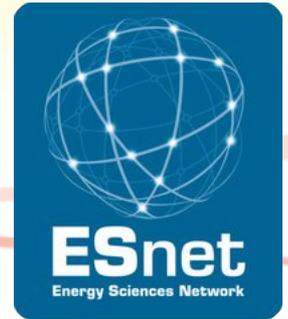


INTERNET
2



November 18th 2013, SC13 Network Performance Tutorial
Jason Zurawski – Internet2/ESnet

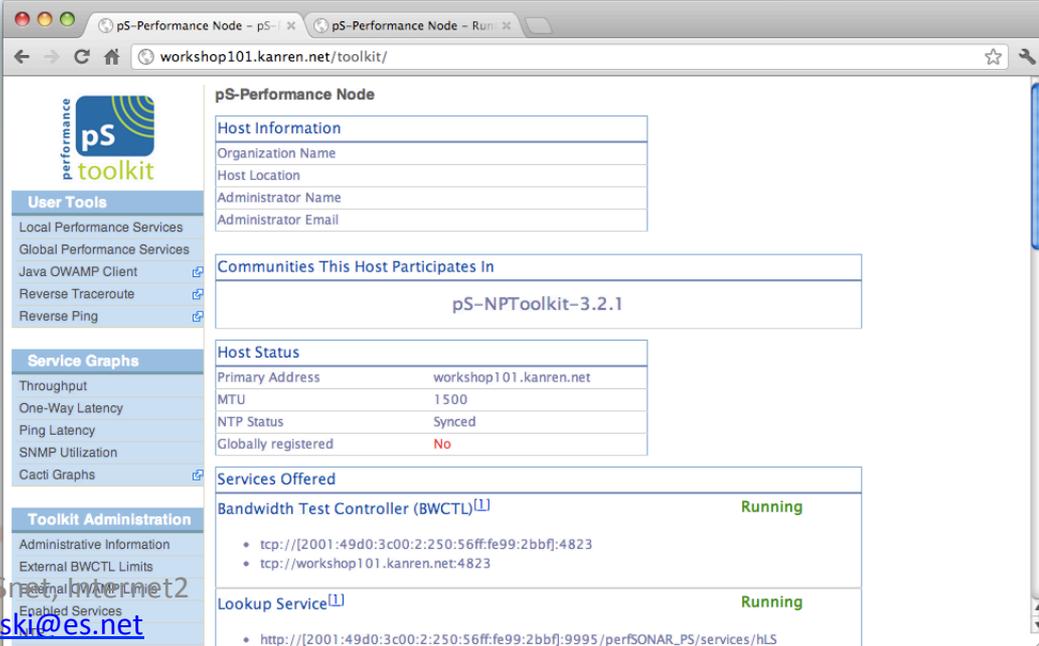
Interpretation of Measurements from Remote Hosts

Outline

- Setup Machines
- Overview of pSPT Functionality

Virtual Machines – Web Interface

- We will be using VMs:
 - perfsonar-ws-2.internet2.edu – perfsonar-ws-10.internet2.edu
 - **Note – Some of you have to share**
- Visit your VM in a web browser first, e.g.:
 - <http://perfsonar-ws-XX.internet2.edu> (where XX is your number)



The screenshot shows a web browser window displaying the pS-Performance Node interface. The browser address bar shows the URL workshop101.kanren.net/toolkit/. The page content is organized into several sections:

- pS-Performance Node**: The main title of the page.
- Host Information**: A table with fields for Organization Name, Host Location, Administrator Name, and Administrator Email.
- Communities This Host Participates In**: A table showing the community **pS-NPToolkit-3.2.1**.
- Host Status**: A table with fields for Primary Address (workshop101.kanren.net), MTU (1500), NTP Status (Synced), and Globally registered (No).
- Services Offered**: A table listing services and their status:

Service	Status
Bandwidth Test Controller (BWCTL)	Running
Lookup Service	Running

The left sidebar contains navigation menus for User Tools, Service Graphs, and Toolkit Administration.

Virtual Machines – Logging In

- Click on “Enabled Services”
 - Note you may need to ‘ok’ a security warning
- Username: “root”
- Password: “psworkshop”

Virtual Machines – Enabling SSH

The screenshot shows a web browser window with the URL https://workshop101.kanren.net/toolkit/admin/enabled_services/. The page title is "Enabled Services Configuration Tool". On the left sidebar, there are sections for "User Tools", "Service Graphs", and "Toolkit Administration". The "Enabled Services Configuration Tool" section contains a table of services with checkboxes and descriptions. The "SSH" service is highlighted with a red circle. Below the table, there are two radio buttons: "Only Enable Bandwidth Services" and "Only Enable Latency Services". At the bottom of the configuration tool, there are "Save" and "Reset" buttons, with the "Save" button also highlighted by a red circle.

Enabled Services Configuration Tool

Save Reset

Services	Description
<input checked="" type="checkbox"/> PingER	Enables this host to perform scheduled ping tests. These tests will periodically ping configured hosts giving administrators a view of the latency from their site over time.
<input checked="" type="checkbox"/> perfSONAR-BUOY Throughput Testing	Enables this host to perform scheduled throughput tests. These tests will run periodically giving administrators a view of the throughput to and from their site over time.
<input checked="" type="checkbox"/> perfSONAR-BUOY Latency Testing	Enables this host to perform scheduled one-way latency tests. These tests will run periodically giving administrators a view of the latency from their site over time.
<input checked="" type="checkbox"/> perfSONAR-BUOY Measurement Archive	Makes available the data collected by the perfSONAR-BUOY Latency and Throughput tests.
<input checked="" type="checkbox"/> NDT	Allows clients at other sites to run NDT tests to this host.
<input checked="" type="checkbox"/> NPAD	Allows clients at other sites to run NPAD tests to this host.
<input checked="" type="checkbox"/> BWCTL	Allows clients at other sites to run Throughput tests to this host
<input checked="" type="checkbox"/> OWAMP	Allows clients at other sites to run One-Way Latency tests to this host
<input type="checkbox"/> SSH	Allows administrators to remotely connect to this host using SSH
<input checked="" type="checkbox"/> SNMP MA	Makes available SNMP statistics collected by Cacti (Note: you must configure cacti for this to work)
<input checked="" type="checkbox"/> Traceroute MA	Makes available results of data collected by scheduled traceroute tests
<input checked="" type="checkbox"/> Traceroute Scheduler	Enables this host to run scheduled traceroute tests.
<input checked="" type="checkbox"/> Lookup Service	Registers your services into the global set of perfSONAR services so that they can be discovered

Only Enable Bandwidth Services Only Enable Latency Services

Save Reset

Virtual Machines – Enabling SSH

- Click ‘SSH’ to enable the SSH service
- Click “Save”
 - A progress bar will appear
 - When done “Configuration Saved And Services Restarted” will appear
 - Note: If you are sharing, only one of you will need to make this change
- SSH is now available on your host

Virtual Machines – SSHing to Host

- Open a terminal
- SSH to root@perfsonar-ws-XX.internet2.edu (where XX) is your number):

```
zurawski — root@perfSONAR-ws-1:~ — ssh — ttys000 — 80x24
[zurawski@poteen ~]$ ssh root@perfsonar-ws-1.internet2.edu
The authenticity of host 'perfsonar-ws-1.internet2.edu (207.75.164.236)' can't be
established.
RSA key fingerprint is 60:0d:fe:d5:be:72:0a:b3:24:4e:81:69:a0:60:47:10.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'perfsonar-ws-1.internet2.edu,207.75.164.236' (RSA) t
o the list of known hosts.
root@perfsonar-ws-1.internet2.edu's password:
Last login: Tue Mar 12 08:20:03 2013
Welcome to the Internet2 pS-Performance Toolkit v3.2.2

To start configuration, run:

sudo /opt/perfsonar_ps/toolkit/scripts/nptoolkit-configure.py

Once you set passwords, you can login to the web interface and finish
configuration. The web interface should be available at:

https://perfsonar-ws-1.internet2.edu/toolkit
[root@perfSONAR-ws-1 ~]#
```

Virtual Machines – Done (For Now)

- Your Virtual Machine is “ready” to go.
 - Diagnostic services are ready to be used
 - Regular testing is scheduled
- If installing @ Home ...
 - Burn a LiveCD (<http://psps.perfsonar.net/toolkit>):
 - Put into bay, and simply boot. This ***will not*** affect the machine’s hard drive ***unless*** you configure storage
 - Burn a NetInstall CD (<http://psps.perfsonar.net/toolkit>):
 - Install like a standard Linux distribution.
 - When done you will have the same setup as the VMs.
 - Detailed configuration instructions are also available:
 - <http://code.google.com/p/perfsonar-ps/wiki/pSPerformanceToolkit33>

Outline

- Setup Machines
- Overview of pSPT Functionality

Home Page

performance pS toolkit

User Tools

- Local Performance Services
- Global Performance Services
- Java OWAMP Client
- Reverse Traceroute
- Reverse Ping

Service Graphs

- Throughput
- One-Way Latency
- Head Ping Latency
- Red PC Ping Latency
- Green PC Ping Latency
- Blue PC Ping Latency
- SNMP Utilization
- Cacti Graphs

Performance Toolkit

- Configuration Help
- Frequently Asked Questions
- About
- Credits

perfsONAR powered

pS-Performance Node

Host Information

Organization Name
Host Location
Administrator Name
Administrator Email

Communities This Host Participates In

--

Host Status

Primary Address	npw.internet2.edu
-----------------	-------------------

Services Offered

Bandwidth Test Controller (BWCTL)	Running
<ul style="list-style-type: none">tcp://npw.internet2.edu:4823tcp://ipv6-annarbor-ofc.internet2.edu:4823tcp://192.168.0.1:4823	
Lookup Service	Disabled
<ul style="list-style-type: none">http://npw.internet2.edu:9995/perfSONAR_PS/services/hLShttp://ipv6-annarbor-ofc.internet2.edu:9995/perfSONAR_PS/services/hLShttp://192.168.0.1:9995/perfSONAR_PS/services/hLS	
Network Diagnostic Tester (NDT)	Running
<ul style="list-style-type: none">tcp://npw.internet2.edu:3001http://npw.internet2.edu:7123tcp://ipv6-annarbor-ofc.internet2.edu:3001http://ipv6-annarbor-ofc.internet2.edu:7123tcp://192.168.0.1:3001	

Reverse Traceroute

pS-Performance Node

Host Information

Organization Name
Host Location
Administrator Name
Administrator Email

Communities This Host Participates In

Host Status

Primary Address	npw.internet2.edu
-----------------	-------------------

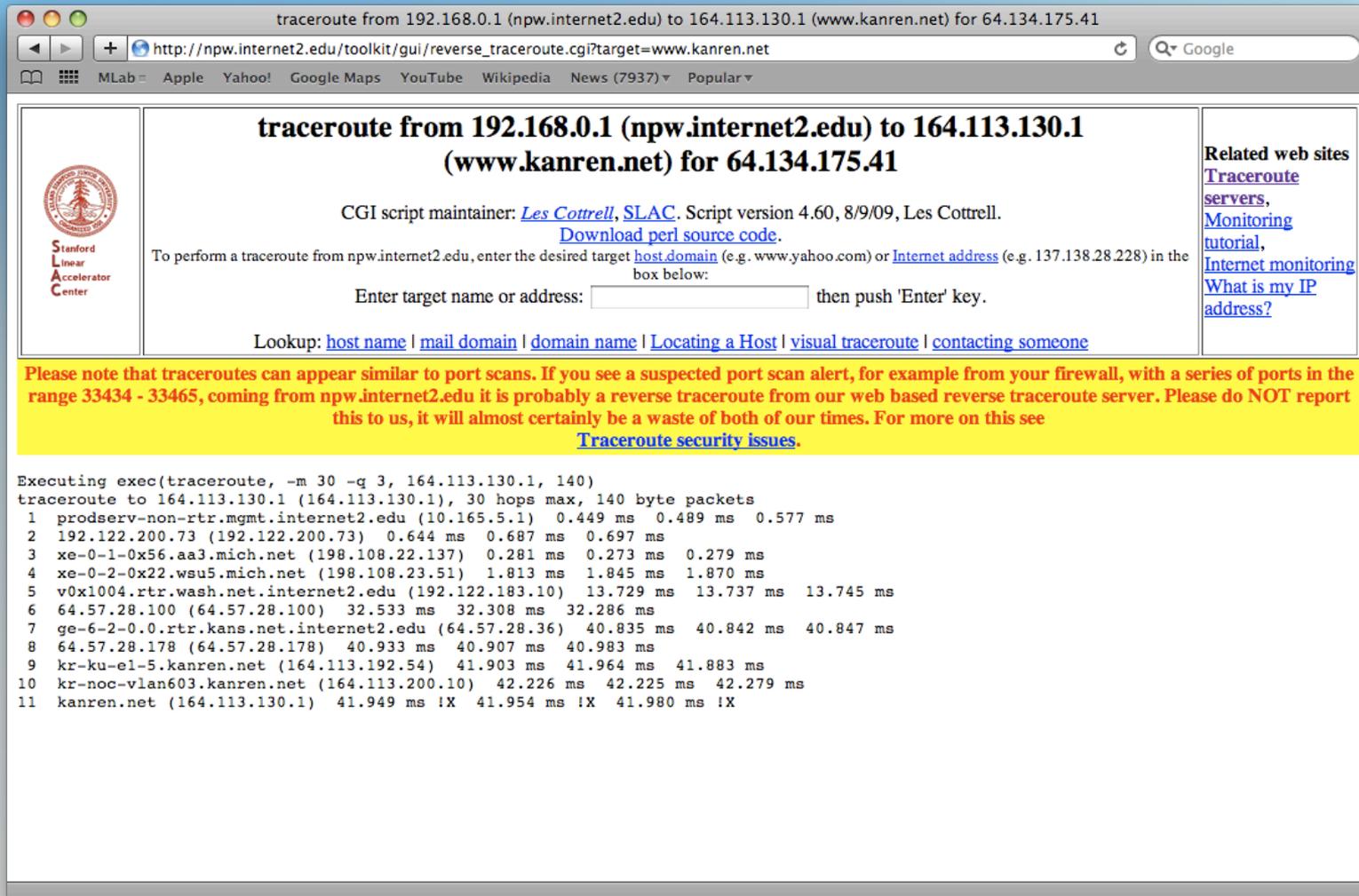
Services Offered

Bandwidth Test Controller (BWCTL) ^[1]	Running
<ul style="list-style-type: none">tcp://npw.internet2.edu:4823tcp://ipv6-annarbor-ofc.internet2.edu:4823tcp://192.168.0.1:4823	
Lookup Service ^[1]	Disabled
<ul style="list-style-type: none">http://npw.internet2.edu:9995/perfSONAR_PS/services/hLShttp://ipv6-annarbor-ofc.internet2.edu:9995/perfSONAR_PS/services/hLShttp://192.168.0.1:9995/perfSONAR_PS/services/hLS	
Network Diagnostic Tester (NDT) ^[1]	Running
<ul style="list-style-type: none">tcp://npw.internet2.edu:3001http://npw.internet2.edu:7123 ^[2]tcp://ipv6-annarbor-ofc.internet2.edu:3001http://ipv6-annarbor-ofc.internet2.edu:7123 ^[2]tcp://192.168.0.1:3001	

Reverse Traceroute Use Case

- Use in conjunction with regular traceroute:
 - Workstation -> Server via your terminal
 - Server -> Workstation via the web
- Detect asymmetric routes
- Cautionary notes:
 - Don't rely on traceroute for latency times (e.g. icmp and routers/switches)
 - Asymmetric routing by itself is not harmful, it's a way of life. If one of the routes has a performance problem then **it is** harmful.

Reverse Traceroute Results



tracertool from 192.168.0.1 (npw.internet2.edu) to 164.113.130.1 (www.kanren.net) for 64.134.175.41

http://npw.internet2.edu/toolkit/gui/reverse_traceroute.cgi?target=www.kanren.net

MLab = Apple Yahoo! Google Maps YouTube Wikipedia News (7937) Popular ▾



Stanford
Linear
Accelerator
Center

traceroute from 192.168.0.1 (npw.internet2.edu) to 164.113.130.1 (www.kanren.net) for 64.134.175.41

CGI script maintainer: [Les Cottrell, SLAC](#). Script version 4.60, 8/9/09, Les Cottrell.
[Download perl source code.](#)

To perform a traceroute from npw.internet2.edu, enter the desired target [host.domain](#) (e.g. www.yahoo.com) or [Internet address](#) (e.g. 137.138.28.228) in the box below:

Enter target name or address: then push 'Enter' key.

Lookup: [host name](#) | [mail domain](#) | [domain name](#) | [Locating a Host](#) | [visual traceroute](#) | [contacting someone](#)

Please note that traceroutes can appear similar to port scans. If you see a suspected port scan alert, for example from your firewall, with a series of ports in the range 33434 - 33465, coming from npw.internet2.edu it is probably a reverse traceroute from our web based reverse traceroute server. Please do NOT report this to us, it will almost certainly be a waste of both of our times. For more on this see [Traceroute security issues.](#)

```
Executing exec(traceroute, -m 30 -q 3, 164.113.130.1, 140)
traceroute to 164.113.130.1 (164.113.130.1), 30 hops max, 140 byte packets
 1 prodserv-non-rtr.mgmt.internet2.edu (10.165.5.1)  0.449 ms  0.489 ms  0.577 ms
 2 192.122.200.73 (192.122.200.73)  0.644 ms  0.687 ms  0.697 ms
 3 xe-0-1-0x56.aa3.mich.net (198.108.22.137)  0.281 ms  0.273 ms  0.279 ms
 4 xe-0-2-0x22.wsu5.mich.net (198.108.23.51)  1.813 ms  1.845 ms  1.870 ms
 5 v0x1004.rtr.wash.net.internet2.edu (192.122.183.10)  13.729 ms  13.737 ms  13.745 ms
 6 64.57.28.100 (64.57.28.100)  32.533 ms  32.308 ms  32.286 ms
 7 ge-6-2-0.0.rtr.kans.net.internet2.edu (64.57.28.36)  40.835 ms  40.842 ms  40.847 ms
 8 64.57.28.178 (64.57.28.178)  40.933 ms  40.907 ms  40.983 ms
 9 kr-ku-e1-5.kanren.net (164.113.192.54)  41.903 ms  41.964 ms  41.883 ms
10 kr-noc-vlan603.kanren.net (164.113.200.10)  42.226 ms  42.225 ms  42.279 ms
11 kanren.net (164.113.130.1)  41.949 ms !X  41.954 ms !X  41.980 ms !X
```

Related web sites
[Traceroute servers,](#)
[Monitoring tutorial,](#)
[Internet monitoring](#)
[What is my IP address?](#)



INTERNET

NDT Tests

The screenshot shows a web browser window titled "pS-Performance Node - pS-Performance Node" with the URL "http://npw.internet2.edu/toolkit/". The page displays the "pS-Performance Node" configuration page. On the left is a navigation menu with sections: "User Tools" (Local Performance Services, Global Performance Services, Java OWAMP Client, Reverse Traceroute, Reverse Ping), "Service Graphs" (Throughput, One-Way Latency, Head Ping Latency, Red PC Ping Latency, Green PC Ping Latency, Blue PC Ping Latency, SNMP Utilization, Cacti Graphs), and "Performance Toolkit" (Configuration Help, Frequently Asked Questions, About, Credits). The main content area is titled "pS-Performance Node" and contains several sections: "Host Information" (Organization Name, Host Location, Administrator Name, Administrator Email), "Communities This Host Participates In", "Host Status" (Primary Address: npw.internet2.edu), "Services Offered" (Bandwidth Test Controller (BWCTL) Running, Lookup Service Disabled, Network Diagnostic Tester (NDT) Running), and "Network Diagnostic Tester (NDT)" (Running). The NDT section lists several test endpoints, with the URL "http://npw.internet2.edu:7123" circled in red. The footer of the page includes the "perfsONAR powered" logo.

Host Information	
Organization Name	
Host Location	
Administrator Name	
Administrator Email	

Host Status	
Primary Address	npw.internet2.edu

Services Offered	
Bandwidth Test Controller (BWCTL)	Running
<ul style="list-style-type: none">tcp://npw.internet2.edu:4823tcp://ipv6-annarbor-ofc.internet2.edu:4823tcp://192.168.0.1:4823	
Lookup Service	Disabled
<ul style="list-style-type: none">http://npw.internet2.edu:9995/perfSONAR_PS/services/hLShttp://ipv6-annarbor-ofc.internet2.edu:9995/perfSONAR_PS/services/hLShttp://192.168.0.1:9995/perfSONAR_PS/services/hLS	
Network Diagnostic Tester (NDT)	Running
<ul style="list-style-type: none">tcp://npw.internet2.edu:3001http://npw.internet2.edu:7123tcp://ipv6-annarbor-ofc.internet2.edu:3001http://ipv6-annarbor-ofc.internet2.edu:7123tcp://192.168.0.1:3001	

NDT = Network Diagnostic Tool

- Perfect for the end user to run from their laptop
 - Convince your campus users to test to this, instead of 'speedtest.net, or FCC'. Install one on **every** campus
 - Runs client to server and reverse
 - Detects common problems
- Caveats
 - NDT heuristics are a little dated (e.g. may tell you your connection is a 'T1' or similar). These are not that important though
 - Detects common problems like queueing, loss, duplication, SACKs, duplicate ACKs. Won't tell you 'where' these are happening, so note it's end to end.
 - Uses the Web100 patched kernel on the server end. If this is disabled for any reason (e.g. initial release perfSONAR update or security update that installs a new kernel), NDT will not work.

NDT Home Screen

NDT server

http://npw.internet2.edu:7123/

Google

pS-Performance Node - pS-Perfo... NDT server

Web100 based Network Diagnostic Tool (NDT)

This java applet was developed to test the reliability and operational status of your desktop computer and network connection. It does this by sending data between your computer and this remote NDT server. These tests will determine:

- The slowest link in the end-to-end path (Dial-up modem to 10 Gbps Ethernet/OC-192)
- The Ethernet duplex setting (full or half);
- If congestion is limiting end-to-end throughput.

It can also identify 2 serious error conditions:

- Duplex Mismatch
- Excessive packet loss due to faulty cables.

A test takes about 20 seconds. Click on "start" to begin.

TCP/Web100 Network Diagnostic Tool v5.5.4a
click START to begin

START Statistics More Details... Report Problem Options

Applet Tcpbw100 started

NPAD Home

The screenshot shows a web browser window titled "pS-Performance Node - pS-Performance Node" with the URL "http://npw.internet2.edu/toolkit/gui/services/". The page displays a list of services and their status:

Service Name	Status
Head Ping Latency	
Red PC Ping Latency	
Green PC Ping Latency	
Blue PC Ping Latency	
SNMP Utilization	
Cacti Graphs	
Performance Toolkit	
Configuration Help	
Frequently Asked Questions	
About	
Credits	
perfSONAR powered	
tcp://npw.internet2.edu:4823 tcp://ipv6-annarbor-ofc.internet2.edu:4823 tcp://192.168.0.1:4823	
Lookup Service	Disabled
http://npw.internet2.edu:9995/perfSONAR_PS/services/hLS http://ipv6-annarbor-ofc.internet2.edu:9995/perfSONAR_PS/services/hLS http://192.168.0.1:9995/perfSONAR_PS/services/hLS	
Network Diagnostic Tester (NDT)	Running
tcp://npw.internet2.edu:3001 http://npw.internet2.edu:7123 tcp://ipv6-annarbor-ofc.internet2.edu:3001 http://ipv6-annarbor-ofc.internet2.edu:7123 tcp://192.168.0.1:3001 http://192.168.0.1:7123	
Network Path and Application Diagnosis (NPAD)	Running
tcp://npw.internet2.edu:8100 http://npw.internet2.edu:8000 tcp://ipv6-annarbor-ofc.internet2.edu:8100 http://ipv6-annarbor-ofc.internet2.edu:8000 tcp://192.168.0.1:8100 http://192.168.0.1:8000	
One-Way Ping Service (OWAMP)	Running
tcp://npw.internet2.edu:861 tcp://ipv6-annarbor-ofc.internet2.edu:861 tcp://192.168.0.1:861	
perfSONAR-BUOY Regular Testing (Throughput)	Running

The "Network Path and Application Diagnosis (NPAD)" service and its associated URLs are circled in red in the original image.

NPAD = Network Path Diagnostics

- Similar to NDT, but spits out a lot more
 - Tries to “simulate” network use based on current conditions.
 - E.g. expectations are a latency and a speed, will tell you if this is or is not possible
- Also relies on Web100, same caveats apply
- “Mom Feature” ... you can retrieve the HTML results from past tests. Users can mail these in trouble ticket reports or network engineers can access the results directly on the server.

NPAD Start – Pick some Expectations

The screenshot shows a web browser window titled "NPAD Diagnostics" with the URL "http://npw.internet2.edu:8000/". The page content includes:

- Instructions for a closer server from the list of [Current NPAD Diagnostic Servers](#).
- Have an end-to-end application performance goal ([target round-trip time](#) and [target data rate](#)) in mind. Enter the parameters on the form below and click **Start Test**. Messages will appear in the log window as the test runs, followed by a diagnostic report.
- In the diagnostic report, failed tests (in red) indicate problems that will prevent the application from meeting the end-to-end performance goal. For each message, a question-mark link ([\(?\)](#)) leads to additional detailed information about the results.
- Every test is fully logged (including your IP address) and test results are [public](#). We use the logs and results to further refine the software.

For more information, see the [NPAD Documentation](#), especially the sections:

- [NPAD Diagnostic Procedure](#) - the full instructions.
- [Theory and Method](#) - why the the tests work.
- [Outcomes](#) - what to do next in the broader debugging context.

Note that tests take 2-5 minutes, depending on the parameters that you provide and the network path. If there is a queue, waiting times might be long.

Test from server npw.internet2.edu to this machine

Round Trip Time (msec):

Target Rate (Mbps):

Log:

Command line client

If the Java applet above exhibits errors or the form is blank, try the command line diagnostic client.

Applet DiagClient started

NPAD Results

Test Results

http://npw.internet2.edu:8000/ServerData/Reports-2011-04/64.134.175.41:2011-04-05-12:46:01.html

MLab = Apple Yahoo! Google Maps YouTube Wikipedia News (7937) Popular

pS-Performance Node - pS-Perfo... NDT server Test Results

Test conditions

Tester: npw.internet2.edu (207.75.164.109) [?]
Target: 64.134.175.41 (64.134.175.41) [?]
Logfile base name: 64.134.175.41:2011-04-05-12:46:01 [?]
This report is based on a 5 Mb/s target application data rate [?]
This report is based on a 30 ms Round-Trip-Time (RTT) to the target application [?]
The Round Trip Time for this path section is 24.000000 ms.
The Maximum Segment Size for this path section is 1344 Bytes. [?]

Target host TCP configuration test: Pass! [?]

TCP negotiated appropriate options: WSCALE=3, SACKok, and Timestamps. [?]
The target passed all tests! See tester caveats: [?]

Path measurements [?]

The path to the tester is too long for accurate measurements.
> **Test a shorter path section or reduce the target data rate and/or RTT.** [?]

Data rate test: Fail! [?]

The maximum data rate was 1.729524 Mb/s. [?]
This is below the target rate (5.000000 Mb/s). [?]
This test did not complete due to other problems with the path, target or tester.
> **Correct other problems first, and then rerun this test.** [?]

Loss rate test: Pass! [?]

Pass: zero losses in 2847 packets, loss rate less than 0.035125%. [?]
FYI: To get 5 Mb/s with a 1344 byte MSS on a 30 ms path the total end-to-end loss budget is 0.251889% (397 packets between losses). [?]

Suggestions for alternate tests

FYI: This path may pass with a less strenuous application: [?]
Try rate=1 Mb/s, rtt=232 ms
Or if you can raise the MTU: [?]
Try rate=1 Mb/s, rtt=1554 ms, mtu=9000 bytes

Network buffering test: Pass! [?]

Cacti

performance
ps
toolkit

User Tools

- Local Performance Services
- Global Performance Services
- Java OWAMP Client
- Reverse Traceroute
- Reverse Ping

Service Graphs

- Throughput
- One-Way Latency
- WSU Ping Latency
- KSU Ping Latency
- KU Ping Latency
- 1102 Grand Ping Latency
- OWAMP Jitter
- Cacti Graphs**

Toolkit Administration

- Administrative Information
- External BWCTL Limits
- External OWAMP Limits
- Enabled Services
- NTP
- Scheduled Tests

pS-Performance Node For KanREN In 1102 Grand, Kansas City

Host Information

Organization Name	KanREN
Host Location	1102 Grand, Kansas City
Administrator Name	KanREN NOC
Administrator Email	noc@kanren.net

Communities This Host Participates In

KanREN

Host Status

Primary Address	ps-data.kanren.net
-----------------	--------------------

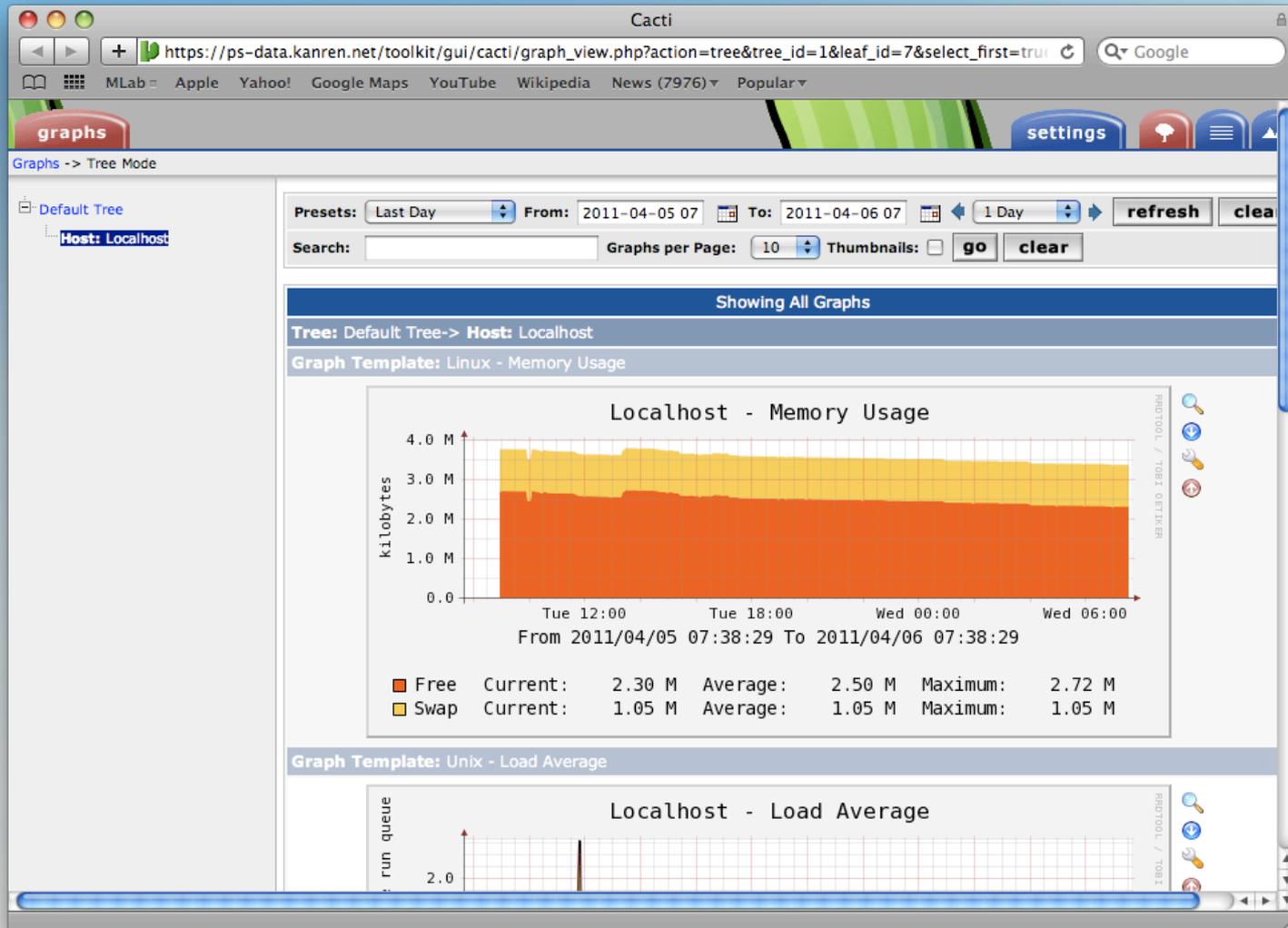
Services Offered

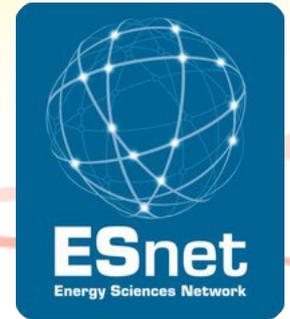
Bandwidth Test Controller (BWCTL)	Disabled
<ul style="list-style-type: none">tcp://ps-data.kanren.net:4823	
Lookup Service	Running
<ul style="list-style-type: none">http://ps-data.kanren.net:9995/perfSONAR_PS/services/hLS	
Network Diagnostic Tester (NDT)	Disabled
<ul style="list-style-type: none">tcp://ps-data.kanren.net:3001http://ps-data.kanren.net:7123	
Network Path and Application Diagnosis (NPAD)	Disabled
<ul style="list-style-type: none">tcp://ps-data.kanren.net:8100	

Using Cacti

- Currently only monitoring the localhost
 - Memory/cpu things
 - Plans to add NTP monitoring as well as some more advanced localhost things (process breakdown, etc.)
- Can be used for SNMP monitoring if desired
 - Note the poll is defaulted to about 5 minutes

Cacti Display





Interpretation of Measurements from Remote Hosts

November 18th 2013, SC13 Network Performance Tutorial
Jason Zurawski – Internet2/ESnet

For more information, visit <http://www.internet2.edu/workshops/npw>

