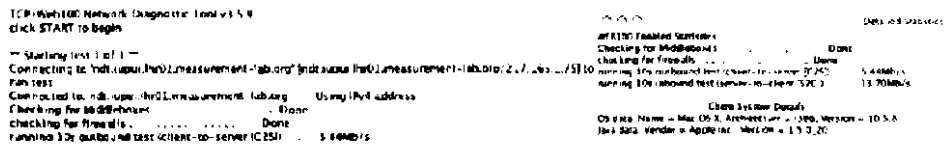
NDT

- Advanced Network Diagnostic Tool
- Report measured upload & download speeds
- Determine what problems are limiting speed i.e. client computer, home network, provider network, or testing server
- Identify if the network connection is behind a NAT
- Detect Firewall and possible end-to-end network settings

http://e2epi.internet2.edu/ndt

User Results



User Results

TCP/Web100 Network Diagnostic Tool v3.5.9
click START to begin

** Starting test 1 of 1 **
Connecting to 'ndt.iupui.lhr01.measurement-lab.org' [ndt.iupui.lhr01.measurement-lab.org/217.163.1.75] to
run test
Connected to. ndt.iupui.lhr01.measurement-lab.org -- Using IPv4 address
Checking for Middleboxes . . . . . Done
checking for firewalls . . . . . Done
running 10s outbound test (client-to-server [C2S]) 5.44Mb/s
running 10s inbound test (server-to-client [S2C]) 13.70Mb/s
The slowest link in the end-to-end path is a 10 Mbps Ethernet subnet
Information. Other network traffic is congesting the link

click START to re-test

START | Statistics | More Details... | Report Problem | Options

minCWNDpeak: 116864
maxCWNDpeak: 1047552
CWNDpeaks: 1

The theoretical network limit is 4.98 Mbps
The NDT server has a 1095.0 KByte buffer which limits the throughput to 70.68 Mbps
Your PC/Workstation has a 7280.0 KByte buffer which limits the throughput to 234.86 Mbp
The network based flow control limits the throughput to 33.00 Mbps

Client Data reports link is 'Ethernet', Client Acks report link is 'Ethernet'
Server Data reports link is 'OC-48', Server Acks report link is 'T3'

Detailed Statistics

WEB100 Enabled Statistics:
Checking for Middleboxes . . . . . Done
checking for firewalls . . . . . Done
running 10s outbound test (client-to-server [C2S]) 5.44Mb/s
running 10s inbound test (server-to-client [S2C]) 13.70Mb/s

------ Client System Details ------
OS data: Name = Mac OS X, Architecture = i386, Version = 10.5.8
Java data Vendor = Apple Inc., Version = 1.5.0_20

------ Web100 Detailed Analysis ------
10 Mbps Ethernet link found.
Link set to Full Duplex mode
Information. throughput is limited by other network traffic.
Good network cable(s) found
Normal duplex operation found.

Web100 reports the Round trip time = 242.17 msec, the Packet size = 1408 Bytes, and
There were 89 packets retransmitted, 974 duplicate acks received, and 1033 SACK blocks rece
The connection was idle 0 seconds (0%) of the time
S2C throughput test. Packet queuing detected: 4.47%
This connection is network limited 98.66% of the time.

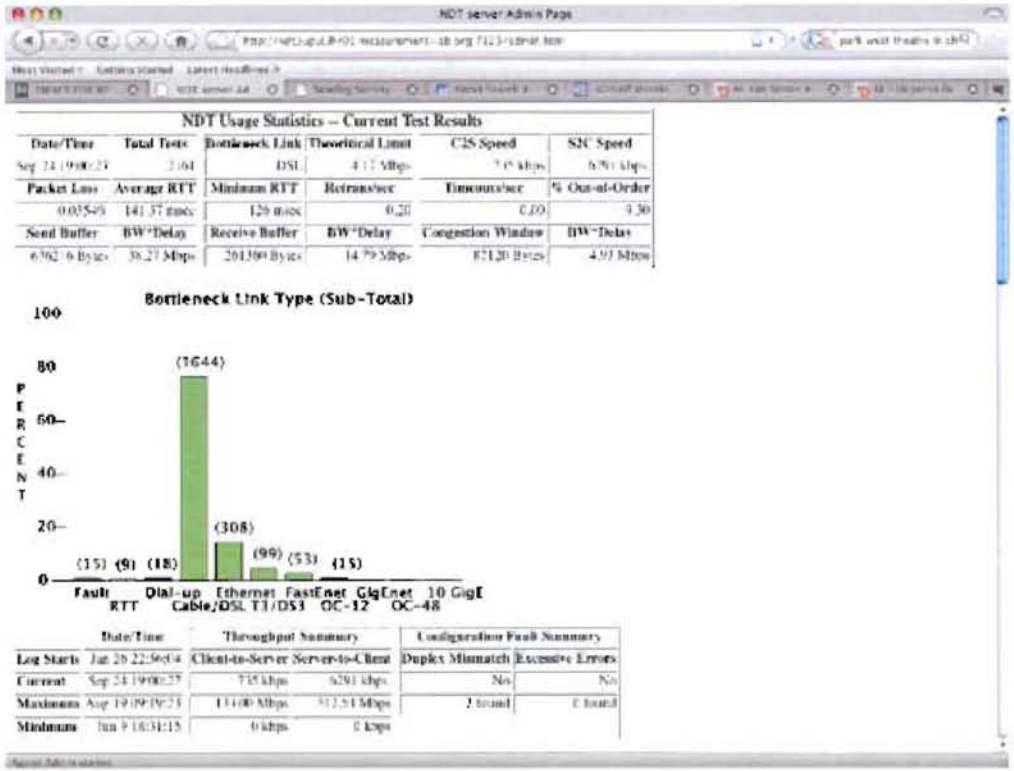
Web100 reports TCP negotiated the optional Performance Settings to.
RFC 2018 Selective Acknowledgment: ON
RFC 896 Nagle Algorithm ON
RFC 3168 Explicit Congestion Notification. OFF
RFC 1323 Time Stamping. ON
RFC 1323 Window Scaling. ON; Scaling Factors - Server=8, Client=10

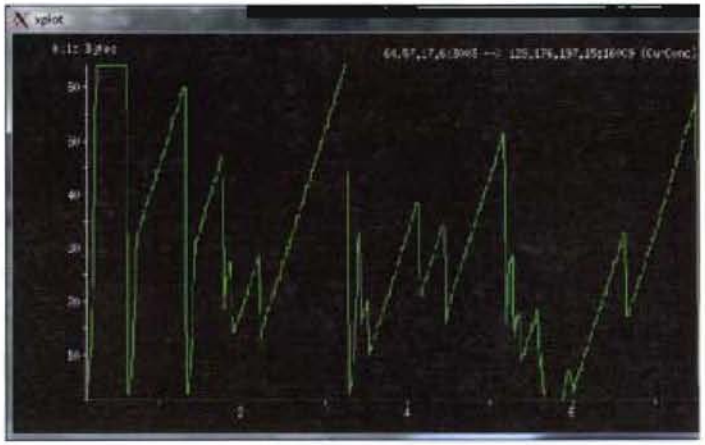
Server 'ndt.iupui.lhr01.measurement-lab.org' is not behind a firewall. [Connection to the epher
Client is probably behind a firewall. [Connection to the ephemeral port failed]
Information. Network Middlebox is modifying MSS variable
Server IP addresses are preserved End-to-End
Information: Network Address Translation (NAT) box is modifying the Client's IP address
Server says [76.16.0.76] but Client says [192.168.1.26]

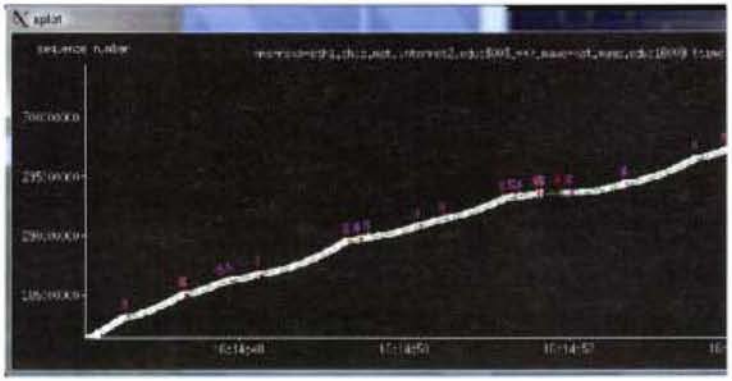
Close | Copy

Client Data reports link is 'Ethernet', Client Acks report link is 'Ethernet'
Server Data reports link is 'OC-48', Server Acks report link is 'T3'

Researcher Results





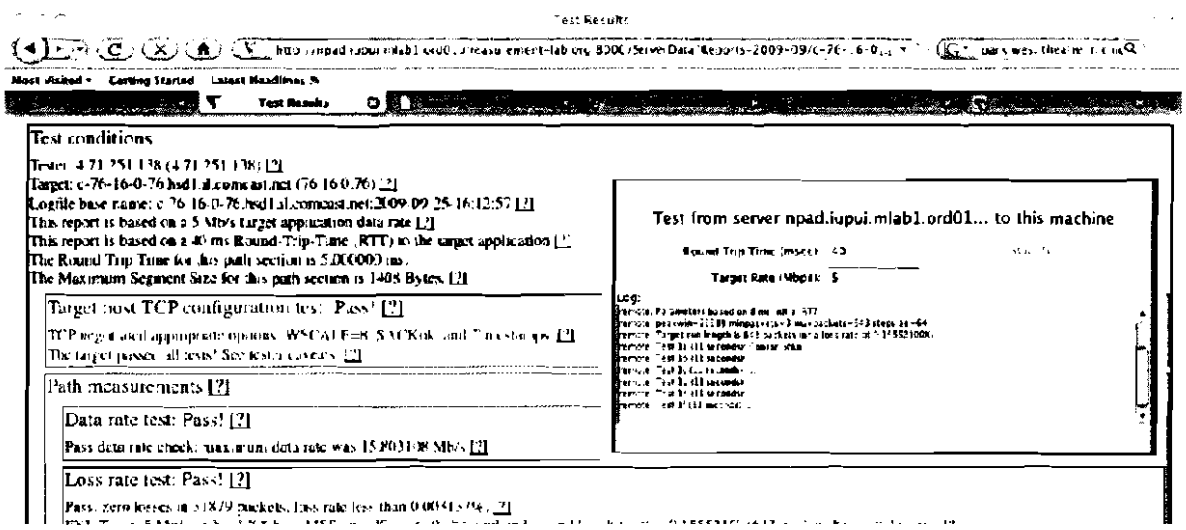


NPAD

Advanced Diagnostic tester

- Analyze host configuration and network path
- Identify if routers/switches would impact WAN performance
- Web-based output simplifies problem reporting

http://www.psc.edu/networking/projects/pathdiag/



Test Results

http://npad.iupui.mlab1.ord01.measurement-lab.org:8000/ServerData/Reports-2009-09/c-76-16-0 ... park west theatre in cl

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Test Results

Test conditions

Tester: 4.71.251.138 (4.71.251.138) [?]
Target: c-76-16-0-76.hsd1.il.comcast.net (76.16.0.76) [?]
Logfile base name: c-76-16-0-76.hsd1.il.comcast.net:2009-09-25-16:12:57 [?]
This report is based on a 5 Mb/s target application data rate [?]
This report is based on a 40 ms Round-Trip-Time (RTT) to the target application [?]
The Round Trip Time for this path section is 5.000000 ms.
The Maximum Segment Size for this path section is 1408 Bytes. [?]

Test from server npad.iupui.mlab1.ord01... to this machine

Round Trip Time (msec): 40

Target Rate (Mbps): 5

Log
remote: Parameters based on 8 ms initial RTT
remote: peakwin=25589 minpackets=3 maxpackets=643 stepsize=64
remote: Target run length is 643 packets (or a loss rate of 0.15552100%)
remote: Test 1a (11 seconds): Coarse Scan
remote: Test 1b (11 seconds):
remote: Test 1c (11 seconds): ...
remote: Test 1d (11 seconds):
remote: Test 1e (11 seconds): .
remote: Test 1f (11 seconds): ...

Target host TCP configuration test: Pass! [?]

TCP negotiated appropriate options: WSCALE=8, SACKok, and Timestamps [?]
The target passed all tests! See tester caveats: [?]

Path measurements [?]

Data rate test: Pass! [?]

Pass data rate check: maximum data rate was 15.803108 Mb/s [?]

Loss rate test: Pass! [?]

Pass: zero losses in 31879 packets, loss rate less than 0.00313796 . [?]
FYI: To get 5 Mb/s with a 1408 byte MSS on a 40 ms path the total end-to-end loss budget is 0.15552159 (643 packets between losses). [?]

Suggestions for alternate tests

FYI: This path may even pass with a more strenuous application: [?]
Try rate=5 Mb/s, rtt=281 ms
Try rate=15 Mb/s, rtt=89 ms
Or if you can raise the MTU: [?]
Try rate=5 Mb/s, rtt=1799 ms, mtu=9000 bytes
Try rate=15 Mb/s, rtt=569 ms, mtu=9000 bytes

Network buffering test: Pass! [?]

Pass: The network bottleneck has sufficient buffering (queue space) in routers and switches. [?]
Measured queue size, Pkts: 116 Bytes: 163328 [?]
This corresponds to a 105.755461 ms drain time. [?]
To get 5 Mb/s with on a 40 ms path, you need 25000 bytes of buffer space. [?]

The network path passed all tests! [?]

Tester validation: Pass! [?]

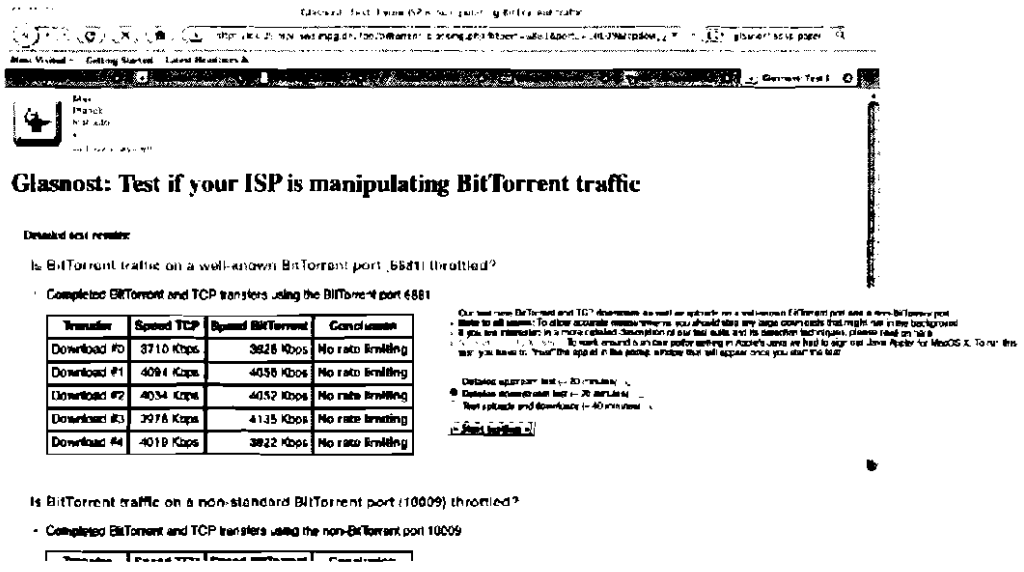
No internal tester problems were detected.
Tester version: 5ld pathdiag.py,v 1.47 2009/06/10 21:19:57 mathis Exp $

[Data_Rate_gnuplot] [RTT_gnuplot] [Loss_Rate_gnuplot] [power_gnuplot]
[tabular data]

Glasnost

Determine if an ISP is blocking email, HTTP or SSH transfer, Flash video, and P2P apps including BitTorrent, eMule and Gnutella.

http://broadband.mpi-sws.org/transparency/bttest-mlab.php



Glasnost: Test if your ISP is manipulating BitTorrent traffic

Is BitTorrent traffic on a well-known BitTorrent port (6881) throttled?

- Completed BitTorrent and TCP transfers using the BitTorrent port 6881

Transfer	Speed TCP	Speed BitTorrent	Conclusion
Download #0	3710 Kbps	3828 Kbps	No rate limiting
Download #1	4094 Kbps	4056 Kbps	No rate limiting
Download #2	4034 Kbps	4052 Kbps	No rate limiting
Download #3	3978 Kbps	4135 Kbps	No rate limiting
Download #4	4019 Kbps	3822 Kbps	No rate limiting

Is BitTorrent traffic on a non-standard BitTorrent port (10009) throttled?

- Completed BitTorrent and TCP transfers using the non-BitTorrent port 10009

Glasnost: Test if your ISP is manipulating BitTorrent traffic

http://loki09.mpi-sws.mpg.de//bb/bittorrent-blocking.php?btport=6881&port2=10009&tcpdov

glasnost sosp paper

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Glasnost: Test i

Max Planck Institute for Software Systems

Glasnost: Test if your ISP is manipulating BitTorrent traffic

Detailed test results:

Is BitTorrent traffic on a well-known BitTorrent port (6881) throttled?

- Completed BitTorrent and TCP transfers using the BitTorrent port 6881:

Transfer	Speed TCP	Speed BitTorrent	Conclusion
Download #0	3710 Kbps	3928 Kbps	No rate limiting
Download #1	4094 Kbps	4056 Kbps	No rate limiting
Download #2	4054 Kbps	4052 Kbps	No rate limiting
Download #3	3978 Kbps	4135 Kbps	No rate limiting
Download #4	4019 Kbps	3922 Kbps	No rate limiting

- Our test runs BitTorrent and TCP downloads as well as uploads on a well-known BitTorrent port and a non-BitTorrent port.
- **Note to all users:** To allow accurate measurements you should stop any large downloads that might run in the background.
- If you are interested in a more detailed description of our test suite and its detection techniques, please read on here.
- To work around a unique policy setting in Apple's Java we had to sign our Java Applet for MacOS X. To n test, you have to *"trust"* the applet in the pop-up window that will appear once you start the test.

- Detailed upstream test (~ 20 minutes)
- Detailed downstream test (~ 20 minutes)
- Test uploads and downloads (~ 40 minutes)

» Start testing «

Is BitTorrent traffic on a non-standard BitTorrent port (10009) throttled?

- Completed BitTorrent and TCP transfers using the non-BitTorrent port 10009:

Transfer	Speed TCP	Speed BitTorrent	Conclusion
Download #0	4221 Kbps	3996 Kbps	No rate limiting
Download #1	3191 Kbps	4439 Kbps	No rate limiting
Download #2	4122 Kbps	4089 Kbps	No rate limiting
Download #3	3957 Kbps	4217 Kbps	No rate limiting
Download #4	4279 Kbps	4415 Kbps	No rate limiting

Pathload2

Measures available bandwidth

- Reports "Raw" bps capacity independent of transport or application protocol

http://www.cc.gatech.edu/fac/Constantinos.Dovrolis/Papers/NetDov0248.pdf

```
Terminal — 92×38
Last login: Fri Sep 18 12:45:15 on ttys002
/Users/rcarlson/bin/pathload2 ; exit;
nereid-2:~ rcarlson$ /Users/rcarlson/bin/pathload2 ; exit;
Connecting to selected M-lab server.
Connected to MLab Server: 38.102.0.87
Measuring Upstream Available Bandwidth
Sending fleet 0, Probing Rate 6.56 Mbps ###########
Sending fleet 1, Probing Rate 9.84 Mbps ###########
Sending fleet 2, Probing Rate 8.21 Mbps ###########
Sending fleet 3, Probing Rate 7.39 Mbps ###########
Sending fleet 4, Probing Rate 6.97 Mbps ###########
Sending fleet 5, Probing Rate 7.17 Mbps ###########
Sending fleet 6, Probing Rate 3.28 Mbps ###########

Measuring Downstream Available Bandwidth
Receiving Fleet 0, Probing Rate 16.29Mbps ###########
Receiving Fleet 1, Probing Rate 8.29Mbps ###########
Receiving Fleet 2, Probing Rate 12.41Mbps ###########
Receiving Fleet 3, Probing Rate 14.48Mbps ###########
Receiving Fleet 4, Probing Rate 15.59Mbps ##
```

Terminal — 92×38

```
Last login: Fri Sep 18 12:45:15 on ttys002
/Users/rcarlson/bin/pathload2 ; exit;
nereid-2:~ rcarlson$ /Users/rcarlson/bin/pathload2 ; exit;
Connecting to selected M-lab server.
Connected to MLab Server: 38.102.0.87
Measuring Upstream Available Bandwidth
Sending fleet 0, Probing Rate 6.56 Mbps ###########
Sending fleet 1, Probing Rate 9.84 Mbps ###########
Sending fleet 2, Probing Rate 8.21 Mbps ###########
Sending fleet 3, Probing Rate 7.39 Mbps ###########
Sending fleet 4, Probing Rate 6.97 Mbps ###########
Sending fleet 5, Probing Rate 7.17 Mbps ###########
Sending fleet 6, Probing Rate 3.28 Mbps ###########

Measuring Downstream Available Bandwidth
Receiving Fleet 0, Probing Rate 16.29Mbps ###########
Receiving Fleet 1, Probing Rate 8.29Mbps ###########
Receiving Fleet 2, Probing Rate 12.41Mbps ###########
Receiving Fleet 3, Probing Rate 14.48Mbps ###########
Receiving Fleet 4, Probing Rate 15.59Mbps ##
Receiving Fleet 5, Probing Rate 15.07Mbps ###########
Measurement completed.

        *****  RESULT *****
Upstream Measurement (towards the Internet)
Available bandwidth range : 3.28 - 7.38 (Mbps)
Measurement duration : 26.48 sec

Downstream Measurement (from the Internet)
Available bandwidth range : 15.28 - 15.59 (Mbps).
Measurement duration : 21.54 sec.

For more information about available bandwidth measurement,
please see: http://www.pathrate.org
logout

[Process completed]
```

Sidestream

- Collect TCP details (web100 variables) from regular web traffic on a client computer
- Collects information as a byproduct of general client network usage
- No special test stream required
- A way to evaluate, compare, and validate other active test results

http://www.measurementlab.net/news/2010/jan/19/side-stream-experiment

Windrider

Attempts to detect whether your mobile broadband provider is performing application or service specific differentiation, i.e. prioritizing or slowing traffic to certain websites, applications, or content.

http://www.cs.northwestern.edu/~ict992/mobile.htm

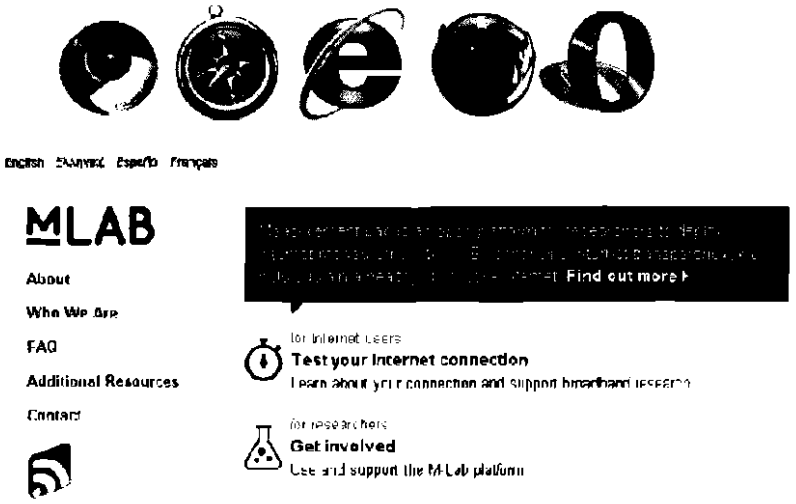
ShaperProbe

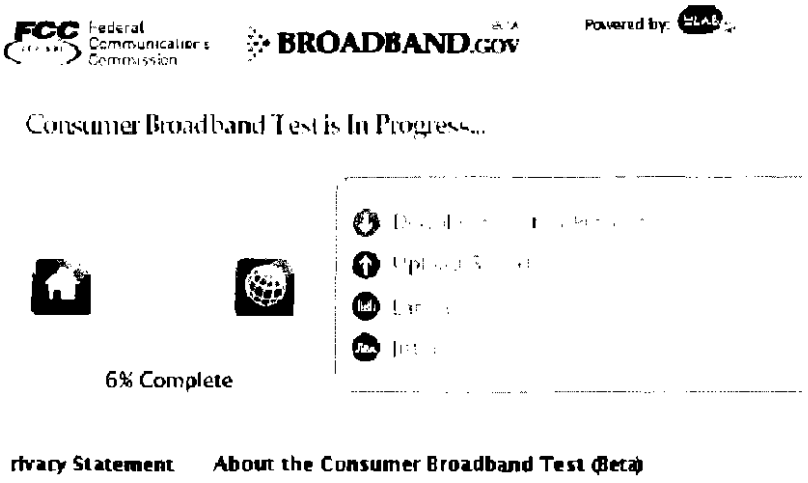
Detects whether your ISP performs "traffic shaping" in either the upload or download directions. In the even of shapping, ShaperProbe reports the shaping rate and the "maximum burst size" before shaping begins.

http://www.cc.gatech.edu/~partha/diffprobe/shaperprobe.html

Test Client Interfaces For Users

In Web Browser





Mobile Devices

Coming soon!

ions, or content.

ern.edu/~ict992/mobile.htm

M-Lab Hosted Tools

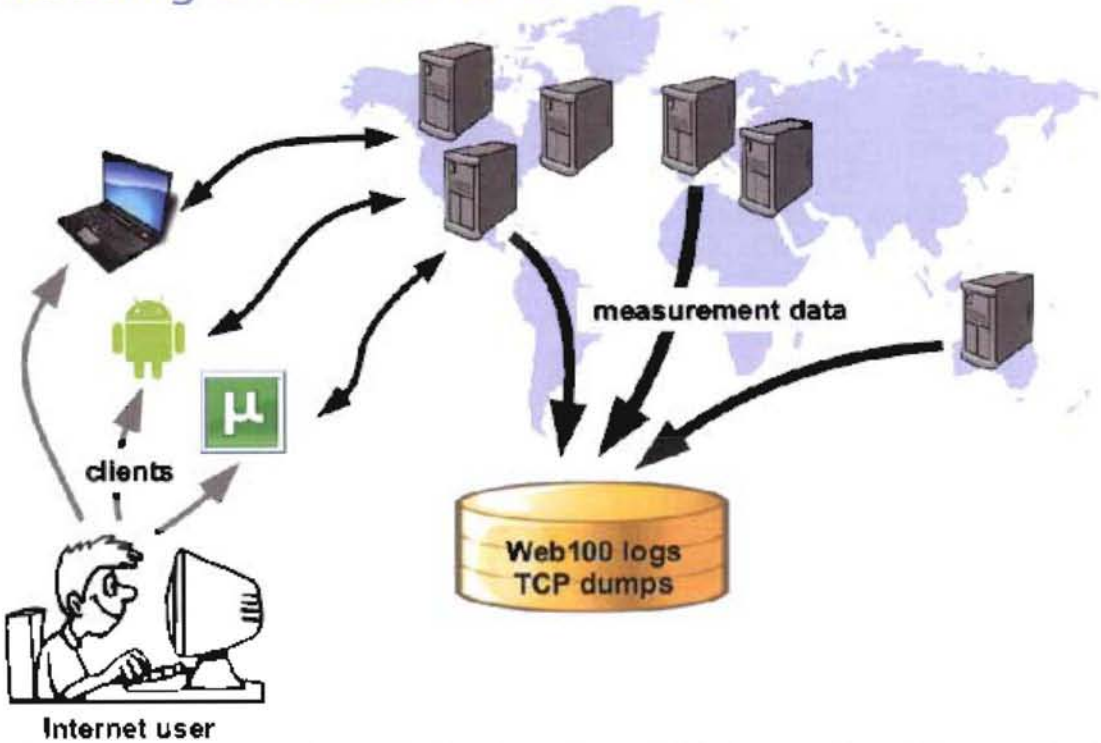
Enabling deep critcal data analysis with transparent and open source tools and methodologies

Open Data

All data collected through M-Lab is intended to be made publicly available and placed in the public domain either immediately or after an optional 1 year embargo

Collecting over 60TB of Data

Collecting over 60TB of Data



- Raw measurement data (web100 and TCPdump logs) is created when a user runs a tool hosted on M-Lab
- Raw data is stored locally on each M-Lab node
- Seperate data collecting servers regularly collect all raw data
- M-Lab tools consolidate raw data and re-format for 3rd party services
- Formated test records are pushed to Amazon's EC2 and Google BigQuery

http://measurementlab.org/news/2009/dec/10/calling-all-researchers-m-lab-data-now-available-amazon-ec2

http://www.measurementlab.org/news/2010/jun/18/more-good-thing-analyze-and-access-m-lab-data-using-google-bigquery-and-google-stor

Next?

We Need You!

- M-Lab depends on the contribution of se

We Need You!

- M-Lab depends on the contribution of servers and connectivity from academic and industrial partners
- Develop a unique tool that can run on the M-Lab platform
- Data storage partners
- Visualization/Infographic developers

A collaborative effort: we welcome suport from researchers, institutions, and companies that share M-Lab's goals

http://www.measurementlab.org/getinvolved

Measurement Lab (M-Lab)

http://www.measurementlab.org

Measurement Lab: Overview and an Invitation to the Research Community
C. Dovrolis, K. Gummadi, A. Kuzmanovic, S. D. Meinrath (June 2010)
http://ccr.sigcomm.org/online/files/p53-3v40n3m-dovrolisPS.pdf