retransmitted). A lost data packet does get retransmitted, but at the expense of increased end-to-end delay. For instance, if certain nodes are often changing their mobility characteristics (focal ratio and/or heading), it builds sense to frequently broadcast their updated status. Yet, for nodes that do not exhibit significant dynamism, the periodic broadcasting of beacons is wasteful.

In this report, we suggest a novel beaconing strategy for geographic routing protocols called Adaptive Status Updates strategy (ASU). Our scheme does forth with the drawbacks of periodic beaconing by adapting to the system variables. ASU incorporates two rules for activating the beacon update process. The first principle, referred as Mobility Prediction (MP), employs a simple mobility prediction scheme. The second principle, referred as On-Demand Learning (ODL), aims at improving the accuracy of the topology along the routing paths between the transmitting nodes. ODL uses an on demand learning strategy, whereby a node broadcasts beacons when it overhears the transmission of a data packet from a new neighbor in its neighborhood. Also comparing the performance and simulations of two on demand routing protocols DSR and AODV for this ASU strategy.

2. Literature Review

DREAM was one of the first protocols that incorporated status information within a routing protocol. In DREAM, each node maintains a location database that stores status information about all other nodes in the network. Of course, this onslaught is not scalable and requires a heavy number of beacon updates. The status updates could be corrected for the node mobility. Nevertheless, no details or practical strategies are talking over. In location information is utilized to forestall the departure time of the link between two mobile nodes, known as the Route Expiration Time (RET). The routing protocol always selects routes with the largest RET for data forwarding. Nevertheless, they only consider topology-based routing protocols in their workplace. In our work, we involve a similar prediction scheme but use it for triggering the beacon updates. As the communication in Ad-hoc networks greatly depend on the efficient turning of each node, it is rather very important to identify such selfish nodes. For many years the researchers have been straining to find out a solution for the security and misbehavior problems of MANETS and ended up with some finest techniques that either avoided selfish nodes or worked a way away even in their bearing. Notwithstanding the introduction of AODV and DSR routing protocol can be rated the best of all these techniques.

3. Methodology

In that respect are three modules in the projected system:-

1) Nodes are created and showing communication between them.
2) Using following rules we can discover the shortest way between the origin and destination.
3) Simulation and Comparison of AODV and DSR Routing Protocols in MANETs

3.1 Adaptive Status Update (ASU):-

We start by listing the assumptions built in our work: (1) all nodes are aware of their own status and speed. (2) All links are bi-directional. (3) The beacon updates include the current location and velocity of the nodes, and (4) data packets can piggyback status and velocity updates and all one-hop neighbors operate in the promiscuous mode and hence can overhear the data packets. Upon initialization, each node broadcasts a beacon informing its neighbors about its bearing and its current location and speed. Pursuing this, in most geographic routing protocols such as GPSR, each node periodically sends its current location information. The position information obtained from neighboring beacons is stored at each node. Grounded along the status updates received from its neighbors, each node continuously updates its local topology, which is interpreted as a neighbor list. Only those nodes from the neighbor list are viewed as possible prospects for data forwarding. Instead of periodic beaconing, ASU adapts the beacon update intervals to the mobility dynamics of the guests and the quantity of data being forwarded in the neighborhood of the lymph glands. ASU employs two mutually exclusive beacons triggering rules, which are talked about in the succeeding.

3.1.1 Mobility Prediction (MP) Rule

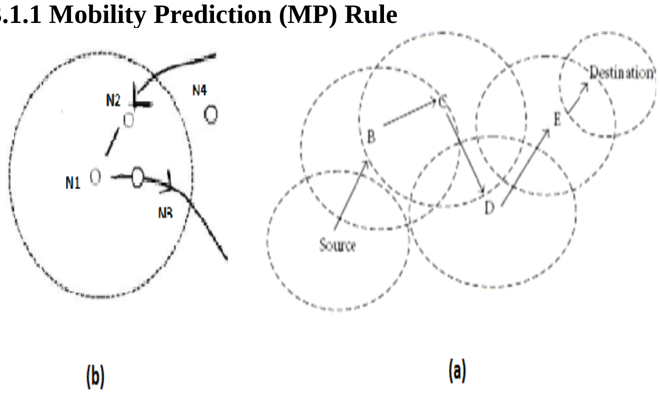

Figure 1: An Ad hoc network set-up

This segment presents the importance of mobility prediction in routing adhoc networks, by making a simple mobility scenario. Fig.1(a) represents an ad hoc network containing four nodes, which are N1, N2, N3 and N4. N1 is stable, N3 moves slowly towards N1 and N2 moves rapidly away from N1 and N4. N1 has data packets to send to N4. It finds that to reach N4, packets can pass either through N2, or through N3.

If N1 chooses N2 as intermediate node, then the communication will not last long time since the link (N1, N2) will be rapidly stopped, due to the mobility of N2. But if N1, takes into account the mobility of N2 and N3, it will choose N3 as an intermediate node because the exit time of the link (N1, N3) is superior to that of (N1, N2), since N3 have a luck to remain in N1 transmission range, more than N2. The fact that N1 chooses N3 as the next hop to reach N4 contributes to the choice of the route which holds the greatest expiration time or the most desirable itinerary. Fig.1. Simple mobility scenario in an ad hoc network, the MP rule thus, tries to maximize the effective duration of each beacon, by broadcasting a beacon only when the status information in the previous beacon becomes inaccurate. N1 further, highly mobile nodes can broadcast frequent beacons to assure that their neighbors are aware of the rapidly changing topology.

3.1.2 On-demand Learning Rule (ODL)

The MP rule solely may not be sufficient for keeping an accurate local topology. Hence, it is necessary to prepare a mechanism, which will maintain a more accurate local topology in those parts of the network where significant data forwarding activities are ongoing. This is precisely what the On-Demand Learning (ODL) rule aims to accomplish. As the name indicates, a node broadcasts beacons on-demand, i.e. in response to data forwarding activities that take place in the neighborhood of that node Fig. 2 illustrates the network topology before node N1 starts sending information to node N7.

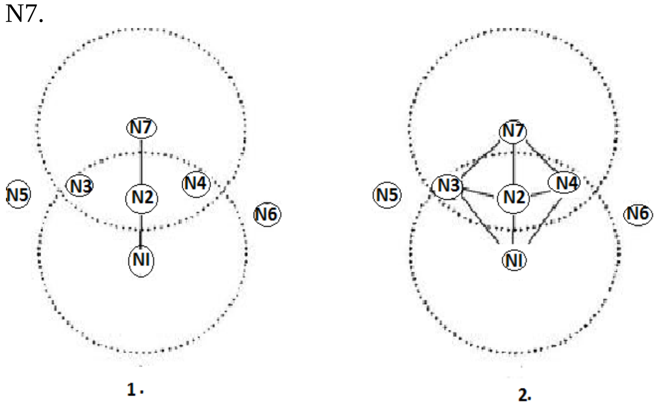

Figure 2: The network topology example

The firm lines in the pattern denote that both ends of the link are aware of each other. The initial possible routing path from N1 to N7 is N1-N2-N7. At present, when source N1 sends a data packet to N2, both N3 and N4 receive the data packet from N1. As N1 is a new neighbor of N3 and N4, according to the ODL rule, both N3 and N4 will send back beacons to N1. As a result, the links N1N3 and N1N4 will be seen. Further, based along the location of the destination and their current locations, N3 and N4 discover that the Fig. 2: An object lesson illustrating the ODL rule destination N7 is within their one-hop neighborhood. Similarly, when N2 forwards the information packet to N7, the links N2N3 and N2N4 are discovered. Fig. 4 (b) reflects the enriched topology along the routing path from N1 to N7.Notice that, though E and F receive the beacons from N3 and N4, respectively, neither of them respond back with a beacon. Since E and F do not lie in the forwarding path, it is vain for them to send beacon updates in response to the broadcasts from N3 and N4. In essence, ODL aims at improving the accuracy of topology on the routing path from the origin to the destination, for each traffic flow inside the net.

3.2 Taxonomy of Routing Protocols

Taxonomy of routing protocols in mobile ad hoc network can be done in many ways; the routing protocols can be categorized as Proactive (Table Driven), Reactive (on-demand) and Hybrid depending on the network structure.

A. Positive routing protocols

Proactive protocols perform routine operations between all source destination pairs periodically, irrespective of the need of such roads. These protocols attempt to maintain shortest path routes by using periodically updated views of the network topology. These are typically maintained in routing tables in each node and updated with the acquirement of raw data. Proactive protocols have the advantage of providing lower latency in data delivery and the possibility of supporting applications that have quality-of-service constraints.

B. Reactive routing protocols

Reactive protocols are designed to minimize routing overhead. Instead of tracking the changes in the network topology to continuously maintain shortest path routes to all destinations, these protocols determine routes only when necessary. Typically, these protocols perform a route discovery operation between the source and the desired destination when the source needs to send a data packet and the route to the destination is not known. Main idea in on-demand routing is to recover and maintain only needed routes. The different types of On Demand driven protocols are Adhoc On Demand Distance Vector (AODV), Dynamic Source routing protocol (DSR), temporally ordered routing algorithm (TORA), Ad-hoc On-demand Multipath Distance Vector Routing (AOMDV). Our discourse is restricted to two on-demand ad-hoc routing protocols DSR and AODV.

1. Dynamic Source Routing (DSR)

The Dynamic Source Routing (DSR) is an on demand source routing protocol that employs route discovery and road maintenance procedures similar to AODV. In DSR, each node maintains a route cache with entries that are continuously updated as a node learns new routes.

Similar to AODV, a node wishing to charge a packet will first inspect its route cache to look whether it already delivers a path to the terminus. If there is no valid route in the cache, the sender initiates a route discovery process by passing around a route request packet, which contains the address of the destination, the address of the source, and a unique request ID. As this request propagates through the mesh, each node inserts its own address in the request packet before rebroadcasting it. As a result, a request packet records a route consisting of all lymph glands it has inflicted. In one case a request packet arrives at the address, it will have recorded the entire route from the origin to the terminus. In symmetric networks, the destination node can unicast a reply packet, containing the collected route information, back to the source using the precise same path as taken by the request packet.

In networks with asymmetric links, the destination can itself initiate a route discovery procedure to the source, where the request packet also carries the itinerary from the origin to the terminus. One time the response packet (or the destination's request packet) arrives at the root, the source can add the new path into its cache and begin sending packets to the address. Similar to AODV, DSR also employs a route maintenance procedure based on error messages, which are generated whenever the link layer detects a transmission failure due to a broken link.

Compared to proactive routing protocols, DSR shares similar advantages and disadvantages as AODV. Unlike AODV, each packet in DSR carries route information, which allows intermediate nodes to add new routes proactively to their own caches. Also, DSR's support of asymmetric links is another advantage compared to AODV.

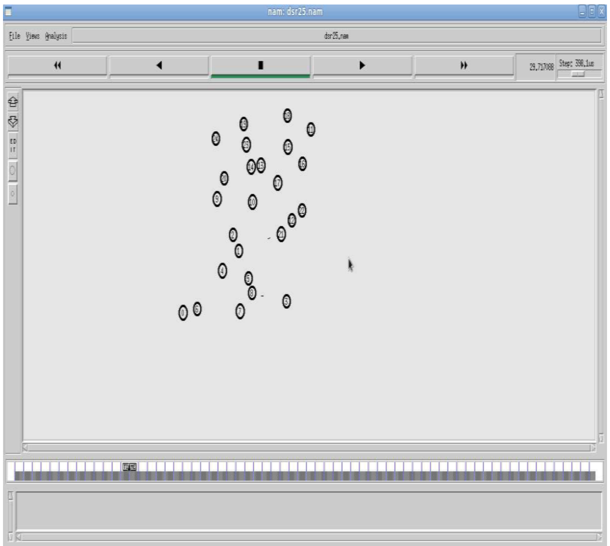

Figure 3: Creation of 25 node of DSR using NAM

2. Ad Hoc on Demand Distance Vector (AODV)

The ad hoc on-demand distance-vector (AODV) routing protocol is an on-demand routing protocol; all routes are discovered only when needed, and are maintained only as long as they are being used. Routes are identified through a route discovery cycle, whereby the network nodes are queried on search of a path to the destination node.

Path Discovery

When a source node has data packets to mail to some goal, it holds in its routing table to see whether it already receives a route to that address. If so, it can then use that route to channel the information packages. Differently, the guest must perform a route discovery procedure to find a route to the terminus.

Route maintenance

In an ad hoc network, links are likely to fail due to the mobility of the lymph glands and the ephemeral nature of the wireless channel. Hence, there must be a mechanism in space to repair routes when links within active routes break. An active route is set to be a route that has recently been used for the transmittal of information packages.

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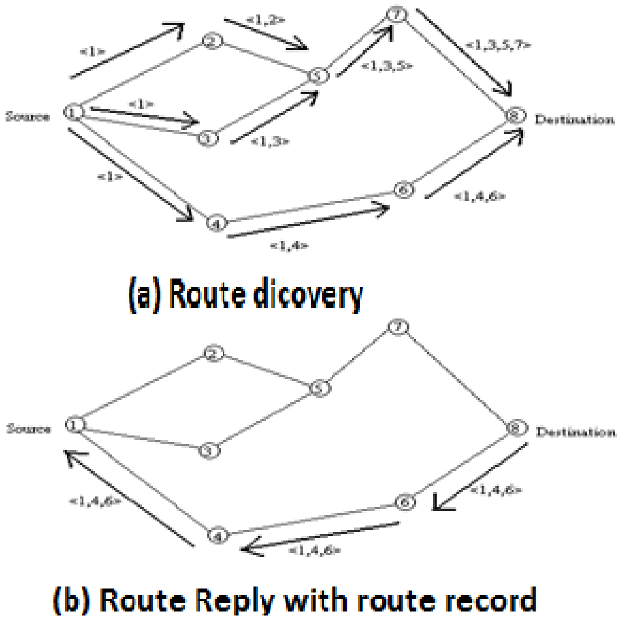

Figure 4: A possible path for a route replies if a wishes to find a route

The above Figure 4 illustrates an AODV route lookup session. Node A wants to initiate traffic to node J for which it has no route. A transfer of a RREQ has been executed, which is flooded to all nodes in the mesh. When this request is forwarded to J from H, J generates a RREP.

This RREP is then unicast back to A using the cached entries in nodes H, G and D. AODV builds routes using a route request/route reply query cycle. When a source node desires a route to a destination for which it does not already have a route, it broadcasts a route request (RREQ) packet across the network. Nodes receiving this packet update their information for the root node and set up backwards pointers to the root node in the route tables. In summation to the source node's IP address, current sequence number, and broadcast ID, the RREQ also contains the most recent sequence number for the destination of which the root node is aware. A node getting the RREQ may send a route reply (RREP) if it is either the destination or if it has a route to the destination with a corresponding sequence number greater than or equal to that held in the RREQ. If this is the case, it incest a RREP back to the beginning. Differently, it rebroadcasts the RREQ. Nodes keep track of the RREQ's source IP address and broadcast ID. If they receive a RREQ which they possess already processed, they discard the RREQ and do not forward it.

4. Research Tool Used

Simulation Tool (Network Simulator 2)

Widely known as NS2, is simply an event driven simulation tool that has proved useful in studying the dynamic nature of communication networks. Simulation of wired as well as wireless network functions and protocols (e.g., routing algorithms, TCP, UDP) can be done using NS2 It consists of two simulation tools. The network simulator (ns) contains all commonly used IP protocols. The network animator (name) is used to visualize the simulations. Ns-2 fully simulates a layered network from the physical radio transmission channel for high-level applications The simulator was originally produced by the University of California at Berkeley and VINT project the simulator was recently expanded to provide simulation support for ad hoc network of Carnegie Mellon University (CMU Monarch Project homepage, 1999). NS2 consists of two key languages: C++ and Object Oriented Tool Command Language (OTcl) while the C++ defines the inner mechanism (i.e., a backend) of the simulation objects, the OTcl sets up simulation by setting up and configuring the objects every bit well as scheduling discrete events (i.e., a front-end). As demonstrated in figure The C++ and the Article are linked together using TclCL After simulation, NS2 outputs either text-based or animation-based simulation solutions. To understand these results graphically and interactively, tools such as NAM (Network AniMator) and XGraph are used.

5. Work Plan

Our ASU scheme is compatible with any geographic routing protocol. In this study, we have incorporated the ASU strategy in the popular GPSR protocol, which we refer to as GPSR-ASU. In this part, we give a simulation-based comparison of GPSR-ASU with the original GPSR scheme. We initially use a random topology which allows us to examine the effect of varying the node mobility on the performance of GPSR-ASU. In summation, we have also examined the issue of the traffic load on ASU using a realistic vehicular network. Since in geographic routing protocols, each node is unaware of the entire network topology, the forwarding path chosen may be longer than the optimal shortest-hop track. Also measured the operation of DSR and AODV using NS-2.

The comparison was based along the packet delivery fraction, throughput and end-to-end delay. AODV gives better performance as compared to DSR and DSR in terms of packet delivery fraction and throughput, but worst in terms of end-to end delay. We have also seen that DSR routing protocol is best in terms of end-to-delay in both Static and dynamic network for each circle of maximum connections.

Table 1: Comparison of Proactive and Reactive routing protocols

Proactive routing protocols	Reactive routing protocols
Attempt to maintain consistent, up-todate routing information from each node to every other node in the network.	A route is built only when required.
Constant propagation of routing information periodically even when topology change does not occur.	No periodic updates. Control information is not propagated unless there is a change in topology.
A route to every other node in ad-hoc network is always available.	Not available
First packet latency is less when compared with on-demand protocols.	First-packet latency is more when compared with table-driven protocols because a route needs to be built.

6. Result Analysis

More or less important performance metrics can be measured:-

1) Packet delivery Fraction

The ratio of the data packets delivered to the destinations to those engendered by the CBR sources. It sets the packet loss rate, which determines the maximum throughput of the net.

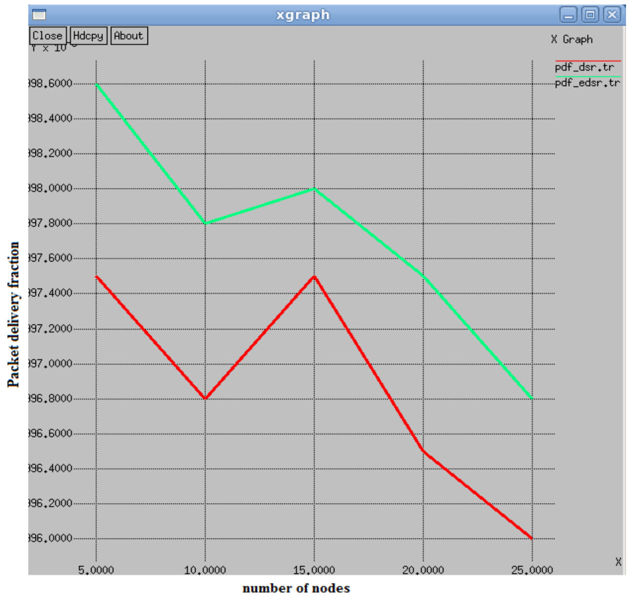

Figure 5: Graphical Representation of Packet delivery

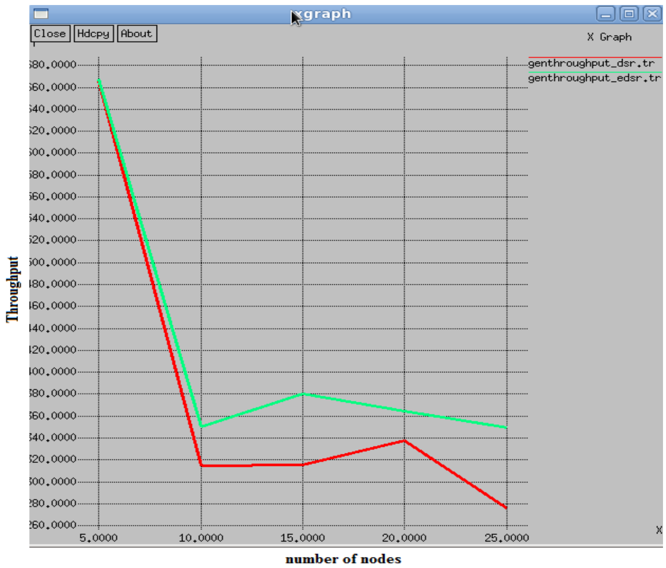

Figure 6: Graphical Representation of Throughput

2) End-to-end Delay:

This metrics average end-to-end delay and indicates how long it took for a packet to travel from the source to the application layer of the destination. It includes all possible time lag caused by buffering during route discovery latency, transmission delays at the MAC, queuing at interface queue, and propagation and transport time. It is usually measured in seconds.

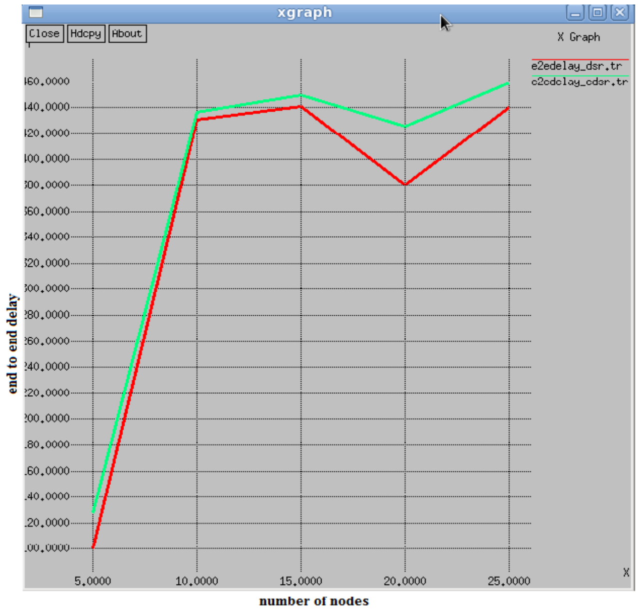

Figure 7: Graphical Representation of End-to-end Delay

3) Throughput

Throughput is total packets successfully delivered to individual destinations over total time divided by full time. The first two metrics are the most important for best-effort traffic. The routing load metric evaluates the efficiency of the routing protocol.

7. Conclusion

We proposed the Adaptive Status Update (ASU) strategy to address these problems. The ASU scheme employs two mutually exclusive rules. The MP rule uses mobility prediction to estimate the accuracy of the location estimate and adapts the beacon update interval accordingly, instead of using periodic beaconing. The ODL rule allows nodes along the data forwarding path to maintain an accurate view of the local topology by exchanging beacons in response to data packets that are overheard from new neighbors.

AODV and DSR are very alike, but AODV mechanisms are easier to implement and to mix with other mechanisms using other different routing protocols. AODV maintains only one route per destination. This is one of the major problems in AODV, since every time a route is gone; a route discovery has to be started. This contributes to more overhead, higher delays and high packet lost. On the other hand, DSR seems to be more stable and has less overhead than AODV. DSR can make usage of multiple tracks and does not charge a periodic packet as AODV. Moreover, it stores all usable routing information extracted from overhearing packets. Nevertheless, these overheard route information could contribute to incompatibilities.

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