Network Performance Workshop Exercises

1. NDT Testing
   a. Go to http://www.measurementlab.net
   b. Select "Test Your Internet Connection"
   c. Select "Network Diagnostic Tool"
   d. Select "Run the network diagnostic tool"
   e. Run the test by clicking "START"
   f. Questions to answer:
      i. What is the performance from client to server?
      ii. What is the performance from server to client?
      iii. What does NDT think is the cause of the network performance problems (if any)?
      iv. Look at the "Statistics" and "More Details" buttons. What additional information are you learning?

2. NPAD Testing
   a. Go to http://www.measurementlab.net
   b. Select "Test Your Internet Connection"
   c. Select "Network path & application diagnostics"
   d. Select "Run NPAD test"
   e. Select an RTT and Bandwidth number (e.g. try 30ms and 10Mbps).
   f. Run the test by clicking "Start Test"
   g. Questions To Answer:
      i. Was your host able to send at the requested rate/latency?
      ii. What caused the failures, if any?
      iii. Change the latency or bandwidth until you are able to complete a successful test. What latency/bandwidth did you choose?

For all subsequent questions, you will need to login to the hosts. This information was mailed to each participant last week. With the username/password, use SSH to login to "npw.internet2.edu". Also open a web browser and point it to "npw.internet2.edu". Note this is a "broken" network, there will be problems that you will be attempting to locate using the tools.

3. NTP Investigation
   a. Investigate the NTP configuration on the "head" host.
   b. You will need to use the "ntpq" command to do this. You can learn about ntpq by using "man ntpq". In particular, learn what commands will display the NTP peers.
   c. Questions To Answer:
      i. What are the peers of the "head" host?
      ii. Which host is the "head" host synchronizing against?

iii. What is the "stratum" of the "head" host?

4. Testbed Layout
    a. There are 4 hosts in our network:
        i. head
        ii. red-pc1
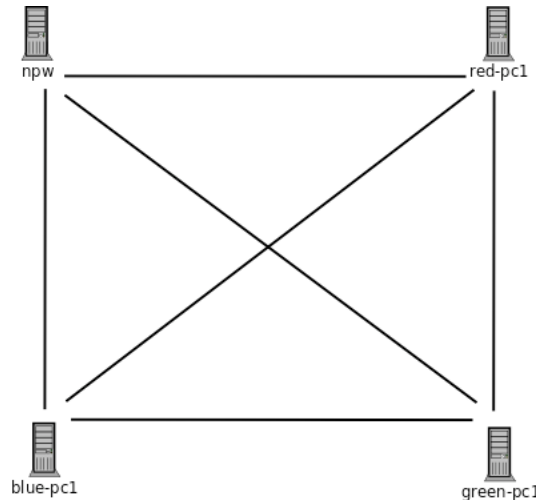   iii. green-pc1
        iv. blue-pc1.

Figure 1 - Network Map

    b. Assume that each host can reach any other host via a direct connection.
    c. Your key will work on each, so feel free to SSH as needed. Check the status of NTP on each host.
    d. Use "ping" to investigate how the various hosts are connected. You can find out more information about ping by running "man ping"
    e. Questions To Answer:
        i. Are all of the clocks stable? If not, which host(s) is(are) suspect? Use NTP as you did in part 3.
        ii. Annotate the above diagram of all the hosts, add IP addresses and hostnames (not required), their link*s* to other hosts, and the round-trip time between each host.

5. OWAMP Investigation
    a. We have seen RTT delays, now lets see OW delays to see if anything is different. Use the "owping" tool to discover the one-way latencies between the hosts. You can find out more information on owping by running "man owping".
    b. Questions To Answer:
        i. Using the information from above, draw another diagram of all the hosts, and the one-way delay between each host on all

links. Take note of any loss, duplicate, or out of order packets seen. ***N.B. May need to investigate by running the tool more than once, or running with a longer number of packets than the default of 100***.

    ii. Based on the results of the NTP comparison, how will the stability of the clocks change the measurement results?

    iii. Based on the latency, duplicate, out of order packets, and loss rates, which links do you think will perform best and which will perform the worst in terms of long term throughput (something we will examine next).

6. BWCTL Investigation
   a. Try to work in teams of 2-3 for this one. BWCTL testing cannot overlap; therefore when everyone tries to schedule tests, there will be resource contention issues.
      i. The instructors will split the room to prevent over-testing
   b. Use the "bwctl" tool to perform bandwidth tests between the hosts. You can find out more information on bwctl by running "man bwctl".
   c. Do only 'TCP' testing for now, use a 30 second test, and use an interval of 2 seconds (to demonstrate TCP's behavior in ramp-up and congestion/loss). Format the output in Mbps for easy comparison.
   d. Questions To Answer:
      i. How long did you have to wait to get the results?
      ii. Draw yet another diagram of all the hosts using the information from above, and note the bandwidth (in Mbps, use the '–f m' option to get this format) between each host. Did the bandwidth match your expectations based on the information you found above?

7. NDT Command Line
   a. Use the "web100clt" tool to perform ndt tests between the hosts. You can find out more information on web100clt by running "man web100clt" or "web100clt -h".
   b. Launch these tests from the head node ***ONLY to the other hosts***
   c. Use the "-d" and "-l" flags (sometimes more than once…) to get more information.
   d. Questions To Answer:
      i. NDT will deliver an answer on bandwidth that is similar to BWCTL, but with more information. What sort of information are you seeing, and does this agree with previous observations?
      ii. Are there any problems (e.g. buffer sizes, queueing) noted between the hosts?

8. NPAD Command Line
    a. Use the "pathdiag.py" tool to perform NPAD tests between the hosts. You can find out more information on pathdiag by running "/opt/npad/pathdiag.py -h"
    b. Questions to Answer:
        i. What local infrastructure problems had NPAD identified?
        ii. Does this meet what we have seen with the other tools?

9. perfSONAR Tools Investigation
    a. As a way to verify your findings, we're running regular performance tests between the various hosts, and recording the results.
    b. Browse to http://npw.internet2.edu/toolkit/
        i. Select the "One-Way Latency" option from the "Service Graphs"
            1. Look at each host, use a "4 hour" or "12 Hour" graph. Does the performance match what you saw?
        ii. Select the "Throughput" option from the "Service Graphs"
            1. Look at each host, use a "1 Hour" graph. Does the performance match what you saw in the diagnostic section? What can you notice if you look at the "1 Month" graph?
        iii. Select the "Head Ping Latency" option from the "Service Graphs"
            1. Examine the graphs for host pairs that you perceive to have a problem
        iv. Select the "Red PC Ping Latency" option from the "Service Graphs"
            1. Examine the graphs for host pairs that you perceive to have a problem
        v. Select the "Green PC Ping Latency" option from the "Service Graphs"
            1. Examine the graphs for host pairs that you perceive to have a problem
        vi. Select the "Blue PC Ping Latency" option from the "Service Graphs"
            1. Examine the graphs for host pairs that you perceive to have a problem
    c. Based on the knowledge of using the tools in a diagnostic fashion, how do the regular monitoring results compare?