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COMPARATIVE ANALYSIS OF AODV AND DSR TO ACHIEVE GROUP COMMUNICATION IN MANET

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Abstract - Secure group communication is a challenging task with respect to MANET's. Since its introduction as a communication medium, wireless technology found broad application on the battlefield. Robust and reliable group communication plays a major role in developing distributed mobile application in which unannounced disconnections will occur frequently due to the mobility of the nodes which take part in mobile applications. Accompanying dramatic advances in wireless technology and the capabilities associated with small computing devices, the demand for advanced mechanisms to employ wireless technology in the battlefield continues to grow. The main objective here is to achieve robust and reliable group communication in mobile ad hoc network .Performance of the group communication is compared with the given protocols through simulation in NS-2. The analysis is made with respect to the throughput, packet transmission between source and destination. We propose four Ad hoc Routing Protocols AODV, DSR, and have given the comparative study.

Keywords*: Mobile ad hoc networks; group communication system; reliable communication; guarantee protocol.*

I. NTRODUCTION

A mobile ad hoc network is an autonomous collection of mobile nodes that communicate over the wireless link. Due to node mobility, the network topology may change rapidly and unpredictably over time. It does not contain any fixed infrastructure and there is no centralized administration [6]. Each node can act as a router and host. Ad hoc networks are used in wide range of applications like military operations, rescue operations, remote site construction, communication among a group of islands or ships, conferencing without the support of a wired infrastructure, and interactive information sharing [12]. The use of wireless network is exploding as the limiting factors such as sufficient bandwidth, device size and weight, and power concerns are eliminated or mitigated. As a result, we are beginning to see the demand for small, highly mobile devices that utilize wireless communications to organize ad hoc networks that dynamically form, intercommunicate and pass information to other wireless users and to wire-based networks, then dissolve. We provide a model that reflects the salient properties of the network and propose protocols that support this environment.

A. Communication on the dynamic battlefield

The modern battlefield is highly dynamic. Units enter and leave and leave the battlefield continuously. The dynamic battlefield demands several characteristics of communications [8]. Some of them are:

(1) *Fast:* While some limited setup may be tolerated before action starts, the ability to communicate during combat should be immediate in its accessibility to the transmitter and its delivery to the recipient.

(2) *Easy/transparent*: The transmitter must be able to communicate with minimal effort apart from their normal battlefield activities.

(3) *Available:* Parties must be able to communicate whenever they need to.

(4) *Authenticated:* The communication initiator must be able to absolutely identify all intended recipients.

(5) *Private*: The communications passed during combat should not be divulged to anyone not intended for receipt.

(6) *Integrity Protected*: Messages must be protected from modification during transmission.

(7) *Acknowledged*: All parties to the communication must know what the other parties did and did not receive.

We do not contend that this list is all-inclusive. Further, we recognize the impact of interactions of these requirements and posit that these interactions create the bulk of the complexity involved secure battlefield communication.

B. Group communication on the battlefield.

Modern battlefield doctrine is based on mobility, flexibility and rapid response to changing situations, yet also requires close coordination and mutually understood objectives among all members of the [command] group. This demands a group communication paradigm.

Group communication [10] is sometimes thought of as broadcast technology. Broadcast and group communications are related, though not identical. Broadcast technology can provide efficient group communication, though group communication may or may not involve broadcasting messages. The group communications paradigm is preferable over point-to-point connections in such an environment simply

from the standpoint of reduced overhead. If the broadcast domains of the group members, the number of transmissions required to fully delivering a group message is minimized. If the broadcast domains are totally overlapping, group messages can be fully delivered with a single transmission.

C. Challenges to manage secure groups

These criteria are categorized into group membership management, network resource consumption, receiver resource requirements, sender resource requirements and dependency upon particular standards. These categories are elucidated below.

• *Group membership management* criteria address the concerns of who is and is not part of the group, what the group looks like, and what happens if the group changes. Questions to consider when evaluating a solution's membership management capabilities are shown in Table

• *Network resource consumption* criteria are concerned with the load on the network for various stages of the multicast communication process. When analyzing the bandwidth consumption of a solution, it

is important to note how many messages must be transmitted each time a member joins or leaves and how large the control messages (those for managing the group) are in relation to the data messages. Also of importance is the volume of communication that can be effectively dealt with and whether the solution can handle bursty traffic.

•*Receiver and sender resource requirements* consider the following: How many keys must each member or sender store and how large are these keys? What is the processing time involved for the member or sender to, respectively, read or sends messages? Does the solution allow non-members to send data? How many senders are allowed? Must these senders be known in advance of group creation?

• *Dependence upon standards* concern with whether the solution depends up a particular network protocol or network characteristics (such as stability, in order packet delivery, or reliable transmission.

II. CLASSIFICATION OF ROUTING PROTOCOLS IN MANET

A routing protocol is a protocol that specifies how routers communicate with each other, disseminating information that enables them to select routes between any two nodes on a computer network. Each router has a priori knowledge only of networks attached to it directly. A routing protocol shares this information first among immediate neighbors, and then throughout the network. This way, routers gain knowledge of the topology of the network.

- Proactive routing protocols
- Reactive routing protocols.

A proactive routing protocol is a protocol that is constantly attempting to keep an up-to date routing table by constantly requesting update information from neighboring nodes and sharing routing tables. This means that when a node wishes to send a packet to a destination the route to that destination is already known.

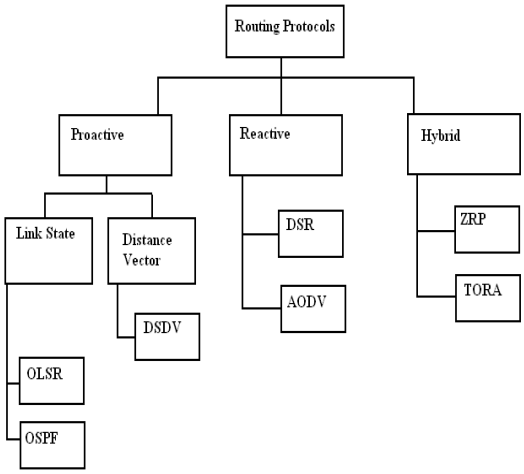


Figure. 1. Classification of routing protocols

The reactive routing protocol only sends requests for a route from the source to the destination when a node wishes to send a packet and there is not a valid route available in the routing table. Hierarchical routing protocols often use clustering techniques to build hierarchical structures on the flat network, where each cluster has a lead node which looks after the cluster and communications with other clusters.

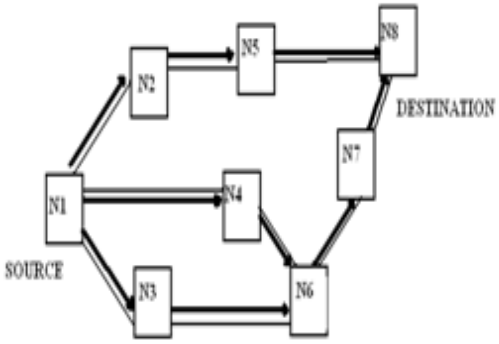
A. Ad hoc on-demand distance vector routing (AODV)

AODV is an improvement [15] on DSDV because it typically minimizes the number of required broadcasts by creating routes on a demand basis, as opposed to maintaining a complete list of routes as in the DSDV algorithm. The AODV [2] routing protocol is a reactive MANET routing protocol. Similar to DSR, AODV [4] broadcasts a route request to discover a route in a reactive mode. The difference is that in AODV [16], a field of the number of hops is used in the route record, instead of a list of intermediate router addresses.

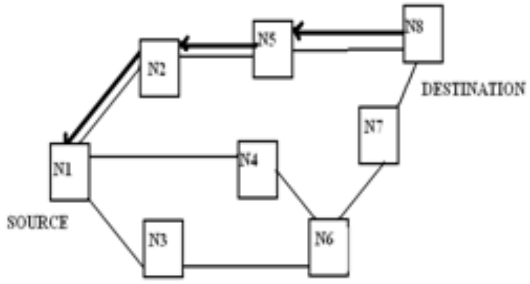
Each intermediate router sets up a temporary reverse link in the process of a route discovery. This link points to the router that forwarded the request. Hence, the reply message can find its way back to the initiator when a route is discovered. When intermediate routers receive the reply, they can also set up corresponding forward routing entries. The authors of AODV [7] classify it as a pure on-demand route acquisition system, since nodes that are not on a selected path do not maintain routing information or participate in routing table exchanges.

Nodes listen for retransmission of data packets to ensure that the next hop is still within reach. If such a

retransmission is not heard, the node may use any one of a number of techniques, including the reception of beacon messages, to determine whether



Propagation of the RREQ
the next hop is within communication range.



Path of the RREP to the source
Figure 2. Route discovery process in AODV

The beacon messages may list the other nodes from which a mobile has heard, thereby yielding greater knowledge of network connectivity

B. Dynamic source routing (DSR)

The Dynamic Source Routing protocol (DSR) [9] is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. DSR allows the network to be completely self-organizing and self-configuring, without the need for any existing network infrastructure or administration. When a node generates a packet to a certain destination and it does not have a known route to that destination, this node starts a route discovery procedure.

Therefore, DSR is a reactive protocol. It uses source routing which means that the source must know the complete hop sequence to the destination. Each node maintains a route cache, where all routes it knows are stored. The route discovery process is initiated only if the desired route cannot be found in the route cache. To limit the number of route requests propagated, a node processes the route request message only if it has not already received the message and its address is not present in the route record of the message. DSR [13] uses source routing, i.e. the source determines the complete sequence of hops that each packet should traverse. One advantage of DSR is that no periodic routing packets are required. DSR also has the capability to handle unidirectional links. There are two main operations in DSR,

- route discovery
- route maintenance

1. Route Discovery

During the route discovery procedure, routers maintain ID lists of the recently seen requests to avoid repeatedly processing the same route request. Requests are discarded if they were processed recently since they are assumed to be duplicates. Here a and b shows that DSR [5] route request and reply. First, the source node looks up its route cache to determine if it already contains a route to the destination [11].If the source finds a valid route to the destination, it uses this route to send its data packets.

If the node does not have a valid route to the destination, it initiates the route discovery process by broadcasting a route request message. The route request message contains the address of the source and the destination, and a unique identification number.

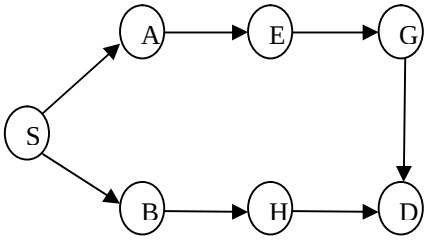


Figure 3. DSR Route Request

2. Route Maintenance

The route maintenance procedure is used when routes become invalid due to the unpredictable movement of routers. Each router monitors [14] the links that it uses to forward packets. Route Maintenance is used to handle route breaks. When a node encounters a fatal transmission problem at its data link layer, it removes the route from its route cache and generates a route error message.

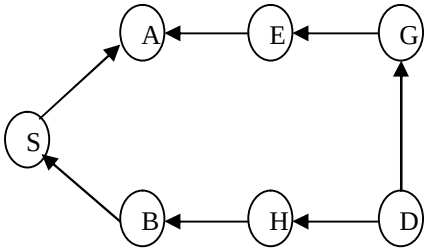


Figure 4. DSR Route Reply.

The route error message is sent to each node that has sent a packet routed over the broken link. When a node receives a route error message, it removes the hop in error from its route cache. Acknowledgment messages are used to verify the correct operation of the route links. In wireless networks acknowledgments are often provided .as e.g. an existing standard part of the MAC protocol [11] in

use, such as the link-layer acknowledgment frame defined by IEEE 802.11. If a built-in

acknowledgment mechanism is not available, the node transmitting the message can explicitly request a DSR-specific software acknowledgment to be returned by the next node along the route.

III. SIMULATION ENVIRONMENT

A. Simulation Model

Here we perform the experiments for the evaluation of the performance of Ad Hoc routing protocol AODV, DSDV, OLSR and TORA. We have 30 simulation run in total out of which 15 trace files has been generated. We tested all performance metrics in our experiment under varying mobility speed of node (10 to 50m/sec) and while other parameters are constant.

B. NS-2 simulator

The network simulations have been done using network simulator NS-2. The network simulator NS-2 is discrete event simulation software for network simulations. It simulates events such as receiving, sending, dropping and forwarding packets. The ns-allinone-2.34 supports simulation for routing protocols for ad hoc wireless networks such as AODV, DSDV and DSR. NS-2 is written in C++ programming language with Object Tool Common Language. Although NS-2. 34 can be built on different platforms, for this paper, we chose a Linux platform i.e. FEDORA 13, as Linux offers a number of programming development tools that can be used with the simulation process. To run a simulation with NS-2.34, the user must write the OTCL simulation script. Moreover, NS-2 also offers a visual representation of the simulated network by tracing nodes events and movements and writing them in a file called as Network animator or NAM file.

IV. SIMULATION RESULTS AND ANALYSIS

The results after simulation are viewed here. The performance of AODV and DSR based on the parameters like packet delivery fraction, average end-to-end delay, normalized routing load and throughput.

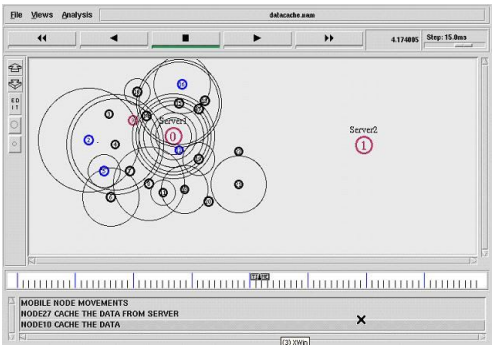


Figure 5. AODV Protocol

Figure 1 shows AODV performs better than OLSR at the lowest speed level because it is on-demand protocol.

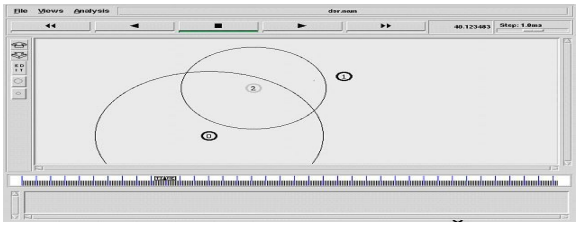


Figure 6. DSR Protocol

Figure 2 shows that the group mobility model and the whole communication process occur between a few groups.

V. CONCLUSION

In this paper, four routing protocols named AODV and DSR have been discussed and compared under specific scenarios with MANET environment. These routing protocols are evaluated in respect to throughput, packet transmission between source and destination in NS-2 simulation environment. However, the simulation results reveal that each protocol has its own advantages as well as its disadvantages making it suitable for some applications and not for others. It is observed that AODV routing protocol performs with satisfactory results of packet delivery ratio but on the cost of some delay and packet loss whereas DSR performs well under high traffic condition. Our future extension is to achieve group communication in an efficient way by adding more parameters with these protocols.

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