Enhanced AODV Routing Protocol through Fixed Expire-time in MANET

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Abstract—Recently, Wireless network industry for the ubiquitous generation is growing quickly. Especially, MANET (Mobile Ad-hoc Networks) is one of special issues of the networking technology for the ubiquitous environments. Then, many researchers are study MANET for enhanced performance. But many researchers are not focusing on developing routing protocol. In this paper, we proposed enhanced routing protocol using AODV(Ad hoc On-demand Distance Vector) for MANET. And it is analyzed the simulation result which compare with original and enhanced AODV protocol.

I. INTRODUCTION

The recent networks are trending toward ubiquitous environment that make possible anywhere, anytime service. So we are using various wireless network technology such as 3G, 4G of cellular network, Ad-Hoc, and IEEE 802.11 based WLAN(Wireless Local Area Network), Bluetooth. Especially, MANET is very important technology of ubiquitous sensor network, because it needs supporting of frequent movement.

At this point, it proposed AODV routing protocol for offered to best services. AODV is a very popular routing protocol for MANET. It used on-demand routing protocol. So it organized routing path when started sending a packet. And it created expire time for maintain routing table during expire time. So, If nodes do moving during expire time, routing path don’t changing.

If it finds a new shortest routing path than already created path during expire time, it doesn’t changing routing path because AODV routing protocol must maintain routing path during expire time. Therefore, we proposed enhanced AODV routing protocol for reset a new shortest routing path during sending a packet.

In this paper, we separated five chapters. At first, we present an introduction of this paper, and then study routing protocol for MANET. Next, we explain an enhanced AODV routing protocol. And then, we analyzed result of simulation. At last, we conclude this paper.

II. ROUTING PROTOCOLS FOR MANET

There are two types routing protocol for wireless network. First, proactive type is operating routing path before sending data. If it changed topology of nodes, this information sends neighbor nodes. And neighbor nodes updated it. The well-known proactive routing protocol is DSDV.

Second, reactive type is setting routing table on demand, and it maintained active routes only. The well-known reactive routing protocols are DSR(Dynamic Source Routing), AODV.

MANET makes frequent movement. So it needs supporting movement of reactive routing protocol. In this section, we study well-known reactive routing protocol.

A. DSR(Dynamic Source Routing)

DSR is being standardized in the IETF MANET working group[1]. DSR is a well-known, reactive routing protocol. It computes a route only if one is needed. The route discovery consists of route request and route reply. The route request is broadcast into the wireless network. However, instead of setting the reverse paths in the routing tables of the nodes, the route request collects the addresses of the traversed nodes on its way to the destination. Route reply sends this path back to the source where all paths are stored in a route cache. The path, that is, the list of addresses from the source to the destination, is included in the header of each packet by the source node. Each node forwards a received packet to the next hop based on the list of addresses in the header(source routing). DSR uses PERR(Packet Error) messages for the notification of route breaks[2].

B. DMR DSR(Disjoint Multi-Path DSR)

DMR DSR is routing protocol that enhanced DSR. It sends message of information of moved or disconnected nodes to neighbor nodes. Next, this information removed in routing table[3]. So DMR DSR routing protocol ensures QoS(Quality of Service).

C. AODV(Ad-hoc On-demand Distance Vector)

AODV is a very popular routing protocol for MANET. AODV has been standardized in the IETF as experimental RFC 3561[4][5]. There are several implementations available, for instance, AODV-UU of Uppsala university[6]. AODV uses a simple request-reply mechanism for the discovery of routes. It can use hello messages for connectivity information and signals link breaks on active routes with error messages. Every routing information has a timeout associated with it as well as a sequence number. The use of sequence numbers allows to detect outdated data, so that only the most current, available routing information is used. This ensures freedom of routing loops and avoids problems known from classical distance vector protocols. When a source node S wants to send data packets to a
destination node D but does not have a route to D in its routing table, then a route discovery has to be done by S. The data packets are buffered during the route discovery.

The source node S broadcasts a RREQ(Route Request) throughout the network. In addition to several flags, a RREQ packet contains the hop count, a RREQ identifier, the destination address and destination sequence number, and the originator address and originator sequence number. The hop count field contains the distance to the originator of the RREQ, the source node S. It is the number of hops that the RREQ has traveled so far. The RREQ ID combined with the originator address uniquely identifies a route request. This is used to ensure that a node rebroadcasts a route request only once in order to avoid broadcast storms, even if a node receives the RREQ several times from its neighbors.

On receipt of a RREP(Route Response) message, a node will create or update its route to the destination D. The hop count is incremented by one, and the updated RREP will be forwarded to the originator of the corresponding RREQ. Eventually, the source node S will receive a RREP if there are paths to the destination. The buffered data packets can now be sent to the destination D on the newly discovered path.

If it has happened link failure, the node generates a RERR(Route Error) message. It contains the addresses and corresponding destination sequence number of all active destinations that have become unreachable because of the link failure. The RERR message is sent to all neighbors that are precursors of the unreachable destinations on this node. A node receiving a RERR invalidates the corresponding entries in its routing table. It removes all destinations that do not have the transmitter of the RERR as next hop from the list of unreachable destinations. If there are precursors to the destinations in this pruned list, the updated RERR message is forwarded to them.

III. ENHANCED AODV ROUTING PROTOCOL

Original AODV routing protocol is not resetting a new shortest routing path during expire time, because it must maintain it until disconnecting nodes. So, we proposed enhanced AODV routing protocol for reset a new shortest routing path during sending packet.

Enhanced AODV routing protocol maintain expire time that created first. So expire time in routing table is not updating until expire time. Therefore, routing table updated in a cycle.

Figure 1. AODV routing discovery.

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Figure 2. Network topology for example.

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nodes. So, the routing table and routing path show Table III and Figure 3.

The enhanced AODV reset the shortest routing path during moving nodes. So, the routing table and routing path show Table IV and Figure 4.

![Figure 4. Routing path of enhanced AODV during moving nodes.](image)

**Table IV**

<table>
<thead>
<tr>
<th>Time</th>
<th>Source</th>
<th>DES</th>
<th>Next hop</th>
<th>Hops</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>0</td>
<td>4</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>90</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>100</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

Enhanced routing protocol ensures shortest routing path through fixed expire time. So the source packet sends to destination quickly than original AODV routing protocol.

**IV. RESULT OF SIMULATION**

We used NS-2(Network Simulator 2) for certify performance of enhanced AODV routing protocol. NS-2 is a discrete event simulator targeted at networking research[7],[8]. NS-2 provides substantial support for simulation of TCP, routing, and multicast protocols over wired and wireless networks.

**A. Simulation Environment**

We used the standard two-ray ground propagation model, the IEEE 802.11 MAC, and omni-directional antenna model of NS-2. We use the AODV routing algorithm, and interface queue length of 50 at each node. We tested the throughput of original and enhanced AODV routing protocol during 130 seconds with 5 mobile nodes.

**Table V**

<table>
<thead>
<tr>
<th>Method</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>channel type</td>
<td>Channel/WirelessChannel</td>
</tr>
<tr>
<td>radio-propagation model</td>
<td>Propagation/TwoRayGround</td>
</tr>
<tr>
<td>network interface type</td>
<td>Phy/WirelessPhy</td>
</tr>
<tr>
<td>MAC type</td>
<td>Mac/802.11</td>
</tr>
<tr>
<td>interface queue type</td>
<td>Queue/DropTail/PriQueue</td>
</tr>
<tr>
<td>link layer type</td>
<td>LL</td>
</tr>
<tr>
<td>antenna model</td>
<td>Antenna/OmniAntenna</td>
</tr>
<tr>
<td>max packet in ifq</td>
<td>50</td>
</tr>
<tr>
<td>number of mobile nodes</td>
<td>5</td>
</tr>
<tr>
<td>routing protocol</td>
<td>AODV</td>
</tr>
</tbody>
</table>

**Figure 5 is network topology and Table VI is OTCL method for the simulation. The source node is 0 and destination node is 4. At first, the node 2 moved near node 1. Next, the node 2 moved existing location. Finally, the node 4 moved near node 1.**

![Figure 5. Network topology for simulation.](image)

**Table VI**

<table>
<thead>
<tr>
<th>OTCL METHOD.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\text{node}_0_\text{set} X_ 100.0 $\text{node}_0_\text{set} Y_ 450.0 $\text{node}_0_\text{set} Z_ 0.0</td>
</tr>
<tr>
<td>$\text{node}_1_\text{set} X_ 100.0 $\text{node}_1_\text{set} Y_ 300.0 $\text{node}_1_\text{set} Z_ 0.0</td>
</tr>
<tr>
<td>$\text{node}_2_\text{set} X_ 450.0 $\text{node}_2_\text{set} Y_ 300.0 $\text{node}_2_\text{set} Z_ 0.0</td>
</tr>
<tr>
<td>$\text{node}_3_\text{set} X_ 100.0 $\text{node}_3_\text{set} Y_ 150.0 $\text{node}_3_\text{set} Z_ 0.0</td>
</tr>
<tr>
<td>$\text{node}_4_\text{set} X_ 300.0 $\text{node}_4_\text{set} Y_ 100.0 $\text{node}_4_\text{set} Z_ 0.0</td>
</tr>
</tbody>
</table>

**B. Simulation Result of Fixed node.**

![Figure 6. Comparison of throughput when fixed nodes.](image)
The throughput of enhanced and original AODV routing protocol seems same result, because these are not changing routing path when fixed nodes. Enhanced AODV present bad throughput at resetting routing path (25 seconds). But it is no problem for an overall performance.

C. Simulation Result of Moved node.

Figure 7 is the result of throughput of enhanced and original AODV routing protocol during moving node. The throughput of enhanced and original AODV routing protocol seems different result, because enhanced AODV routing protocol is changing routing path in a cycle. Especially, Enhanced AODV routing protocol present good result at 40–60 and 90–130, because it reset shortest routing path than original AODV routing protocol.

V. CONCLUSION

In this paper, we proposed enhanced AODV routing protocol through fixed expire time in MANET. And we simulated it for analyzed performance by NS-2.

Enhanced routing protocol ensures shortest routing path through fixed expire time. So the source packet sends to destination quickly than original AODV routing protocol.

If you used enhanced AODV routing protocol for frequent movement state, you experience improvement of performance. Especially, MANET happen frequent movement. So, it is a good routing protocol for MANET.

ACKNOWLEDGMENT

This research was supported by the Internet information Retrieval Research Center (IRC) in Korea Aerospace University. IRC is a Regional Research Center of Gyeonggi Province, designated by ITEP and Ministry of Knowledge Economy.

REFERENCES