Chapter 6

Results of Simulation

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RESULTS OF SIMULATION

In this chapter the implementation part for the new Multipath routing protocol is discussed. The next section will introduce about the tested for the implementation and then the next section shows the results and then at last the conclusion part of the implementation.

6.1 TESTED

The simulation is done in NS2. The complete guidance about the simulation environment can be seen in [1] [2]. The simulation with 31 nodes was done with the new Multipath routing protocol. Below is given the simulation environment

**Scenario**

The scenario for the network is given below:

Area = 670 x 670 meters  Node movement
   = Random Packet size = 512 bytes for constant bit rate Interface Queue length = 50 packets
   Interface Queue = Tail drop for AODV, DSDV and Multipath
   and Priqueue for DSR Simulation length = 140 seconds Antenna Type = Omni directional Transmission range = 250 meters
   Transmitting power and Receiving power = 281.8 mille Watt
   Propagation Type = Two-ray ground Reflection
Table 6.1: Comparison of different routing protocols with max mobility 10 m/s

<table>
<thead>
<tr>
<th>Parameters</th>
<th>AODV</th>
<th>DSR</th>
<th>DSDV</th>
<th>Multipath Routing</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Nodes</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Mobility Max</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Packets Type</td>
<td>CBR</td>
<td>CBR</td>
<td>CBR</td>
<td>CBR</td>
</tr>
<tr>
<td>Efficiency (%)</td>
<td>93</td>
<td>92</td>
<td>94</td>
<td>100</td>
</tr>
<tr>
<td>Avg Delay (ms)</td>
<td>33.4912</td>
<td>9.8416</td>
<td>8.26218</td>
<td>25.7392</td>
</tr>
<tr>
<td>Min Delay (ms)</td>
<td>5.469</td>
<td>5.45034</td>
<td>5.44978</td>
<td>5.469</td>
</tr>
<tr>
<td>Max Delay (ms)</td>
<td>61.1047</td>
<td>399.78</td>
<td>20.3764</td>
<td>691.963</td>
</tr>
</tbody>
</table>

Table 6.2: Comparison of different routing protocols with max mobility 20m/s

<table>
<thead>
<tr>
<th>Parameters</th>
<th>AODV</th>
<th>DSR</th>
<th>DSDV</th>
<th>Multipath Routing</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Nodes</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Mobility Max</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Packets Type</td>
<td>CBR</td>
<td>CBR</td>
<td>CBR</td>
<td>CBR</td>
</tr>
<tr>
<td>Efficiency (%)</td>
<td>92.96</td>
<td>100</td>
<td>75.39</td>
<td>99.84</td>
</tr>
<tr>
<td>Avg Delay (ms)</td>
<td>15.5204</td>
<td>19.1148</td>
<td>11.8156</td>
<td>14.0406</td>
</tr>
<tr>
<td>Min Delay (ms)</td>
<td>11.2043</td>
<td>11.8337</td>
<td>11.1637</td>
<td>11.2035</td>
</tr>
<tr>
<td>Max Delay (ms)</td>
<td>61.1047</td>
<td>399.78</td>
<td>20.3764</td>
<td>691.963</td>
</tr>
</tbody>
</table>

Delay and Throughput

From the Table 6.1 and 6.2 it shows that the efficiency of the protocol is decreased when the mobility increases. In case of Multipath routing protocol the case is not true. In Multipath routing protocol when the mobility is 10m/s the
efficiency i.e. the ratio of packets sent to the packets received is not 100% because in this the packets are dropped when there is link breakage.

Figure 6.1, 6.2, 6.3 and 6.4 shows delay graph for different routing protocol. From the graph it is shown that the minimum delay is for the DSDV routing protocol than is for Multipath followed by AODV and DSR. DSDV protocol is best suited for the application where packet loss is tolerable for e.g. conversational voice, voice messaging etc. but the delay is not tolerable. Likewise AODV and DSR are more applicable where delay is preferable but packet loss are tighter, for e.g. data transfer.

The packet loss in DSDV routing protocol is due to the control information that is disseminated into the network for the up-to-date routing table. This control information has more priority than that of the data packets as they contain the network related information. So, due to this the data packets are dropped at the intermediate node which acts as the router. As the routing table contains the route to the entire available destination and the path to that destination is the lowest the delay is less in this routing protocol.
Figure 6.1: Delay of Multipath routing protocol with maximum mobility 20m/s
Fig 6.2 Delay of DSR Routing Protocol with maximum mobility 20m/s

Fig 6.3 Delay of AODV Routing Protocol with maximum mobility 20m/s
As from the results of this routing protocol the required routing protocol was where the delay is less than AODV and DSR routing protocol and the packet loss is less than that of DSDV routing protocol. The new Multipath routing protocol suites best at that place where the packet loss is less than DSDV and delay is less than DSR and AODV routing protocol. In Multipath routing protocol multiple paths are discovered for the source. All the paths are having different number of hop count to the destination. So when the source has the data to transmit it selects the best path from the available paths. So as seen from the graph the delay is somewhat same. As the routing protocol searches for the multiple paths the control information are more than that of AODV and DSR routing protocol and so suffers from the packet loss. In case of AOD and DSR routing protocol the control information is transmitted periodically i.e. at fixed interval of time, even if the network topology changes. Also the routing table is updated for the source is updated only when there is link breakage. So, in this type of routing table the control information are less and so the packet loss are less. As the routing table is update only when there is link breakage the delay is more.

6.2 CONCLUSION

It can be clearly seen from the table 6.1 that the delay is less for DSDV than other protocols. This delay variation is so because the routing tables in DSDV protocol is updated as the topology changes. During the topology change the control information about the node is to be broadcasted. This broadcasting of the routing table is dependent on the timing interval of how frequent the routing
table is updated. This updated information is to be transmitted to the other nodes in the network. So the packet loss is more due to the control packets processing at the intermediate nodes. As the routing tables are the updated regularly the source gets the best path to the destination.

In case of DSR and AODV routing protocol the route for the packets from the source once established is updated only when there is path break. So even if the destination node is far away during the first packet transmission and comes to a single hop distance during the other packet transmission the path do not change as long as the path is active. This is the main reason for more delay in AODV and DSR routing protocol. The other parameter is the packet loss in the AODV and DSR routing protocol, in this the control packets are transmitted on timely basis i.e. at fixed interval of time the control information is disseminated into the network. So due to less number of control packets the node which acts as the router handles the data packets.

The new Multipath routing protocol searches for multiple paths to the destination. The maximum number of paths is limited to four paths because of control to dissemination of control packets in the network. This dissemination of control packets is increased with respect to the network size. So the delay difference in this protocol is due to restriction made on number of paths to destination. Also the control information transmitted is on timely basis as in case of AODV and DSDV routing protocol. In case of DSDV routing protocol, single path is available; this is the best one to reach the destination.
6.3 Scope for the future work

The packet loss ratio is high in Multipath routing protocol than that of AODV and DSR routing protocol. Whenever there is a link break, the packet is dropped. This is mostly occurring at the intermediate nodes. So, the next work direction is towards reducing these packet losses.

6.4 REFERENCES


APPENDIX A

INSTALLING NS-2

NS-2 is designed to run from on most UNIX based operating systems [1]. It is possible to run NS-2 on Windows machines using Cygwin. If you don't have a UNIX install, you can also use a virtual linux machine and run that under Windows. VMWare has a free VMWare Player that allows you to download linux systems like Ubuntu and run them on your computer. You will need to make sure you have standard development packages like 'make' and 'gcc'.

Installing NS2 on UNIX Based System

First, download a copy of ns-allinone-2.29.3.tar.gz. Then from the command prompt there, execute the following:

```
tar -xzf ns-allinone-2.29.3.tar.gz

cd ns-allinone-2.29

./install
```

After a long wait and a whole lot of text, you should see the installation finish up with text like the following:

Nam has been installed successfully.
Ns-allinone package has been installed successfully.

Here are the installation places:

- . tcl8.4.11: /home/pcranen/ns-allinone-2.29/{bin,include,lib}
- . tk8.4.11: /home/pcranen/ns-allinone-2.29/{bin,include,lib}
- . otcl: /home/pcranen/ns-allinone-2.29/otcl-1.1l
- . tclcl: /home/pcranen/ns-allinone-2.29/tclcl-1.17
. ns: /home/pcraven/ns-allinone-2.29/ns-2.29/ns
. nam: /home/pcraven/ns-allinone-2.29/nam-1.1l/nam
. xgraph: /home/pcraven/ns-allinone-2.29/xgraph-12.1
. gt-itm: /home/pcraven/ns-allinone-2.29/itm, edriver, sgb2alt,
        sgb2ns, sgb2comns, sgb2hierns

put
/home/myusername/ns-allinone-2.29/bin:/home/myusername/ns-
allinone-2.29/tcl8.4.11/unix:/home/myusername/ns-allinone-
2.29/tk8.4.11/unix

into your **PATH environment**; so that you'll be able to run
itm/tclsh/wish/xgraph.

(1) You MUST put

/home/myusername/ns-allinone-2.29/otcl-
1.1l, /home/myusername/ns-allinone-2.29/lib,

into your **LD_LIBRARY_PATH** environment variable.

If it complains about X libraries, add path to your X libraries
into

**LD_LIBRARY_PATH.**

If you are using csh, you can set it like:

    setenv LD_LIBRARY_PATH

    <paths> If you are using sh, you can set it

    like:

    export LD_LIBRARY_PATH = <paths>

(2) You MUST put

    /home/myusername/ns-allinone-2.29/tcl8.4.1 l/library
into your **TCL_LIBRARY** environmental variable. Otherwise ns/nam will complain during startup.

(3) [OPTIONAL] To save disk space, you can now delete directories tc!8.4.11 and tk8.4.11. They are now installed under /home/myusername/ns-allinone-2.29/{bin,include,lib}

After these steps, you can now run the ns validation suite with

```bash
cd ns-2.29;
./validate
```

At this point, you should follow the advice here and update your environment variables. You should also add ns-allinone-2.29/bin to you path. This has links to all the executables created by NS-2. Since the Tel scripts may call these executables (like nam or xgraph), it is a good idea to have them in the path.