The hitchhiker’s guide to the Network Neutrality Bot test methodology

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http://nexa.polito.it/

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Congresso AICA
The NEXA Center for Internet & society

- Academic research center, founded in 2006
- Multidisciplinary: technology, law, economics
- Co-directed by an engineering prof and a law prof
- Coordinator of two large EU funded projects on digital content (COMMUNIA) and Public Sector Information (LAPSI)
- Topics: Freedom of expression online, anonymity, web geography, creative commons, network neutrality, Internet governance, open data
- Partner of Harvard University and Keio Univ. (Tokio)
- More info: http://nexa.polito.it/
Network neutrality

- Internet is open and neutral
  - This is a value for our society
  - Extraordinary platform for distributed innovation
  - Level playing field for citizens, companies, ...
- Nowadays, fine-grained discrimination is possible
- How to protect NN?
  - Top-down: the Law (or other norms)
    - The recent Dutch example (Bits of Freedom)
  - Self-regulation
  - Bottom-up: giving power to the users
    - What kind of power? First of all, information
Related work: quality and neutrality

- **Active tools**
  - NDT [1]
  - Glasnost (Max Planck) [2]
  - NPAD [3]
  - Pathload2 [4]
  - ShaperProbe [5]
  - NetPolice [6]
  - Grenouille [7]
  - Speedtest.net [8]
  - BISMark [13]
  - Ne.Me.Sys. [14]
  - Netttart.no [15]

- **Passive tools**
  - NANO [9]
  - Weaver, Sommer and Paxson's paper [10]
  - Switzerland (EFF) [11]

- **Complementary**
  - **M-Lab**: Distributed server platform for active tools [12]
  - Respect My Net: the NN violations hub [16]
Neubot: Objective and Design

- **Objective**
  - perform distributed measurements, collect results, share raw results, publish analysis
  - Become a **client-side platform** for transmission tests

- **Design**
  - Neubot is an **active tool** and is a bot, hence runs tests automatically (but you can run tests on-demand)
  - Tests **emulate existing protocols** and Neubot measures “quality” during the test
  - Results are collected at a set of central servers and stored on a local database
Server architecture

- **Rendezvous**
  - Get *Test Server* address and test type from *Master Server*

- **Negotiate**
  - Wait for *Test Server* to be ready for a test and negotiate test parameters

- **Test**
  - Perform the test and measure “quality” metrics

- **Collect**
  - Share results with *Test Server*
Client architecture

- Daemon
- localhost

Viewer

Notifier

16 Novembre 2011

http://www.neubot.org/
HTTP test implementation

- A single TCP connection
- **Round-trip time**
  - Time required to connect()
  - Time required to “HEAD” a resource
- **Goodput**
  - Measure time $T$ required to GET/POST $K$ bytes
  - Calculate goodput $= \frac{K}{T}$
  - $K$ adapted so that next test would take $T=5$ seconds (under current conditions)
BitTorrent test implementation

• Similar to HTTP test
• Emulates a continuous transfer by **pipelining** an initial burst of requests and then sending one more request when a new piece is received
• The burst size is 1/3 of the target number of bytes to transfer
• Measurement starts after the first piece is received, assuming the pipeline to be full at that point
Discussion and caveats

Discussion

• SYN/ACK loss for “time to connect”
• RTT range for comparison
• Test duration (1 second vs. 5 second vs...)
• Number of connections
• Receive buffer

Caveats

• User activity
• Home connection sharing
• Lossy wireless home connection
• Congestion in the backbone
• Server-load
• ...
Turin-area data set
(http://www.neubot.org/data)

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<th>Whole dataset</th>
<th>Turin area</th>
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<tr>
<td>Number of Neubots</td>
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<td>30-05-2011</td>
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<tr>
<td>Last test</td>
<td>13-09-2011</td>
<td>13-09-2011</td>
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Cumulative request-response latency distribution

Frequency

Request-response latency [ms]

0.0  0.2  0.4  0.6  0.8  1.0

0  50  100  150  200  250  300  350  400

- AS30722 Vodafone N.V.
- AS1267 Infostrada S.p.A.
- AS12874 Fastweb SpA
Cumulative download goodput distribution

Frequency

Download goodput [Mbit/s]

- AS30722 Vodafone N.V.
- AS1267 Infostrada S.p.A.
- AS12874 Fastweb SpA
- AS3269 Telecom Italia S.p.A.
Cumulative upload goodput distribution

- AS30722 Vodafone N.V.
- AS1267 Infostrada S.p.A.
- AS12874 Fastweb SpA
Ongoing & future work

• Ongoing
  • Geo-scaling
    – Deploying to M-Lab
    – Will switch to DONAR?
  • Skype?
  • Deeper data analysis

• Future
  • Peer to peer tests
    – Neubot will behave like a test server
    – More groundwork is needed
Thank you!

http://www.neubot.org/
(also on Facebook & Twitter)
http://nexa.polito.it/
References