Virginia Tech ■ ECE/CS 4570: Wireless Networks and Mobile Systems ■ Spring 2006
At-home Exercise 8 (E08)
Report Due: March 30, 2006 (at 4:00 p.m.)

Part I – Objectives

The objective of this assignment is to evaluate the OLSR routing protocol by analyzing the results from the in-class experiment. After completing the assignment, the student should be able to:

❑ Understand the operation of OLSR routing protocol in mobile ad-hoc networks.

❑ Compare the performance of the MANET routing protocols in different network topologies.

Part II – At-home Laboratory Assignment and Report

Each student group should submit one report with results for the following tasks. Provide concise answers for each task. Each answer should be limited to one page maximum.

The following two tools have been developed to help analyze the logs of the OLSR routing daemon.

1) print_log <-b|-B> <begin_time> <-e|-E> <end_time> <log_file>

   The program will print the log messages from the log files (*olsrd.log*) between <begin_time> and <end_time>. Use "./print_log -help" for more information. You can specify both the beginning and ending time, only the beginning time, or only the ending time.

2) print_rt <-t|-T> <log_time> <log_file>

   The program will print the routing table for a given time from the routing table log files (*olsrd_rt.log*). Use "./print_rt -help" for more information.

The time arguments in the above commands can be specified in relative time (in seconds) since the first record in the log. They can also be specified in system time (hours:minutes:seconds format). Note that the beginning time of the first log record may vary for different log files.

Each student group is expected to perform the following tasks.

1. For both tests, use *print_rt* command to obtain the routing table and neighbors of all participating nodes (including the controlling node). Draw the layout of the actual topology by examining neighbors of all participating nodes for at lease two time instances in each test. It is recommended that you *not* choose the time at the beginning or the end of the test. Verify the routing table for the resulting topology. Include topology drawings and verification results in your report.

   1) It is recommended that you first refer to the *olsrd_rtupd.log* file for kernel route updates. Then use *print_rt* to get the routing table and list of neighbors for a certain time instance. The *print_log* command can be used to closely examine the changes in the topology and routing table. For analysis, choose a time when the topology is relatively stable.

   Hint: Use the "hop count" field to help obtain the neighbors from the routing table.

   2) Note that the following default parameter values for the OLSR routing daemon are used:

      a) Interval between HELLO messages: 0.5 second

      b) Interval between TC messages: 2.0 seconds

      c) Neighbor hold time: 4 seconds

      d) Topology hold time: 10 seconds

   What might be the effects of these parameter settings on your analysis?

2. For both tests, inspect the routing daemon log files (*olsrd.log*) of all participating nodes to determine the MPRs and the MPR selectors for two time instances. Use the same time instances in the previous task. It is recommended that you not choose the time at the beginning or the end of the test. For analysis, choose a time when the topology is relatively stable. Summarize the MPRs and MPR selectors for each mobile nodes with tables in your report. Verify the MPRs and MPR selectors are valid for the topology results.

   You can use the *grep* command to find all related MPR messages as follows.

   ```
   # grep MPR  olsrd.log | more
   ```

   The following are notes on the MPR log messages.

   1) When the OLSR daemon detects changes in the neighbors, it will recalculate the MPRs. The following message will be printed to olsrd.log: "Updating MPRs".

   2) Whenever a neighbor is selected as an MPR, the following message will be printed to olsrd.log: "Change neighbor status: select 10.0.1/2.X as MPR". Note that the same neighbor may be selected as an MPR multiple times for different two-hop neighbors. Also, one or more neighbors may be selected as MPRs at the same time.

   3) When the daemon completes the MPR update process, the following message will be printed to olsrd.log: "Finish updating MPRs".

   4) The MPRs remain unchanged until next update process.

3. For both tests, extract the packet loss rate and average round trip delay statistics from files *pingtest.log* for either team 1 or team 2. Estimate the overall packet loss rate. Note that each statistics report in the log file corresponds to a 15-second period.

   Plot the packet loss rate results on the same graph. Use the time since the test starts as the *x*-axis and the packet loss rate as the *y*-axis. Plot the round trip delay results on another graph. Use the time since the test starts as the *x*-axis and the round trip delays as the *y*-axis.

   Hint: Use the *grep* command to scan the log files.

4. For both tests, gather the throughput statistics from files *iperf_1.log* and *iperf_2.log* for either team 3 or 4. Plot all throughput results on the same graph. Use the time since the test starts as the *x*-axis and throughput as the *y*-axis.

   Hint: Use the *grep* command to scan the log files.

5. Based on the experimental data and your analysis, compare the performance results in the two topologies, in terms of packet loss rate, round trip delay, connectivity, and throughput.

6. Include the screen captures from the in-class lab experiment. This includes screen captures of: (a) output of olsrquery to show the routing table for in-class lab Test 1; (b) output of olsrquery to show the neighbor list for in-class lab Test 1; (c) output of olsrquery to show the routing table for in-class lab Test 2; and (d) output of olsrquery to show the neighbor list for in-class lab Test 2.

Part III – General Conclusions

This is the free-form portion of your report. Provide a summary of lessons learned in this lab, general observations on how each of the tools illustrated by the experiments can be used to configure and assess performance of the network, any unexpected results obtained, etc. Feel free to suggest improvements to the experiments.

Appendix – Routing Daemon Logs

The log files for the OLSR routing daemon include the following.

1) *olsrd.log* – General message log for the OLSR routing daemon. All of the protocol messages and operations are saved in this file. Each line of the log record begins with a time stamp followed by a short description of the events.

2) *olsrd_rt.log* – The OLSR routing table is saved to this file every 2 seconds while the routing daemon is running.

3) *olsrd_rtupd.log* – Routing update log. Each line begins with a "+" or "-" character followed by the timestamp, destination, next hop and metric fields. The plus sign ("+") mean that a new route was added and the minus sign ("-") means that an old route was deleted.