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A Quantative Survey on Routing Protocols used in Mobile Ad-hoc Network

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Abstract—A MANET is a collection of mobile nodes sharing a wireless channel without any centralized control or established communication backbone. MANET has dynamic topology and each mobile node has limited resources such as battery, processing power and on-board memory. Selection of the protocols and path routing are the most common strategies that are to be focused while designing any kind of wireless networks such as MANETs, WSNs, WMNs and VANETs. MANETs are basically characterized as frequently changing network topology, multi-hop wireless connectivity and an efficient dynamic routing protocol. In MANETs, the protocol is selected on the basis of how the data is delivered and how its integrity is maintained. Hence, before making the selection of any routing protocol we should make the performance analysis of various routing protocol. In this paper, performance analysis of various routing protocols Ad-hoc On-Demand Distance Vector (AODV),Temporally Ordered Routing Algorithm (TORA), Optimized Link State Routing (OLSR) and Destination Sequenced Distance Vector (DSDV) are carried out using NS2 simulator. We compare the performance of these routing protocols on the basis of various parameters such as throughput, packet delivery ratio, delay and control overhead.

Key terms:- MANET,AODV, TORA,DSDV,OLSR, PROACTIVE AND REACTIVE PROTOCOL

INTRODUCTION:-

A collection of mobile nodes are comprised into the Mobile Ad-hoc Networks (MANETs). The mobile nodes creates a wireless networks among themselves without using any infrastructure or administrative support dynamically. Ad-hoc wireless networks are self-creating, self-organizing, and self-administering. By communicating among their component mobile nodes they inherit from being exclusive. Therefore, in order to provide the necessary control and administration function, such communications are used for supporting such network. In earlier days due to such apparent advantages, When a discovered route is no longer needed, the source node initiates a route delete (RD) broadcast. All nodes along the route delete the route entry from their routing tables. The RD message is propagated by a full broadcast, as opposed to a directed broadcast, because the source node may not be aware of any route node changes that occurred during RRCs.

3.3 Hybrid Protocols

Hybrid Routing Protocols attempts to combine the characteristics of both Proactive and Reactive approaches by dividing the network into Zones or Clusters. It reduces the Control Overhead of Proactive Protocols and decreases the Latency caused by Route Discovery in Reactive Routing Protocols. The examples are Zone Routing Protocol (ZRP), Sharp Hybrid Adaptive Routing Protocol (SHARP), and Cluster Based Routing Protocol (CBRP) etc.

3.3.1 Zone Routing Protocol (ZRP)

ZRP is a hybrid Routing Protocol which exploits the good features of both Reactive and Proactive Routing Protocol. It divides the network into several routing zones. The routing in ZRP based on two procedures: Intra-zone Routing Protocol (IARP) and Inter-zone Routing Protocol (IERP). IARP uses Proactive Routing Protocols to operate inside the zones, and IERP uses Reactive Routing Protocols to find optimal routes to destinations that are located outside the zones. When sender node wants to send packet then firstly the packet is sent in the Intra-zone of the source node. If the destination belongs to same zone, then deliver it, otherwise source node sends a RREQ to all peripheral nodes. At reception of RREQ, if the peripheral node finds the destination node then it sends a "Route Reply" message back to the source node. ZRP reduces the control overhead compared to the On-demand and Table-driven approaches. But in the absence of Query-control, this protocol produces higher control overhead then the abovementioned schemes.

3.3.2 Temporally Ordered Routing Algorithm (TORA)

The Temporally Ordered Routing Algorithm (TORA) is a highly adaptive, efficient and scalable distributed routing algorithm based on the concept of link reversal. TORA is proposed for highly dynamic mobile, multi-hop wireless networks. It is a source-initiated on-demand routing protocol. It finds multiple routes from a source node to a destination node. The main feature of TORA is that the control messages are localized to a very small set of nodes near the occurrence of a topological change. To achieve this, the nodes maintain routing information about adjacent nodes. The protocol has three basic functions: Route creation, Route maintenance, and Route erasure.

Each node has a quintuple associated with it -

- Logical time of a link failure
- The unique ID of the node that defined the new reference level
- A reflection indicator bit
- A propagation ordering parameter
- The unique ID of the node

The first three elements collectively represent the reference level. A new reference level is defined each time a node loses its last downstream link due to a link failure. The last two values define a delta with respect to the reference level.

Route Creation is done using QRY and UPD packets. The route creation algorithm starts with the height (propagation ordering parameter in the quintuple) of destination set to 0 and all other node's height set to NULL (i.e. undefined). The source broadcasts a QRY packet with the destination node's id in it. A node with a non-NULL height responds with a UPD packet that has its height in it. A node receiving a UPD packet sets its height to one more than that of the node that generated the UPD. A node with higher height is considered upstream and a node with lower height downstream. In this way a directed acyclic graph is constructed from source to the destination. Figure 6 illustrates a route creation process in TORA. As shown in figure 6a, node 5 does not propagate QRY from node 3 as it has already seen and propagated QRY message from node 2. In figure 6b, the source (i.e. node 1) may have received a UPD each from node 2 or node 3 but since node 4 gives it lesser height, it retains that height.

4. Result

Tabular Summary of all four routing protocols vs. Throughput.

No of Nodes	10	20	30	40	50
Protocols↓					
AODV	2800	2500	2180	2170	2600
TORA	2700	2440	1990	2100	2480
OLSR	3190	3170	2700	2900	2600
DSDV	3600	3450	3100	3450	3220

5. CONCLUSIONS AND FUTURE WORK

In this paper, a performance comparison of AODV (Ad-Hoc on Demand Distance Vector) Routing Protocol and Proactive includes DSDV (Destination Sequences Distance vector) Routing Protocol on the basis of Average End to

End Delay, Network Load, Throughput and Packet Delivery Ratio (PDR) metrics by using Riverbed (OPNET) Simulator. We have simulated the Protocols with 50 numbers of fixed nodes for FTP environment. DSDV outperforms AODV Routing Protocol in the Throughput and Packet Delivery Ratio (PDR) performance metrics used in this research. It also outperforms another protocol when deployed in high load networks. DSDV has shown the worst performance in packet End-to-End Delay and Network Load. Itis therefore well suited for high capacity networks. The high routing traffic in DSDV used to discover and maintain routes makes it unsuitable for low capacity networks. From this study, we conclude that among the protocols considered, there is no single one with an overall superior performance. One protocol may be superior in terms of packet End-to-End Delay and Network Load whilst others may be superior in terms of Packet Delivery Ratio, or Throughput. The choice of a particular Routing Protocol will depend on the intended use of the network. In future, number of nodes, more sources, and additional metrics such as average hop count, average jitter and routing overhead may be used.

In this paper we evaluated the four performance measures i.e. control overhead, PDR, end to-end delay and throughput with different number of nodes, different speed (pause time) of nodes and different size of network. From results reported in section 4 we concluded that DSR protocol is the best in terms of average PDR. For high mobility condition of nodes DSR gives better packet delivery ratio than other protocols making it suitable for highly mobile random networks. Similarly for network size analysis it is observed that the DSR protocol outperforms other protocols if the network size is less than 600x600sqm. From this analysis we consider 600X600 sqm size networks to evaluate the network load analysis and mobility analysis. If the network size is more than 600x600sqm. And if PDR and throughput are the prime criteria, the OLSR protocol is the better solution for high mobility condition. In future, utilizing these performances we can design such a protocol that can be suitably provide data integrity as well as data delivery in highly random mobility network. Our focus is to analyze the energy metrics as the cost function for routing in these protocols for better QoS applications.

In this article, several existing routing protocols for ad hoc Wireless Networks were described. Two categories of routing protocols were discussed. Table-driven and on-demand routing protocols. In table-driven protocols, each node maintain up-to-date routing information to all the nodes in the network where in on-demand protocols a node finds the route to a destination when it desires to send packets to the destination.

Several table-driven protocols were discussed. DSDV and GSR are table-driven protocols that use destination sequence numbers to keep routes loop-free and up-to-date. HSR and ZHLS are hierarchical routing. FSR reduces the size of tables to be exchanged by maintaining less accurate information about nodes farther away. CGSR is a cluster-based routing protocol where nodes are grouped into clusters.

On-demand routing protocols were also discussed. In on-demand protocols, a route creation is initiated by the source when the source wants to communicate to the destination. CBRP is a cluster based routing algorithm like CGSR except that it is an on-demand routing mechanism as opposed to CGSR that is table-driven. AODV on-demand version of DSDV routing protocol. DSRP is a source routing mechanism where the route is in each packet. ABR uses the degree of associativity to select routes. Similarly, SSR selects routes based on signal strength.

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