COMPARISON OF DIFFERENT ROUTING PROTOCOLS FOR MOBILE AD-HOC NETWORK

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ABSTRACT

In this paper we are presenting a routing protocol comparison for mobile Ad-Hoc Networks. So far, the protocols have been analyzed theoretically. Compares the result from these theoretical/qualitative analyses and shows what properties the protocols have and do not have. As it can be seen from Table, none of the protocols support power conservation or Quality of Service. This is however working in progress and will probably be added to the protocols. All protocols are distributed, thus none of the protocols is dependent on a centralized node and can therefore easily reconfigure in the event of topology changes. This paper compared seven routing protocols on the basis of four parameters like hello message requirement, update destination, routing strategy and method of communication. AODV and CBRP only uses broadcast hello message. DSDV, WRP and AODV uses distance vector routing strategy and DSR and CBRP uses source routing that uses the concept of route cache. DSDV, WRP and TORA broadcast the packets in the network. CBRP uses flooding of the packets and DSR unicast the packet to next neighbor.

Keyword: - *MANET, AODV, DSR, WRP and TORA etc.*

1. INTRODUCTION

A Mobile Ad hoc Network (MANET) is a collection of mobile platforms that form a dynamic infrastructure-less communication network wherever it is required. The nodes in the network not only acts as hosts but also as routers that discover and maintain routes to other nodes in the network. Quick and easy establishment of such networks make them feasible to be used in military, disaster area recovery and in other environments where no infrastructure exists or it has been destroyed. Since mobile nodes move in various directions causing existing links to break and the establishment of new routes, routing in such networks is a challenging task. The mobility (i.e. how nodes move) of mobile nodes plays a significant role on the performance of routing protocols. Routes between two communicating nodes may consist of multiple hops through other nodes in the network. Therefore, finding and maintaining routes in MANET is nontrivial. Several routing protocols have been developed for mobile ad hoc networks. Such protocols must deal with typical limitations of these networks which include low bandwidth, high power consumption, and high error rates. Ad hoc networks are characterized by multi-hop wireless connectivity, frequently changing network topology and the need for efficient dynamic routing protocols plays an important role. We compare the performance of two prominent on-demand routing protocols for mobile ad hoc networks: Dynamic Source Routing (DSR), Ad Hoc On- demand distance Vector Routing (AODV). A detailed simulation model with MAC and physical layer models is used to study the interlayer interactions and their performance implications. We demonstrate that even though DSR and AODV share similar on-demand behavior, the differences in the protocol mechanisms can lead to significant performance differentials. In this paper we examine two on demand routing protocols AODV and DSR based on packet delivery ratio, normalized routing load, normalized MAC load, average end to end delay by varying the number of sources, speed and pause time.

2. MOBILE AD-HOC WIRELESS NETWORKS

Mobile ad-hoc wireless networks hold the promise of the future, with the capability to establish networks at anytime, anywhere. These networks don't rely on extraneous hardware, which makes them an ideal candidate for rescue and emergency operations. These networks are built, operated, and maintained by their constituent wireless nodes. These nodes generally have a limited transmission range and, so, each node seeks the assistance of its neighboring nodes in forwarding packets. In order to establish routes between nodes which are further than a single hop, specially configured routing protocols are engaged. The unique feature of these protocols is their ability to trace routes in spite of a dynamic topology. These protocols can be categorized into two main types: reactive and proactive. The nodes in an ad hoc network generally have limited battery power and, so, reactive routing protocols endeavor to save power by discovering routes only when they are essentially required. In contrast, proactive routing protocols establish and maintain routes at all instants of time so as to avoid the latency that occurs during new route discoveries Mobility models define nodes' movement pattern in ad- hoc networks. Since, MANETs are currently not deployed on a large scale and due to the inherent randomness of mobility models, research in evaluating the performance of routing protocols on various mobility models are simulation based . Therefore in most of the cases performance analysis is carried out using various popular simulators like NS-2. In this paper, the performance of MANET using AODV and DSR routing protocol is evaluated by comparing different mobility models like Random Waypoint mobility. An Ad-Hoc routing protocol must be able to decide the best path between the nodes, minimize the bandwidth overhead to enable proper routing, minimize the time required to converge after the topology changes. Ad hoc networks are very useful in emergency search-and-rescue operations, meetings or conventions in which persons wish to quickly share information, and data acquisition operations in inhospitable terrain.

Table 1.1: Compersion of different Protocol

	DSDV	WRP	DSR	AODV	TORA	ZRP
Hello Message Requirement	No	No	No	No	No	No
Update Destination	Neighbors	Neighbors	Source	Source	Neighbors	Neighbors
Routing Strategy	Distance Vector	Distance Vector	Source Routing	Distance Vector	Link State	Hybrid
Method of Communication	Broadcast	Broadcast	Unicast	Unicast	Broadcast	Broadcast

3. REACTIVE ROUTING PROTOCOLS

Reactive or on-demand routing protocols were designed to reduce overheads present in proactive protocols by maintaining information. It uses distance - vector routing algorithm and establishes the route to given destination only when a node requests it by initiating route discovery process. This protocols work on route discovery and route maintenance mechanism .

Reactive routing protocols have drawback of delay in finding routes to new destination. There are number of reactive routing protocols available in MANET like DSR, AODV, TORA and LMR etc.

Proactive routing protocols are also known as Table-driven routing protocol uses link-state routing algorithms which floods link information about its neighbors frequently. This type of protocol keeps and maintains up-to-date routing information between every pair of nodes by sending control message periodically in network .

One of the main advantages of this protocol is that routes are ready to use when needed. The major drawback of proactive routing protocols includes the overhead of flooding route there are various proactive routing protocols present for MANET [2] like DSDV, OLSR, and WRP etc.

Table 1.2: Comparison between protocols

Features	Reactive	Proactive	Hybrid
Routing Structure	Flat	Flat/ Hierarchical	Hierarchical
Route Acquisition on	On demand	Table driven	Combination of both
Routing overhead	Low	High	Medium
Latency	High due to flooding	Low due to routing tables	Inside zones low outside similar to reactive protocol
Scalability	Non Suitable for large network	Low	Designed for large network
Routing information	Available When Required	Always available	Combination of both
Periodic Updates	Not Needed	Yes Whenever the topology of the network	Yes
Mobility	Route Maintenance	Periodic Update	Combination of both

4. COMPARISON

So far, the protocols have been analyzed theoretically. Table 1.1 summarizes and compares the result from these theoretical/qualitative analyses and shows what properties the protocols have and do not have. As it can be seen from Table 1.3, none of the protocols support power conservation or Quality of Service. This is however working in progress and will probably be added to the protocols . All protocols are distributed, thus none of the protocols is dependent on a centralized node and can therefore easily reconfigure in the event of topology changes.

DSDV is the only proactive protocol in this comparison. It is also the protocol that has most in common with traditional routing protocol in wired networks. The sequence numbers were added to ensure loop-free routes. DSDV will probably be good enough in networks, which allows the protocol to converge in reasonable time. This however means that the mobility cannot be too high. The authors of DSDV came to the same conclusions and designed AODV, which is a reactive version of DSDV. They also added multicast capabilities, which will enhance the performance significantly when one node communicates with several nodes. The reactive approach in AODV has many similarities with the reactive approach of DSR. They both have a route discovery mode that uses request messages to find new routes. The difference is that DSR is based on source routing and will learn more routes than AODV. DSR also has the advantage that it supports unidirectional links. DSR has however one major drawback and it is the source route that must be carried in each packet. This can be quite costly, especially when QoS is going to be used . ZRP and CBRP are two very interesting proposals that divide the network into several zones/clusters. This approach is probably a very good solution for large networks. Within the zones/clusters they have a more proactive scheme and between the zones/clusters they have a reactive scheme that has many similarities with the operation of AODV and DSR. They have for instance a route discovery phase that sends request through the network. The difference between ZRP and CBRP is how the network is divided. In ZRP all zones are overlapping and in CBRP clusters can be both overlapping and disjoint. None of the presented protocols are adaptive, meaning that the

protocols do not take any smart routing decisions when the traffic load in the network is taken into consideration. As route selection criteria, the proposed protocols use metrics such as shortest number of hops and quickest response time to a request. This can lead to the situation where all packets are routed through the same node even if there exist better routes where the traffic load is not as large.

Table 1.3: Comparison between ad-hoc routing protocols

	DSDV	**AODV**	**DSR**	**ZRP**	**TORA/IMEP**	**CBRP**
Loop free	Yes	Yes	Yes	Yes	No, short Lived loops	Yes
Multiple routes	No	No	Yes	No	Yes	Yes
Distributed	Yes	Yes	Yes	Yes	Yes	Yes
Reactive	No	Yes	Yes	Partially	Yes	Yes
Unidirectional link support	No	No	Yes	No	No	Yes
Qos Support	No	No	No	No	No	No
Multicast	No	No	No	No	No	No
Security	No	No	No	No	No	No
Power conservative	No	No	No	No	No	No
Periodic broadcasts	Yes	Yes	No	Yes	Yes (IMEP)	Yes
Requires reliable or sequenced data	No	No	No	No	Yes	No

The Table 1.4 shows the comparison between different routing protocols. This table compared seven routing protocols on the basis of four parameters like hello message requirement, update destination, routing strategy and method of communication. AODV and CBRP only uses broadcast hello message. DSDV, WRP and AODV uses distance vector routing strategy and DSR and CBRP uses source routing that uses the concept of route cache. DSDV, WRP and TORA broadcast the packets in the network. CBRP uses flooding of the packets and DSR unicast the packet to next neighbor.

Table 1.4: Comparison of different routing protocols

	DSDV	WRP	DSR	AODV	TORA	ZRP	CBRP
Hello message requirement	No	No	No	Yes	No	No	Yes
Update Destination	Neighbors	Neighbors	Source	Source	Neighbors	Neighbors	Neighbors
Routing Strategy	Distance vector	Distance vector	Source routing	Distance vector	Link state	Hybrid	Source routing
Method of Communication	Broadcast	Broadcast	Unicast	Unicast	Broadcast	Broadcast	Flooding

5. CONCLUSIONS

In this paper we will discuss the Ad Hoc Wireless Network and different types of routing protocols. In this paper comparison of different types of routing protocols and compared seven routing protocols on the basis of four parameters like hello message requirement, update destination, routing strategy and method of communication. AODV and CBRP only uses broadcast hello message. DSDV, WRP and AODV uses distance vector routing strategy and DSR and CBRP uses source routing that uses the concept of route cache. The Table 1.4 shows the comparison between different routing protocols. This table compared seven routing protocols on the basis of four parameters like hello message requirement, update destination, routing strategy and method of communication. The reactive approach in AODV has many similarities with the reactive approach of DSR. They both have a route discovery mode that uses request messages to find new routes. The difference is that DSR is based on source routing and will learn more routes than AODV. DSR also has the advantage that it supports unidirectional links. DSR has however one major drawback and it is the source route that must be carried in each packet. This can be quite costly, especially when QoS is going to be used . ZRP and CBRP are two very interesting proposals that divide the network into several zones/clusters. This approach is probably a very good solution for large networks. Within the zones/clusters they have a more proactive scheme and between the zones/clusters they have a reactive scheme that has many similarities with the operation of AODV and DSR.

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