Survey on Classified Ad-hoc Routing Protocols in MANET

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Abstract: ***An ad hoc mobile network is a collection of mobile nodes that are dynamically and arbitrarily located in such a manner that the interconnections between nodes are capable of changing on a continual basis. Within the network in order to facilitate communication, a routing protocol is used to discover routes between nodes. Correct and efficient route establishment is the primary goal of an ad hoc network routing protocol. Such an establishment between a pair of nodes so that messages may be delivered in a timely manner. Route construction should be done with a minimum of overhead and bandwidth consumption. This paper examines routing protocols for ad hoc networks and given set of parameters. This paper provides an overview of different protocols by presenting their characteristics and functionality, and then provides a comparison and discussion of their respective merits and drawbacks.***

Keywords: Routing protocols, DSDV, AODV, DSR, ZRP, FSR, MANET

1. Introduction

An ad hoc routing protocol is a convention, or standard, that controls how nodes decide which way to route packets between computing devices in a network. In *ad hoc networks*, mobile nodes are not familiar with the topology of their networks. Instead, they have to discover it: typically, [8] a new node announces its presence listens for announcements broadcast by its neighbors. Each node learns about others nearby and how to reach them , and may announce that it too can reach them. Note that in a wider sense, literally used ad hoc protocol, to mean an improvised and often impromptu protocol established for a specific purpose. A mobile ad hoc network (MANET) is a self-configuring infrastructure less network of mobile devices connected by wireless. *Ad hoc* is Latin and means "for this purpose".

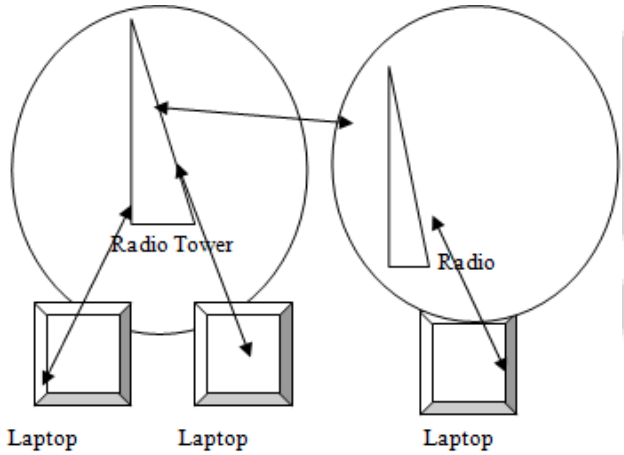

Figure 1: Infrastructure Wireless Networks

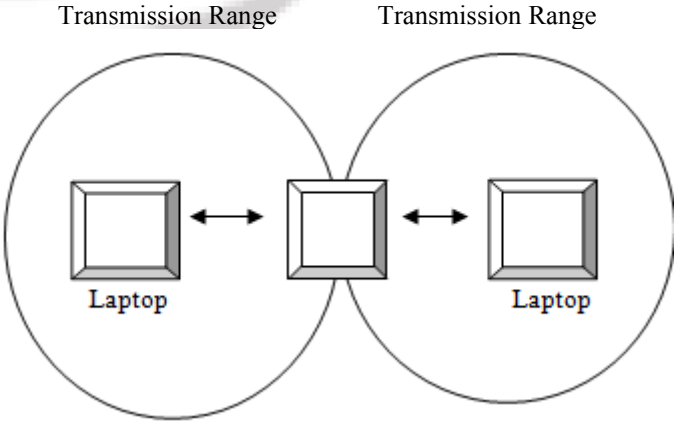

Figure 2: Infrastructure-less Ad Hoc Wireless Networks

In a MANET each device is free to move independently in any direction, and will therefore change its links to other devices frequently by forwarding packets. Each must forward traffic unrelated to its own use, [8] and therefore be a router. The primary goal in building a MANET is configuring each device to continuously maintain the information required to properly route traffic. Such networks may operate by themselves or may such network be connected to the larger Internet. MANETs are a kind of Wireless ad hoc network that usually has a routable networking environment on top of a Link Layer ad hoc network.The Destination Sequence Distance Vector (DSDV) is a well known MANET routing protocol. It is a table-driven routing protocol that comes under proactive. It is based on Bellman-Ford routing mechanism. Actually, it is the improved form of Bellman-Ford routing mechanism. Every node in this maintains a routing table which contains list of all known destination node within the network along with number of hops required to reach a particular node. [9]In DSDV each table must contain or maintain the destination node address, the minimum number of hops to that destination, an entry for sequence numbers for every destination and the next hop in the direction of that destination. A higher sequence number denotes a more

recent update sent out by the source node. To overcom e the limitations o f D SDV d esign the AODV routing protocol. AODV is basically an im provement of DSDV [9] . The MANET (M obile Ad-hoc Net works) W orking Group for routing of the IEFT com munity has publ ished t he fi rst version of the AODV Routing Protocol (Ad hoc On Demand Distance Vector) In November 2001.

AODV belongs to t he cl ass of Di stance Vect or Rout ing Protocols (DV). [10] In a DV every node knows i ts neighbors and the costs to reach them . It does not require nodes to maintain routes to destinations that are not actively used. A node m aintains i ts own rout ing t able, t he di stance and the next hop t o t hem and st oring a ll nodes i n t he network. The di stance to it is set to infinity, if a node is not reachable. Every node sends its neighbors periodically its whole routing table. [10] So t hey can check node usi ng this neighbor as next hop i f t here i s a useful rout e t o another. When a link breaks a C ount-To- Infi nity coul d happen.Dynamic Source Routing (DSR) [7] i s an Ad Hoc routing prot ocol whi ch i s based on t he t heory of source-based routing instate of table-based. This protocol is source-initiated rather th an hop-by- hop. This is particularly designed for use in m ulti hop wireless ad hoc networks of mobile nodes. Basically, DSR prot ocol does not need any existing net work i nfrastructure or adm inistration and this allows the structure of Network to b e co mpletely self-organizing and sel f-configuring. This Prot ocol i s com posed of t wo essent ial par ts of r oute discovery and route maintenance. Every node maintains a cache to store recently discovered paths. Every node maintains a cache to store recently discovered paths [4]. It first checks its entry in the cache; when a node desires to send a packet to some node. In this protocol, the mobile nodes are required to maintain route caches or the known routes. If it is there, then it uses that path to transmit the packet and also attach its source address on t he p acket. I f i t i s not there in the cache or the entry in cache i s e xpired (because o f l ong t ime i dle), [7] t he sender broadcasts a route request packet t o al l of i ts nei ghbours asking for a path to the d estination. Th e sen der will b e waiting till th e route is d iscovered. During waiting time, the sender can perform ot her t asks such as sending/forwarding other packet s. As t he rout e reque st packet arrives to any of the n odes, t hey c heck f rom t heir n eighbour o r from their caches whether the destination asked is known or unknown. If rout e information is known, t hey send back a route reply packet to th e d estination o therwise th ey broadcast the same route request packe t.If a pa cket's destination i s i n t he s ame zone as the origin, t he proact ive prot ocol usi ng an al ready stored routing table i s us ed to deliver the packet immediately. If the route extends out side t he packet 's originating zone, a reactive protocol takes over to check each successive zone in the route to see whether the destination is inside t hat zone. Thi s reduces t he processi ng overhead for those routes, the proactive prot ocol, or st ored rout e-listing table, is u sed to d eliver th e packet once a zone is confirmed as containing the dest ination node. Fi sheye St ate R outing (FSR) [2] i s an i mplicit hi erarchical rout ing protocol. Also considered a proactive protocol and i s a l ink st ate based routing protocol that has been adapted to the wireless ad hoc environment. R elays on l ink state protocol as a base, and it has th e ab ility to p rovide ro ute in formation in stantly b y maintaining a topology map at e ach n ode. [2] T hus w ill maintain updated information from the neighbor node through a link state table. In each node the n etwork, utilized after a full topology map is stored.

1.1 Characteristics of MANETs

- Dynamic Topol ogy: Thi s m eans t hat t here is no fixed topology of t he nodes i n a net work. The t opology of the network gets formed before the communication starts.
- Uni-directional links: Inspite of a dy namic t opology t he communication links bet ween t wo nodes are uni - directional.
- Constrained resources: Due t o a wi reless net work it[6] uses battery power and wireless transmitter range.

Network p artitions: Partitio ns o f a n etwork d ue to wireless transmitter range are defined in MANETs.

The main objective of this p aper is to stu dy th e ro uting protocols [1] i n a m obile ad hoc net work [4] using a simulator software NS-2. In this paper a comparison between a proactive protocol (DSDV) [9] a nd a r eactive p rotocol (AODV) under different situation are made. This paper also carry out the analysis and discussion on the result set to find out which protocol is the best b etween A ODV [11] a nd DSDV and thus to increase the scalability among them.

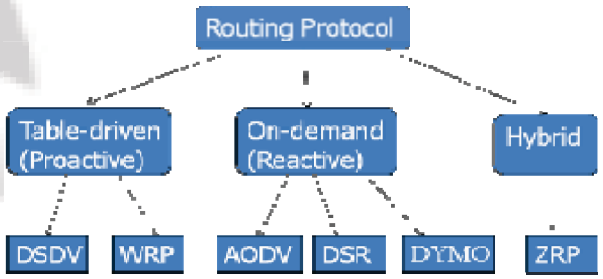

Figure 3: Classification of routing protocols in MANET

To facilitate co mmunication with in th e n etwork, a ro uting protocol [1] is used to di scover rout es bet ween nodes. Constructing a rout e i nvolves m inimizing Prot ocol i s a standard t hat c ontrols h ow n odes c ome t o agree which way to route packets between com puting devices in a m obile ad-hoc net work [4] . In M ANET a new node announces its presence and l istens t o broadcast announcem ents from its neighbors. The n ode l earns about n ew near nodes and ways to reach them , and announces th at it can also reach those nodes.

2. History / Literature Review

2.1 Table driven (proactive) routing

This typ e o f p rotocols m aintains fresh lists o f d estinations and t heir rout es by peri odically di stributing rout ing tables throughout t he net work. The m ain di sadvantages of such algorithms are: R espective am ount of data for maintenance. Slow reaction on restructuring and failures.

Examples of proactive algorithms are:

2.1.1 Destination Sequenced Distance Vector (DSDV)

The Destination Sequence Distance Vector (DSDV) is a well known MANET routing protocol. It is a table-driven routing

protocol that comes under proactive. It is based on Bellman-Ford routing mechanism [9]. Actually, it is the improved form of Bellman-Ford routing mechanism. Every node in this maintains a routing table which contains list of all known destination node within the network along with number of hops required to reach a particular node. In DSDV each table must contain or maintain the destination node address, the minimum number of hops to that destination, an entry for sequence numbers for every destination and the next hop in the direction of that destination. A higher sequence number denotes a more recent update sent out by the source node.

DSDV at first determines the topology information and the route information by exchanging these routing tables, which each node maintains. Whenever a node detects a change in topology exchanging of routing updates are done. When a node receives any update information, it first check the sequence number in the packet and if the information in the packet is older than the receiving node has in its routing tables, then the packet is rejected otherwise the information is updated approximately in the receiving node's routing table. After this exchanging the information the update packet is forwarded to all other neighboring nodes except the one from which the packet came. The update made may be full update or a partial update. The complete routing table is sent out in full update, while in case of a partial update only the changes since last update are sent out.

2.2 On-demand (Reactive) routing

This type of protocols finds a route on demand by flooding the network with Route Request packets. The main disadvantages of such algorithms are:
1. High latency time in route finding.
2. Excessive flooding can lead to network clogging.
Examples of on-demand algorithms are:

2.2.1 Ad hoc on Demand Distance Vector (AODV)
To overcome the limitations of DSDV design the AODV routing protocol. AODV is basically an improvement of DSDV. [10] The MANET (Mobile Ad-hoc Networks) Working Group for routing of the IEFT community has published the first version of the AODV Routing Protocol (Ad hoc On Demand Distance Vector) In November 2001.

AODV belongs to the class of Distance Vector Routing Protocols (DV). In a DV every node knows its neighbors and the costs to reach them. It does not require nodes to maintain routes to destinations that are not actively used. A node maintains its own routing table, the distance and the next hop to them and storing all nodes in the network. The distance to it is set to infinity, if a node is not reachable. Every node sends its neighbors periodically its whole routing table. So they can check node using this neighbor as next hop if there is a useful route to another. When a link breaks a Count-To-Infinity could happen [10]. AODV is an 'on demand routing protocol' with small delay. That means that routes are only established when needed to reduce traffic overhead. Without any future protocol AODV supports Unicast, Broadcast and Multicast. The Count-To-Infinity and loop problem is solved with sequence numbers and the registration of the costs. In AODV every hop has the constant cost of one. The routes age very quickly in order to accommodate the movement of the mobile nodes. Link breakages can locally be repaired very efficiently. To configure the AODV with the five criteria used AODV is distributed, hop-by-hop, deterministic, single path and state dependent.

2.2.2 Dynamic Source Routing (DSR)
Dynamic Source Routing (DSR) is an Ad Hoc routing protocol which is based on the theory of source-based routing instate of table-based. This protocol is source-initiated rather than hop-by-hop [7]. This is particularly designed for use in multi hop wireless ad hoc networks of mobile nodes. Basically, DSR protocol does not need any existing network infrastructure or administration and this allows the structure of Network to be completely self-organizing and self-configuring. This Protocol is composed of two essential parts of route discovery and route maintenance [4]. Every node maintains a cache to store recently discovered paths. Every node maintains a cache to store recently discovered paths. It first checks its entry in the cache; when a node desires to send a packet to some node. In this protocol, the mobile nodes are required to maintain route caches or the known routes. If it is there, then it uses that path to transmit the packet and also attach its source address on the packet. If it is not there in the cache or the entry in cache is expired (because of long time idle), the sender broadcasts a route request packet to all of its neighbours asking for a path to the destination. The sender will be waiting till the route is discovered. During waiting time, the sender can perform other tasks such as sending/forwarding other packets. As the route request packet arrives to any of the nodes, they check from their neighbour or from their caches whether the destination asked is known or unknown [7]. If route information is known, they send back a route reply packet to the destination otherwise they broadcast the same route request packet.

2.3 Hybrid (both Proactive and Reactive) protocol

This type of protocol combines the advantages of proactive and reactive routing. The routing is initially established with some proactively prospected routes and then serves the demand from additionally activated nodes through reactive flooding [2]. The choice of one or the other method requires predetermination for typical cases. The main disadvantages of such algorithms are: Advantage depends on number of other nodes activated. Reaction to traffic demand depends on gradient of traffic volume. Examples of hybrid algorithms are:

2.3.1 ZRP (Zone Routing Protocol)
If a packet's destination is in the same zone as the origin, the proactive protocol using an already stored routing table is used to deliver the packet immediately [2].

A reactive routing protocol takes over to check each successive zone in the route to see whether the destination is inside that zone. When the route extends outside the packet's originating zone,. This reduces the processing overhead for those routes. Once a zone is confirmed as containing the destination node, the proactive protocol, or stored route-listing table, is used to deliver the packet. In this way of forwarding information packets with destinations within the

same zone as the originating zone are delivered immediately using a stored routing table. Along the way by using the reactive protocol to check whether each zone encountered contains the destination node Packet s delivered to nodes outside the sending zone to avoid the overhead of checking routing tables [1].

While eliminating the delays for routing within a zone that would be caused by the route-discovery processes of reactive routing protocols. Thus the ZRP reduces the control overhead for longer routes that would be necessary if using proactive routing protocols throughout the entire route,What is called the Intra-zone Routing Protocol (IARP), or a proactive routing protocol, is used inside routing zones. What is called the Inter-zone Routing Protocol (IERP), or a reactive routing protocol, is used between routing zones. IARP uses a routing table. Since this table is already stored, this is considered a proactive routing protocol. IERP uses a reactive protocol. Any route to a destination, therefore within the same local zone is quickly established from the source's proactively cached routing table by IARP. That is, if the source and destination of a packet are in the same zone, the packet can be delivered immediately.

- Most existing proactive routing algorithms can be used as the IARP for ZRP.
- In ZRP a zone is defined around each node, called the node's *k-neighborhood*, which consists of all nodes within *k* hops of the node. [2] *Border nodes* are nodes which are exactly *k* hops away from a source node.
- For routes beyond the local zone, route discovery happens reactively. The source node sends a route request to the border nodes of its zone, containing its own address, the destination address and with a unique sequence number. Each border node checks its local zone for the destination. If the destination is not a member of this local zone, the border node adds its own address to the route request packet and forwards the packet to its own border nodes. If the destination is a member of the local zone, it sends a route reply on the reverse path back to the Source. The source node uses the path saved in the Route reply packet to send data packets to the destination.

3. Conclusions

The completion of this paper on **— Survey on Classified Ad-hoc routing protocols in MANET**. From the above discussion we will study the different types of network routing protocols namely DSDV, AODV, DSR, ZRP and FSR. This paper provides an overview of different protocols by presenting their characteristics and functionality, and then provides a comparison and discussion of their respective merits and drawbacks.

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