A Comparative Survey on Routing Protocols for Adhoc Wireless Networks

Shruti B.V, Dr.Mrinal Sarvagya

Abstract—This paper presents a detailed review on routing protocols for adhoc wireless networks. The different types of routing protocol are taken into consideration for the survey as well as comparison, their performance is being analysed. The four types of routing protocols that are broadly classified namely DSDV, DSR, AODV and TORA which are discussed here.

Keywords: Adhoc Routing, AODV, DSDV, DSR, TORA

1. INTRODUCTION

Ad hoc means "for this," further meaning "for this purpose only" in Latin language. In ad hoc network all nodes are mobile and can be connected in arbitrary manner. Default router is not available. Every node potentially becomes a router which must be able to forward traffic on behalf of others [1]. An ad hoc network is a collection of wireless mobile nodes which dynamically forming a temporary network without the use of any existing network infrastructure or centralized administration.

There are 2 types of adhoc Networks:

1) Infrastructured network:

A network with fixed and wired gateways. When a mobile unit goes out of range of one base station, it connects with new base station.

2) Infrastructure less (ad hoc) networks:

All nodes of these networks behave as routers and take part in discovery and maintenance of routes to other nodes.

- *Shruti B.V is currently pursuingPh.D in computer science and engineering inVisvesvaraya Technological University, India, PH-9880273399. E-mail: shrutibv@gmail.com*
- *Dr.Mrinal Sarvagya professor, Dept. of Electronics and Communication Engineering, inVisvesvaraya Technological University, India PH-8762734006. E-mail: mrinalsarvagya@gmail.com*

2. BASIC PROPERTIES OF ROUTING PROTOCOL

1) A routing protocol should be distributed.

2) Assume routes as unidirectional links.

3) Power efficient.

4) Security.

5) Hybrid Protocols can be preferred.

I. CLASSIFICATION OF ROUTING PROTOCOLS

Routing Protocols for ad hoc wireless networks can be classified into several types based on different criteria. A classification tree is shown in Figure1.Some of the classification, their properties, and the basis of classification is discussed below.

1. Table Driven Routing Protocols:

Pro-active, learn the network's topology before a forwarding request comes in

2. On-Demand Routing Protocols:

Re-active, become active only when needed

A. DSDV

DSDV [1] is a distance vector routing protocol it takes hop-by-hop distances. It requires each node to periodically broadcast routing updates.

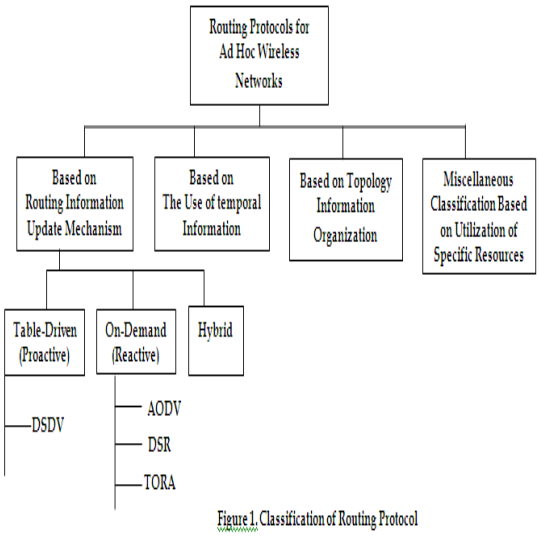

Figure 1. Classification of Routing Protocol

The important advantage of DSDV over other distance vector protocols is it guarantees Loop freedom.With small adjustments, DSDV[7] has become more suitable for adhoc networks. The small adjustments includes

- topology changes in the time between broadcasts is taken care by triggered updates.

- to reduce the amount of information and the incremental dump.

- the full dump carries all available routing information and all incremental dumps that only carry the information that has changed from last dump.

Routes with more recent sequence numbers are always preferred as the basis for making forwarding decisions, but not necessarily advertised. If the paths have same sequence number then those with the better metric is used.

As it is table driven routing protocol, routes to all destinations are readily available at every node at all times. The tables are exchanged between neighbors at regular intervals to keep up-to-date view of the network topology. The tables are also forwarded if a node observes a significant change in local topology. The table updates are two types: incremental and full dumps. Incremental updates takes single network data packet units (NDPU), while a full dump may take multiple NDPUs.Incremental updates are used when a node does not observe significant changes in the local topology. A dump is done either when the local topology changes significantly or when an incremental update requires more than a single NDPU.Table updates are initiated by a destination with a new sequence number which is greater than the previous one. Upon receiving updates its table based on the received information or holds the same update table from different neighboring nodes.

Advantages: The availability of routes to all destinations at all times implies that much less delay is involved in the route setup process. The mechanism of incremental updates with sequence number tags makes the existing wired network protocol can be adaptable to ad hoc wireless networks.

Disadvantages: This protocol suffers from excessive control overhead that is proportional to the number of nodes in the network and therefore is not scalable in ad hoc wireless networks, which have limited bandwidth and whose topologies are highly dynamic. In DSDV the order to obtain information about particular destination node, a node has to wait for a table update message initiated by the same destination node. This delay could result in stale routing information at nodes.

On Demand Routing Protocols

Unlike the table driven routing protocols, on demand routing protocols execute the path-finding process and exchange routing information only when a path is required by a node to communicate with a destination.

B. **DSR**

DSR [2,3,4] uses source routing rather than hop by-hop routing, with each packet to be routed carrying in its header the complete, ordered set of nodes through which the packet must pass. The key advantage of source routing is that intermediate nodes do not need to maintain updated routing information in order to route the packets they forward since the packets themselves already contain all the routing decisions. This fact, coupled with the on-demand nature of the protocol, eliminates the need for the Periodic route advertisement and neighbor detection packets present in other protocols.

DSR [2] [3] [4] also belongs to the class of reactive protocols and allows nodes to dynamically discover a route across multiple network hops to any destination. Source routing means that each packet in its header carries the complete

ordered list of nodes through which the packet must pass. DSR uses periodic routing messages, thereby reducing network bandwidth overhead, conserving battery power and avoiding updates throughout the ad-hoc network. Instead DSR relies on support from the MAC layer. The two basic modes of operation in DSR are route discovery and route maintenance.

DSR [10] is an on-demand protocol designed to restrict the bandwidth consumed by control packets in ad hoc wireless networks by eliminating the periodic table-update messages required in the table driven approach. The major difference in this and the other on-demand routing protocols is that it is beacon – less and hence does not required periodic hello packet (beacon) transmissions, which are used by a node to inform its neighbors of its presence. The basic approach of this protocol during route construction phase is to establish a route by flooding Route Request packets in the network. The destination node, on receiving a Route Request packet, responds by sending Route Reply packet back to the source, which carries the route traversed by the Route Request packet received.

Advantages: DSR protocol uses a reactive approach, which eliminates the need to periodically flood the network with table update messages, which are required in a table-driven approach. In this approach, route is established when it is required, so need not to find routes to all other nodes in the network .The intermediate nodes also utilize the route cache information efficiently to reduce control overhead.

Disadvantages: DSR protocol does not locally repair a broken link in the route maintenance mechanism. Stale route cache information could also result in inconsistencies during the route reconstruction phase. The connection setup delay is higher than in table-driven protocols. Even though the protocol performs well in static and low mobility environments; the performance degrades rapidly with increasing mobility. Considerable routing overhead is involved due to source routing mechanism employed in DSR.This routing overhead is directly proportional to the path length.

C. **AODV**

The Ad Hoc On-Demand Distance Vector (AODV) routing protocol enables multi-hop routing. AODV [12] is essentially a combination of both DSR and DSDV.It borrows the basic on-demand mechanism of Route Discovery and Route Maintenance from DSR, plus the use of hop by-hop routing, sequence numbers, and periodic beacons from DSDV.

AODV [11] routing protocol uses an on-demand approach for finding routes, a route is established when a source node for transmitting the data packets requires it. It employs destination sequence numbers to identify the most recent path.

The major difference between AODV and DSR stems out from the fact that DSR uses source routing in which a data packet carries the complete path to be traversed. In AODV, the source node and the intermediate nodes store the next-hop information corresponding to each flow for data packet transmission. In an on-demand routing protocol, the source node floods the Route Request packet in the network when a route is not available for the desired destination. It may obtain multiple routes to different destinations from a single Route Request.

The major difference of AODV from other on-demand routing protocols is that it uses a destination sequence number(DestSeqNum) to determine an update –to-date path to the destination. A node updates its path information only if the DestSeqNum of the current packet received is greater than the last DestSeqNum stored at the node.

Advantages: The main advantage of this protocol is that routes are established on demand and destination sequence numbers are used to find the latest route to the destination. The connection setup delay is less.

Disadvantages: The intermediate nodes can lead to inconsistent routes if the source sequence number is very old and the intermediate nodes have a higher but not the latest destination sequence number , thereby having stale entries.

Multiple Route Reply packets in response to a single Route Request packet can lead to heavy control overhead.

The periodic beaconing leads to unnecessary bandwidth consumption.

D. **TORA**

TORA [7, 8] is a distributed routing protocol breed on a "link reversal' algorithrn. It is designed to discover routes on demand, provide multiple routes to a destination, establish routes Quincy, and minimize communication overhead by Iodizing algorithrnic reaction to topological changes when possible. Route optimality (shortest-path routing) is considered of second importance, and longer routes are often used to avoid tie overhead of discovering newer routes. The actions taken by TORA can be described in terms of water flowing downhill towards a destination node through a network of tubes that models the routing state of the red network. The tubes represent W between nodes in the network, the junctions of tubes represent the nodes, and the water in the tubes represents the packets flowing towards the destination. Each node has a height

with respect to the destination that is computed by the routing protocol.

TORA ,each node maintains its one–hop local topology information and also has the capability to detect partitions.TORA has the unique property of limiting the control packets to a small region during the reconfiguration metric used in TORA which is nothing but the length of the path, or the height from the destination.

TORA has three main functions: establishing, maintaining and erasing routes.

The route establishment function is performed only when a node requires a path to a destination but does not have any directed link. This process establishes a destination – oriented directed acyclic graph (DAG) using a Query / Update mechanism.

Advantage: By limiting the control packets for route reconfiguration to a small region, TORA incurs less control overhead.

Disadvantage: The local reconfiguration of paths results in non-optimal routes.

II. COMPARATIVE STUDY FOUR ROUTING PROTOCOLS IS SHOWN BY A TABLE:

	DSDV	AODV	DSR	TORA
Loop Free	YES	YES	YES	NO,SHORT LIVED LOOPS
Distributed	NO	NO	NO	YES
Reactive	NO	YES	YES	YES
Unidirectional Link Support	NO	NO	YES	NO
QoS Support	NO	NO	NO	NO
Multicast	NO	YES	NO	NO
Security	NO	NO	NO	NO
Power conservative	NO	NO	NO	NO
Periodic broadcasts	YES	YES	NO	YES
Requires reliable or sequenced data	NO	NO	NO	YES

By the table we can infer that QoS support such as security constraint be improved in these routing protocols.

CONCLUSION

The On Demand Routing Protocols displays more advantage than Table Driven Routing protocol which saves time. The security aspect of the routing protocols can be improved while routing as per the table.

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