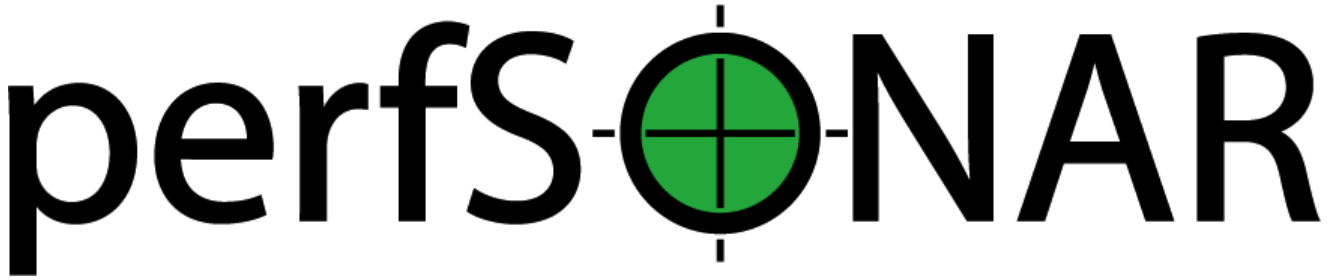


Some Details

Network Startup Resource Center

ESnet
ENERGY SCIENCES NETWORK

U.S. DEPARTMENT OF ENERGY
Office of Science

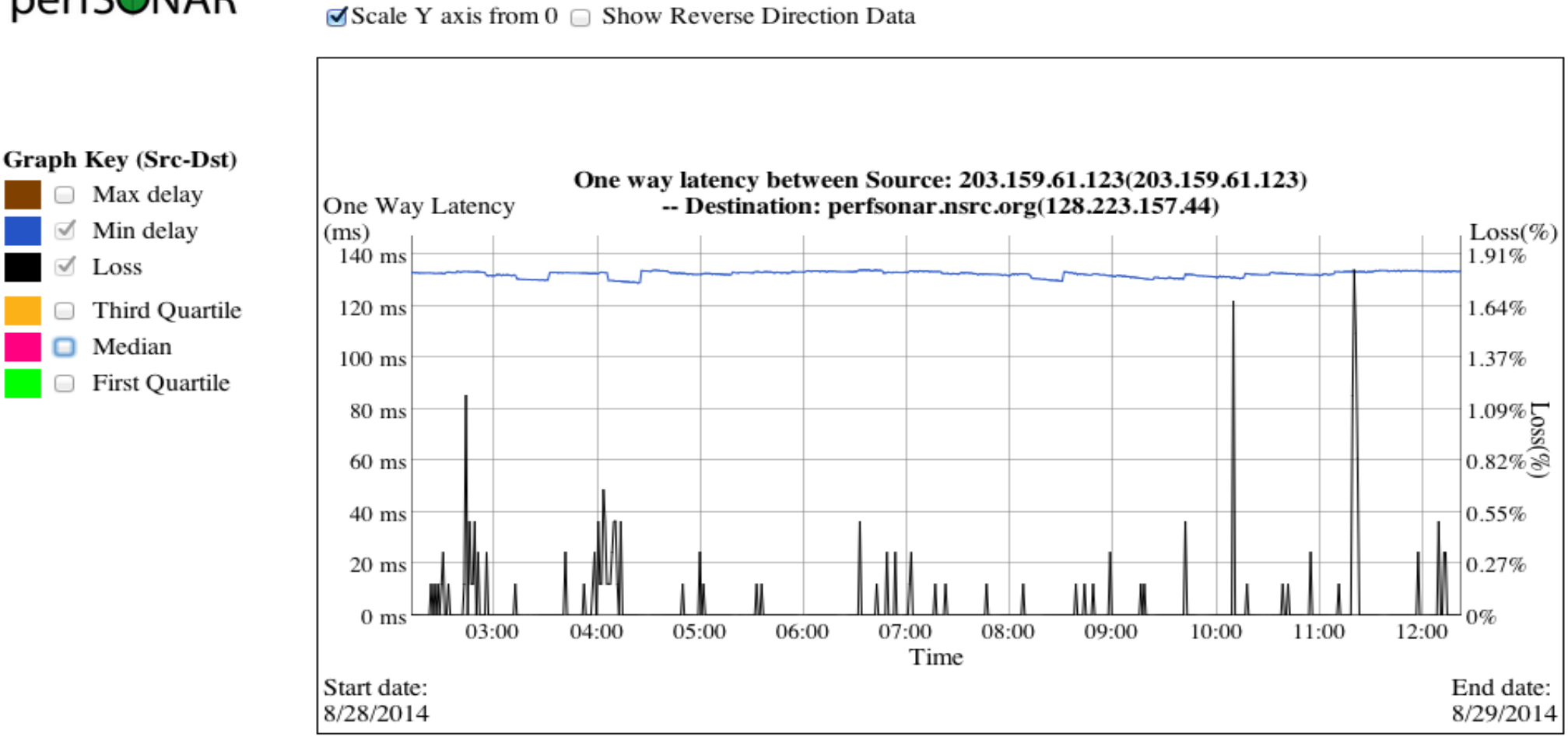
BERKELEY LAB

Bandwidth Testing vs. Latency

perfSONAR Toolkit version 3.3.2

- Select either bandwidth testing or latency – Not both
- Bandwidth testing will affect latency results

perfSONAR



PerfSONAR-PS Where/How to Run

- Does not work well to run perfSONAR in a VM
- Be sure that NTP services are properly configured before collecting data.
- Select the machine's timezone at install time and do not change this.
- For 1Gbps or lower connections you can do some bandwidth testing on smaller machines. Otherwise see: http://fasterdata.es.net/
- Run perfSONAR-PS where you will be doing work.

PerfSONAR-PS Troubeshooting

Solving performance issues is ***completely*** non-trivial in most cases...

You have some tools:

- Historical perfSONAR data
- npad
- ndt
- traceroute, tracepath, mtr, reverse traceroute, ping, netstat, lsof, kernel tuning, tcpdump, etc.

Securing the perfSONAR-PS Host

Runs CentOS Linux (version 6.5)

- Are the running services reasonable?
- What ports are open and in use?
- Is software up-to-date?
- Do you allow root access?
- Are you using ssh keys or passwords?

Securing the perfSONAR-PS Host

Are the running services reasonable?

Try this on your perfSONAR-PS machine now:

```
$ ps auxwww | less
```

```
root      1525  0.0  0.0  10676  4400 ?        Ss   Aug26   0:00 NetworkManager --pid-
file=/var/run/NetworkManager/NetworkManager.pid
root      1529  0.0  0.0   4792  2284 ?        S    Aug26   0:00 /usr/sbin/modem-manager
root      1537  0.0  0.0   7596   884 ?        Ss   Aug26   0:00 /usr/sbin/wpa_supplicant -c
/etc/wpa_supplicant/wpa_supplicant.conf -B -u -f /var/log/wpa_supplicant.log -P /var/run/wpa_supplicant.pid
root      1573  0.0  0.0   3404  1052 ?        S    Aug26   0:00 /usr/sbin/web100srv -a -s -l /var/log/ndt/web100srv.log
499       1613  0.0  0.2  28684 20904 ?        Ss   Aug26   0:00 SimpleLSBootStrapClientDaemon.pl
499       1636  0.0  0.3  36164 28764 ?        Ss   Aug26   0:01 ls_cache_daemon.pl
499       1690  0.0  0.2  26096 17932 ?        Ss   Aug26   0:00 perfsonar-daemon.pl (1690)
499       1691  0.0  0.2  26096 17816 ?        S    Aug26   0:06 perfsonar-daemon.pl (1690) - Listener (8087)
499       1874  0.0  0.1  12956  8556 ?        Ss   Aug26   0:00 /opt/perfsonar_ps/perfsonarbuoy_ma/bin/bwmaster.pl:master
499       1910  0.0  0.1  13108  8624 ?        Ss   Aug26   0:02 /opt/perfsonar_ps/perfsonarbuoy_ma/bin/powmaster.pl:master
499       1945  0.0  0.2  34388 20192 ?        Ss   Aug26   0:00 perfsonar-daemon.pl (1945)
499       1946  0.0  0.2  34388 20920 ?        S    Aug26   0:02 perfsonar-daemon.pl (1945) - Listener (9990)
root      2093  0.0  0.0  48008  6796 ?        Sl   Aug26   0:19 /usr/bin/python /usr/bin/fail2ban-server -b -s
/var/run/fail2ban/fail2ban.sock -p /var/run/fail2ban/fail2ban.pid -x
root      3804  0.0  0.0   5280  1264 ?        S    01:05   0:00 /bin/sh /usr/bin/mysqld_safe --datadir=/var/lib/mysql
--socket=/var/lib/mysql/mysql.sock --pid-file=/var/run/mysqld/mysqld.pid --basedir=/usr --user=mysql
mysql     3915  0.0  0.2 143892 24252 ?        Sl   01:05   0:25 /usr/libexec/mysqld --basedir=/usr --datadir=/var/lib/mysql
--user=mysql --log-error=/var/log/mysqld.log --pid-file=/var/run/mysqld/mysqld.pid --socket=/var/lib/mysql/mysql.sock
bwctl     3960  0.0  0.0   3032   700 ?        Ss   01:05   0:00 /usr/bin/bwctld -c /etc/bwctld -R /var/run
499       3989  0.0  0.3  39160 26856 ?        Ss   01:05   0:00 perfsonar-daemon.pl (3989)
499       3990  0.0  0.3  39160 27664 ?        S    01:05   0:02 perfsonar-daemon.pl (3989) - Listener (8085)
499       3991  0.0  0.3  39160 27784 ?        S    01:05   0:00 perfsonar-daemon.pl (3989) - Service Maintenance
```

Securing the perfSONAR-PS Host

`$ ps auxwww | less`

Does it seem reasonable?

```
root      1525  0.0  0.0  10676  4400 ?        Ss   Aug26   0:00 NetworkManager --pid-
file=/var/run/NetworkManager/NetworkManager.pid
root      1529  0.0  0.0   4792  2284 ?        S    Aug26   0:00 /usr/sbin/modem-manager
root      1537  0.0  0.0   7596   884 ?        Ss   Aug26   0:00 /usr/sbin/wpa_supplicant -c
/etc/wpa_supplicant/wpa_supplicant.conf -B -u -f /var/log/wpa_supplicant.log -P /var/run/wpa_supplicant.pid
root      1573  0.0  0.0   3404  1052 ?        S    Aug26   0:00 /usr/sbin/web100srv -a -s -l /var/log/ndt/web100srv.log
499       1613  0.0  0.2  28684 20904 ?        Ss   Aug26   0:00 SimpleLSBootStrapClientDaemon.pl
499       1636  0.0  0.3  36164 28764 ?        Ss   Aug26   0:01 ls_cache_daemon.pl
499       1690  0.0  0.2  26096 17932 ?        Ss   Aug26   0:00 perfsonar-daemon.pl (1690)
499       1691  0.0  0.2  26096 17816 ?        S    Aug26   0:06 perfsonar-daemon.pl (1690) - Listener (8087)
499       1874  0.0  0.1  12956  8556 ?        Ss   Aug26   0:00 /opt/perfsonar_ps/perfsonarbuoy_ma/bin/bwmaster.pl:master
499       1910  0.0  0.1  13108  8624 ?        Ss   Aug26   0:02 /opt/perfsonar_ps/perfsonarbuoy_ma/bin/powmaster.pl:master
499       1945  0.0  0.2  34388 20192 ?        Ss   Aug26   0:00 perfsonar-daemon.pl (1945)
499       1946  0.0  0.2  34388 20920 ?        S    Aug26   0:02 perfsonar-daemon.pl (1945) - Listener (9990)
root      2093  0.0  0.0  48008  6796 ?        Sl   Aug26   0:19 /usr/bin/python /usr/bin/fail2ban-server -b -s
/var/run/fail2ban/fail2ban.sock -p /var/run/fail2ban/fail2ban.pid -x
root      3804  0.0  0.0   5280  1264 ?        S    01:05   0:00 /bin/sh /usr/bin/mysqld_safe --datadir=/var/lib/mysql
--socket=/var/lib/mysql/mysql.sock --pid-file=/var/run/mysqld/mysqld.pid --basedir=/usr --user=mysql
mysql     3915  0.0  0.2 143892 24252 ?        Sl   01:05   0:25 /usr/libexec/mysqld --basedir=/usr --datadir=/var/lib/mysql
--user=mysql --log-error=/var/log/mysqld.log --pid-file=/var/run/mysqld/mysqld.pid --socket=/var/lib/mysql/mysql.sock
bwctl     3960  0.0  0.0   3032   700 ?        Ss   01:05   0:00 /usr/bin/bwctld -c /etc/bwctld -R /var/run
499       3989  0.0  0.3  39160 26856 ?        Ss   01:05   0:00 perfsonar-daemon.pl (3989)
499       3990  0.0  0.3  39160 27664 ?        S    01:05   0:02 perfsonar-daemon.pl (3989) - Listener (8085)
499       3991  0.0  0.3  39160 27784 ?        S    01:05   0:00 perfsonar-daemon.pl (3989) - Service Maintenance
```

Securing the perfSONAR-PS Host

What ports are open?
Does this seem reasonable?

Let's check by doing:

```
$ sudo lsof -i
```

Review the output from lsof. Now try with netstat:

```
$ sudo netstat -ltup
```

Review the output.

Securing the perfSONAR-PS Host

Sample output:

```
owampd    22857     owamp    7u  IPv6 472972      0t0  TCP *:owamp-control (LISTEN)
owampd    22857     owamp    8u  IPv6 619127      0t0  TCP 203.159.61.100:owamp-control->203.159.61.100:56379
(ESTABLISHED)
owampd    22858     owamp    7u  IPv6 472972      0t0  TCP *:owamp-control (LISTEN)
owampd    22858     owamp    8u  IPv6 619127      0t0  TCP 203.159.61.100:owamp-control->203.159.61.100:56379
(ESTABLISHED)
powstream 22862 perfsonar   16u  IPv4 619143      0t0  TCP 203.159.61.100:37059->203.159.61.100:owamp-control
(ESTABLISHED)
powstream 22862 perfsonar   19u  IPv4 619155      0t0  UDP 203.159.61.100:8931
powstream 22870 perfsonar   13u  IPv4 575951      0t0  TCP 203.159.61.100:46538->perfsonar.nsrc.org:owamp-
control (ESTABLISHED)
powstream 22870 perfsonar   16u  IPv4 619213      0t0  TCP 203.159.61.100:60518->perfsonar.nsrc.org:owamp-
control (ESTABLISHED)
powstream 22870 perfsonar   19u  IPv4 619219      0t0  UDP 203.159.61.100:8859
bwctld    24490     bwctl   10u  IPv6 630746      0t0  TCP 203.159.61.100:4823->perfsonar.nsrc.org:39359
(ESTABLISHED)
bwctld    24491     bwctl   10u  IPv6 630746      0t0  TCP 203.159.61.100:4823->perfsonar.nsrc.org:39359
(ESTABLISHED)
bwctld    24491     bwctl   14u  IPv4 630755      0t0  TCP 203.159.61.100:6158->perfsonar.nsrc.org:50357
(ESTABLISHED)
iperf     24492     bwctl    8u  IPv4 631745      0t0  TCP 203.159.61.100:5221 (LISTEN)
iperf     24492     bwctl   10u  IPv6 630746      0t0  TCP 203.159.61.100:4823->perfsonar.nsrc.org:39359
(ESTABLISHED)
iperf     24492     bwctl   14u  IPv4 630755      0t0  TCP 203.159.61.100:6158->perfsonar.nsrc.org:50357
(ESTABLISHED)
httpd     24570    apache    4u  IPv6  14159      0t0  TCP *:http (LISTEN)
httpd     24570    apache    6u  IPv6  14163      0t0  TCP *:https (LISTEN)
```

Securing the perfSONAR-PS Host

Is software up-to-date?

Let's do:

```
$ sudo yum update
```

If there are packages to be updated respond “Yes”

Securing the perfSONAR-PS Host

Turning on automatic udpates

We'll do this now. On your perfSONAR-PS Toolkit machine run the following commands:

```
$ sudo yum install yum-cron
$ sudo chkconfig yum-cron on
$ sudo service yum-cron start
```

And you should see:

```
Enabling nightly yum update:                               [OK]
```

Securing the perfSONAR-PS Host

Do you allow root access via ssh?
Are you using passwords via ssh?

If you answer “Yes” to either... strongly consider:

- Disabling root access
- Allow ssh public/private key access only

Let's do this now...

Securing the perfSONAR-PS Host

On your virtual machine (pc1-pc36) log in as user “sysadm and do the following:

```
$ ssh-keygen -t rsa -b 2048
```

Press <ENTER> for where to save file. Use a passphrase to protect your private key.

```
Generating public/private rsa key pair.
Enter file in which to save the key (/home/sysadm/.ssh/id_rsa):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/sysadm/.ssh/id_rsa.
Your public key has been saved in /home/sysadm/.ssh/id_rsa.pub.
```

Securing the perfSONAR-PS Host

On your perfsonar-PS Toolkit node do:

```
$ useradd -G wheel sysadm
$ passwd sysadm
$ sudo -s
# su - sysadm
$ mkdir /home/sysadm/.ssh
$ chmod 700 /home/sysadm/.ssh
```

Securing the perfSONAR-PS Host

On your virtual machine as user *sysadm* do:

```
$ cd /home/sysadm/.ssh
$ scp id_rsa.pub sysadm@203.159.61.1NN:.ssh/.
```

On your perfSONAR-PS Toolkit node do:

```
$ sudo vi /etc/ssh/sshd_config
```

Next slide for changes to make...

Securing the perfSONAR-PS Host

In the file /etc/ss/sshd_config make the changes:

```
#PermitRootLogin yes
```

to

```
PermitRootLogin no
```

and change

```
PasswordAuthentication yes
```

to

```
PasswordAuthentication no
```

Now save the file and type:

```
$ sudo service sshd reload
```

Securing the perfSONAR-PS Host

On your virtual machine (pc1-pc36) logged in as user “sysadm” try connecting to your perfSONAR-PS Toolkit node:

```
$ ssh root@203.159.61.1NN
```

This should fail... Now try:

```
$ ssh sysadm@203.159.61.1NN
```

And you should be asked for your private key's passphrase – ***not*** the remote password for sysadm

Looking at Some Results

Let's review the graphs from a few of our perfSONAR-PS Toolkit installations:

- perfsonar.nsrc.org
- Perfsonar1.itu.dk
- 203.159.61.100 (intel i5 NUC)
- 203.159.61.123 (laptop)
- 203.159.61.104
- 203.159.61.109
- 203.159.61.110
- 203.159.61.111
- 203.159.61.112
- 203.159.61.113
- 203.159.61.115

Looking at Some Results

Command line tests using:

`bwctl` from 203.159.61.0/24

```
bwctl --verbose --tool iperf3 -fM -t 30 -s 202.28.229.115

bwctl --verbose --tool iperf -fM -t 30 -s 202.28.229.115

bwctl --verbose --tool nuttcp -fM -t 30 -s 202.28.229.115

bwctl --verbose --tool iperf3 -fM -t 30 -s perfsonar.nsrc.org
```

Looking at Some Results

Command line tests using ndt (network diagnostic tool):

`ndt client (web100cl)` from 203.159.61.0/24

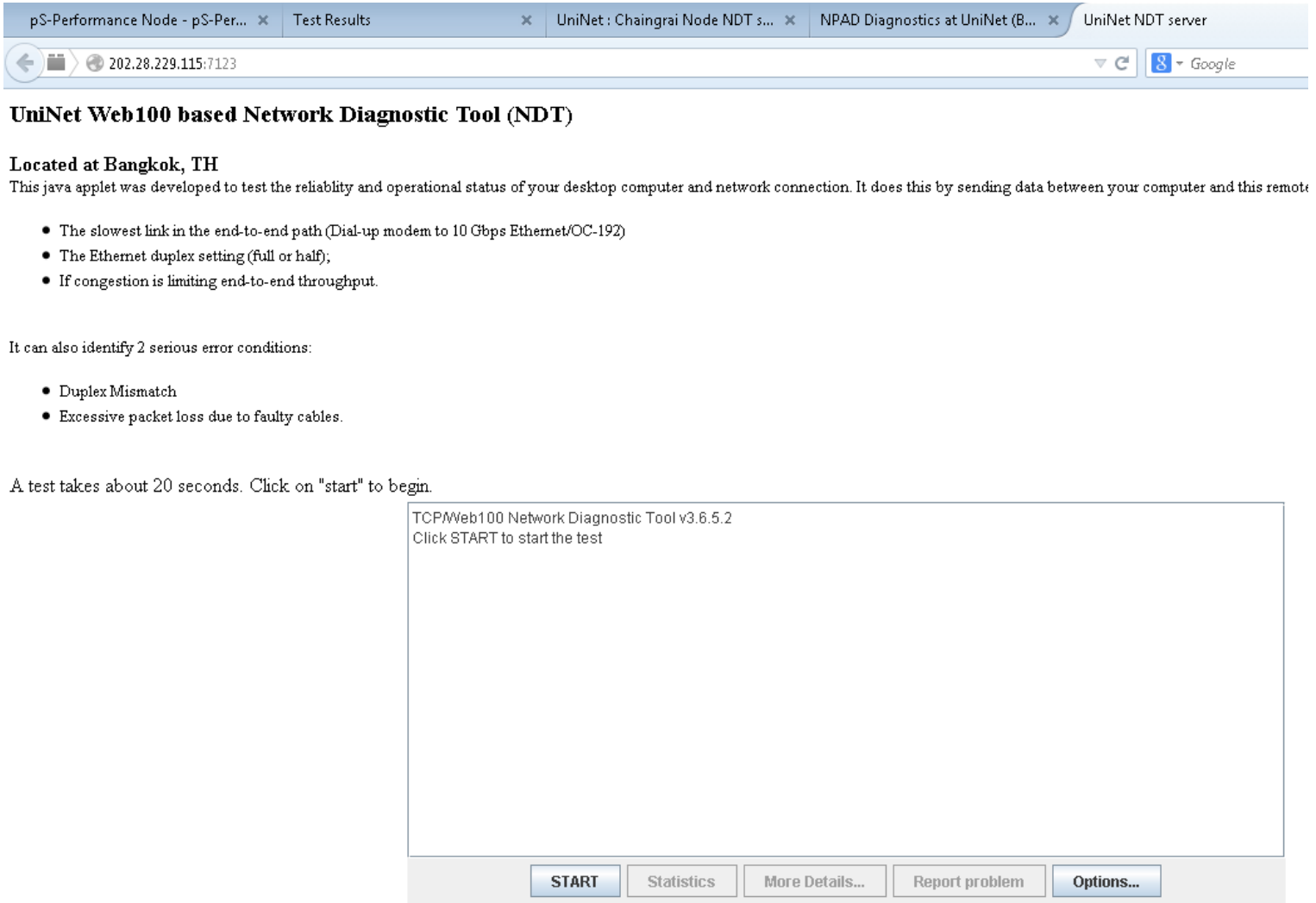
```
web100clt -d -n 202.28.229.115
```

"`-d`" for (d)ebugging information

End point is UniNet bandwidth testing perfSONAR node in Thailand

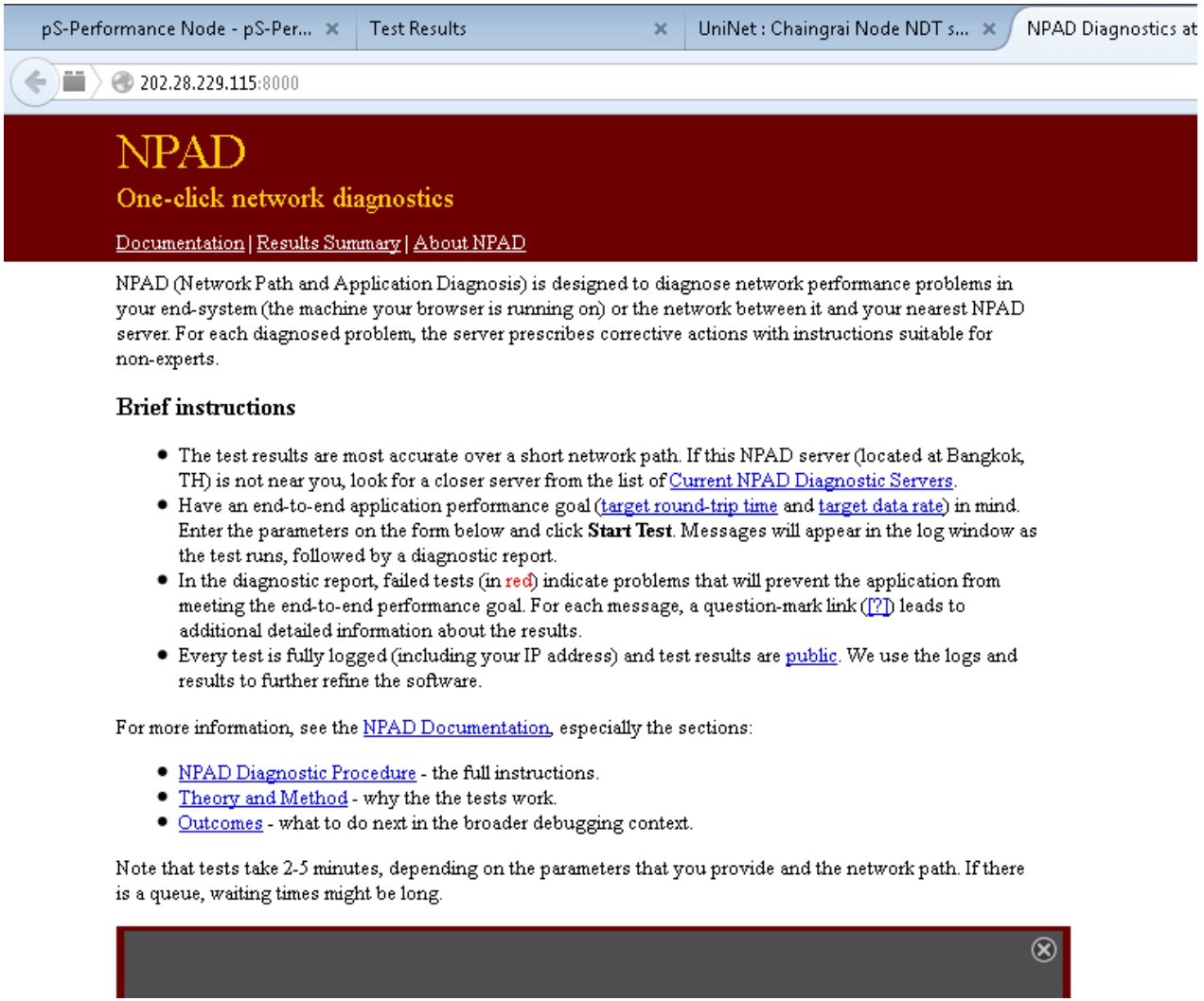
Looking at Some Results

`ndt` from a browser (port 7123):



Looking at Some Results

`npad` (network pathdiag) from a browser (port 8000):



Resources

Axel

http://freecode.com/projects/axel

Esnet Fasterdata Knowledge Base

http://fasterdata.es.net/

GridFTP

http://toolkit.globus.org/toolkit/docs/latest-stable/gridftp/

NDT/NPAD

https://fasterdata.es.net/performance-testing/network-troubleshooting-tools/ndt-npad/

https://twiki.grid.iu.edu/bin/view/Documentation/Release3/NetworkPerformanceToolkit