A Study on Mobile Internet Protocol and Mobile Adhoc Network Routing Protocols

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Abstract: The internet has become ubiquitous and there has been tremendous growth in wireless communications in recent years. Many wireless communication techniques are commercially available, such as the Wireless LAN, Bluetooth, GSM, GPRS, and CDMA. Because an all-IP network will be a trend, access to the Internet via wireless communication devices has become an important issue. Mobile Internet protocol is an extension to Internet Protocol proposed by the Internet Engineering Task Force (IETF) which enables mobile user devices to move from one network to another regardless of their location and without changing their IP address. A Mobile Ad-hoc Network (MANET) is an autonomous system of mobile hosts connected by wireless links. The ad-hoc network is a non-infrastructure architecture in which nodes can access services from another regardless where they are. Ad-hoc network is that the ad-hoc method has no fixed infrastructure, allowing nodes to communicate with one another at any time and anywhere. Therefore this survey paper reviews about internet protocol and routing protocols in MANETS.

Keywords: Mobile IP, Ad-hoc, MANET, Routing protocols.

1. Introduction

Mobile IP can be thought of as the cooperation of three major subsystems. First, there is a discovery mechanism defined so that mobile computers can determine their new point of attachment as they move from place to place with in the internet. Second once the mobile computer knows the IP address at its point of attachment and registers with an agent representing it at its home network. Lastly Mobile IP defines simple mechanisms to deliver datagrams to the mobile node when it is away from its home network. This mobility binding is maintained by some specialized routers known as mobility agents. Mobility agents of two types home and foreign agents. The home agent, a designated router in the home network of the mobile node, maintains the mobility binding in a mobility binding table where each entry is identified by the tuple permanent home address, temporary care-of address, association life time. Figure 1 shows a mobility binding table. The purpose of this table is to map a mobile node’s home address with its care-of address and forward packets accordingly [1].

<table>
<thead>
<tr>
<th>Home address</th>
<th>Care-of Address</th>
<th>Lifetime(in sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>131.193.171.4</td>
<td>128.172.23.78</td>
<td>200</td>
</tr>
<tr>
<td>131.193.171.2</td>
<td>119.123.54.78</td>
<td>150</td>
</tr>
</tbody>
</table>

Fig I: Mobility Binding Table

2. Mobile IP Terminology

2.1 Mobile IP

Mobile IP is an internet protocol designed to support host mobility. Its goal is to provide the ability of a host to stay connected to the internet regardless of their location. Mobile IP is able to track a mobile host without needing to change the mobile host's long-term IP address [2].

2.1 Agent Advertisement

An advertisement message constructed by attaching a special Extension to a router advertisement [4] message. Foreign agents are expected to periodically issue agent advertisement messages. If a mobile node needs agent information immediately, it can issue an ICMP router solicitation message. Any agent receiving this message will then issue an agent advertisement.

2.3 Care-Of Address

The termination point of a tunnel towards a mobile node, for datagrams forwarded to the mobile node while it is away from home. The protocol can use two different types of care-of address. A "foreign agent care-of address” is an address of a foreign agent with which the mobile node is registered, and a “co-located care-of
address” is an externally obtained local address which the mobile node has associated with one of its own
network interfaces. However, in some cases a mobile node may move to a network that has no foreign agents or
on which all foreign agents are busy. A colocated care-of address is an IP address obtained by the mobile node
that is associated with the current interface to a network of that mobile node. The means by which a mobile node
acquires a colocated address is beyond the scope of Mobile IP. One means is to dynamically acquire a temporary
IP address through an Internet service such as Dynamic Host Configuration Protocol (DHCP). Another alternative
is that the colocated address may be owned by the mobile node as a long term address for use only while visiting a
given foreign network.

2.4 Correspondent Node
A peer with which a mobile node is communicating. A correspondent node may be either mobile or stationary.
This node sends the packets which are addressed to the mobile node.

2.5 Foreign Network
Any network other than the mobile node's Home Network. It delivers information between the mobile node and
the home agent.

2.6 Home Address
A permanent IP address that is assigned to a mobile node. It remains unchanged regardless of where the mobile
node is attached to the internet [2].

2.7 Home Agent (HA)
A router that maintains a list of registered mobile nodes in a visitor list. It is used to forward mobile node-
addressed packets to the appropriate local network when the mobile nodes are away from home. After checking
with the current mobility bindings for a particular mobile node, it encapsulates datagrams and sends it to the
mobile host's current temporary address when the mobile node.

2.8 Foreign Agent (Fa)
A router that assists a locally reachable mobile node that is away from its home network. It delivers information
between the mobile node and the home agent.

2.9 Mobility Agent
An agent which supports mobility. It could be either a home agent or a foreign agent

3. Tunnel
The path which is taken by encapsulated packets. It is the path which leads packets from the home agent to the
foreign agent.

3.1 Support Services
The following services are supported in Mobile IP [2]:

4. Comparisons Of Routing Protocols
The following sections provide comparisons of the previously described routing algorithms. The next section
compares table-driven protocols, and another section compares on demand protocols.

4.1 Table Driven Protocols

DSDV The Destination-Sequenced Distance-Vector Routing Protocol was designed ad hoc with a table-driven
routing protocol. This is a hop-by-hop distance vector routing protocol requiring each node to periodically
broadcast routing updates. The key advantage of DSDV is that it guarantees loop-freedom. If a node cannot
access any base stations, the DSDV routing protocol allows a path along which data can be exchanged with all
nodes. A sequence number is used with the basic Bellman–Ford mechanism to each route table entry. When the
network topology is modified with decreased frequency little routing table data is exchanged [3,5].

Fig 3: CGSR: routing from nodes 2-4, 6 and 7 form a single cluster.
4.2 Source-Initiated On-Demand Routing Protocols

**CGSR** Cluster-Head Gateway Switch Routing is similar to the DSDV routing protocol. In Cluster-Head Gateway Switch Routing (CGSR) the nodes form clusters. A cluster head is selected. All nodes within the cluster heads radio transmission range. A cluster head is selected for every department. A gateway node can communicate with two or more cluster heads (Fig. 3).

**AODV** Ad Hoc On-Demand Distance Vector Routing offers a pure distance-vector approach. It does not maintain a routing table. AODV is a purely “on demand” method that follows a route request and reply discovery cycle when the nodes communicate with other nodes. Fig. 4 shows the AODV format. The AODV routing table will record a message with a destination sequence number (as with DSDV) to avoid a routing loop and produce the latest new routing topology [3].

![Fig 4: AODV: Reverse path formation.](image)

**DSR** The Dynamic Source Routing (DSR) protocol presented in Fig. 12 is an on-demand routing protocol based on the source routing concept. When mobile nodes request communications, the DSR protocol will search for a path. Mobile nodes are required to maintain route caches that contain the source routes of which the mobile is aware. Entries in the route cache are continually updated as new routes are learned [3,4]. The DSR protocol is similar to AODV and uses the source broadcast method as the DSR is shown in Figs. 5 and 4.

![Fig 5: DSR: Route request.](image)
The Temporally Ordered Routing Algorithm (TORA) is a highly adaptive loop-free distributed routing algorithm based on the link reversal concept. TORA is designed to operate in a highly dynamic mobile networking environment. There are three steps in the TORA protocol: Route Creation, Route Maintenance and Route Erasure [3]. During the route creation and maintenance phases, the nodes use a “height” function. This algorithm does not make changes to other routes when the topology is modified, as shown in Fig. 7.

Fig 7: TORA: Route maintenance (A: source, G: Destination)

Table 1. Comparisons of the three protocol characteristics:

<table>
<thead>
<tr>
<th></th>
<th>Proactive(table-driven)</th>
<th>Reactive(on-demand)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routing protocols</td>
<td>DSDV</td>
<td>AODV, DSR, TORA</td>
</tr>
<tr>
<td>Route acquisition delay</td>
<td>Lower</td>
<td>Higher</td>
</tr>
<tr>
<td>Control overhead</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Power requirement</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Bandwidth requirement</td>
<td>High</td>
<td>Low</td>
</tr>
</tbody>
</table>
5. Conclusion

This paper presented a survey of routing protocols designed for MANETs. We provided the classification between proactive and Reactive protocols by giving their performance in various aspects. To design a MANET routing protocol with multiple metrics is a challenge task, especially as the network topology and traffic are changing all the time. We may consider not limiting the mobile nodes to a single predefined routing protocol, instead we let each node decide which protocol to choose based on the environment around it at that time where it is called active adhoc routing. Since there are many routing protocols, we can’t say which is best algorithms results depends on situation and given parameters. We plan future investigations to find better algorithm implementing swarm intelligence doing simulation.

References