The network neutrality bot architecture: a preliminary approach for self-monitoring of Internet access QoS

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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
- 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
  - Self-regulation
  - **Bottom-up**: giving power to the users
    - What kind of power? First of all, **information**

Related work

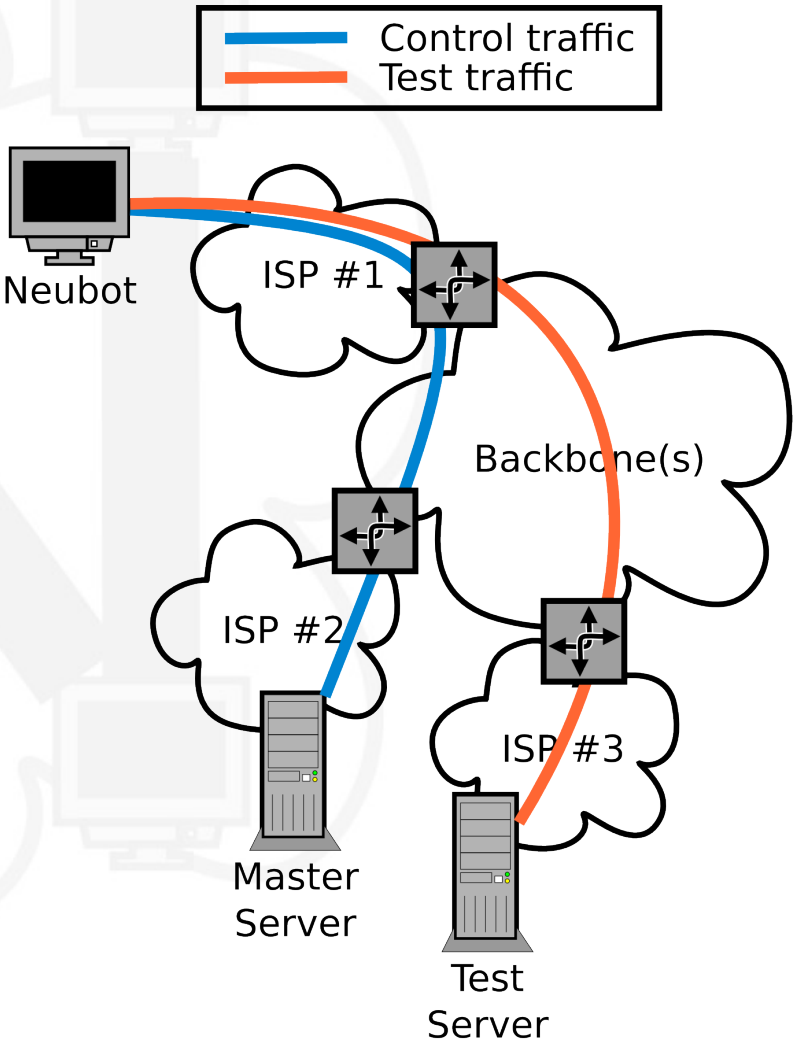
- Active tools
  - NDT [1]
  - Glasnost (Max Planck) [2]
  - NPAD [3]
  - Pathload2 [4]
  - ShaperProbe [5]
  - NetPolice [6]
  - Grenouille [7]
  - Speedtest.net [8]
  - BISMark [13]
  - Ne.Me.Sys. [14]
  - Nettfart.no [15]
- Passive tools
  - NANO [9]
  - Weaver, Sommer and Paxson's paper [10]
  - Switzerland (EFF) [11]
- Other approaches
  - **M-Lab**: Distributed server platform for active tools [12]

Neubot: Objective and Design

- Objective
  - perform distributed measurements, collect results, **share** raw results, **publish** analysis
- 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

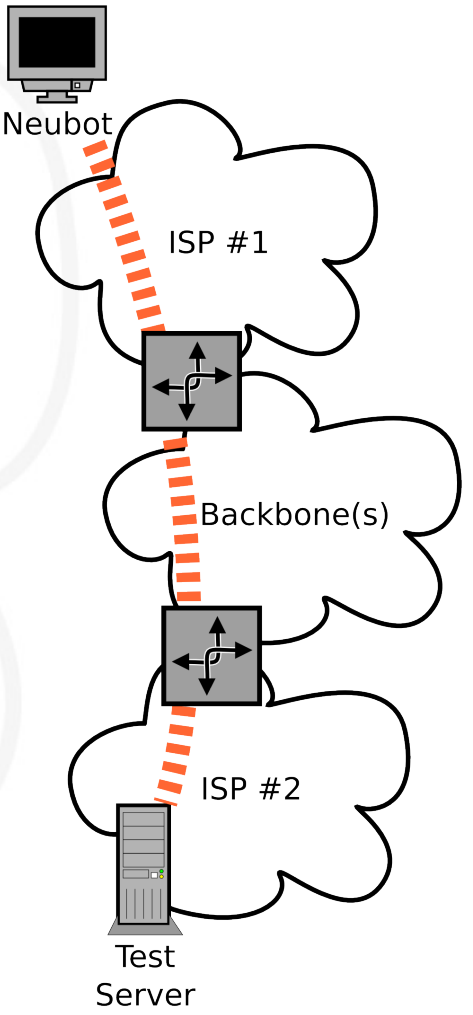
Architecture

- **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*



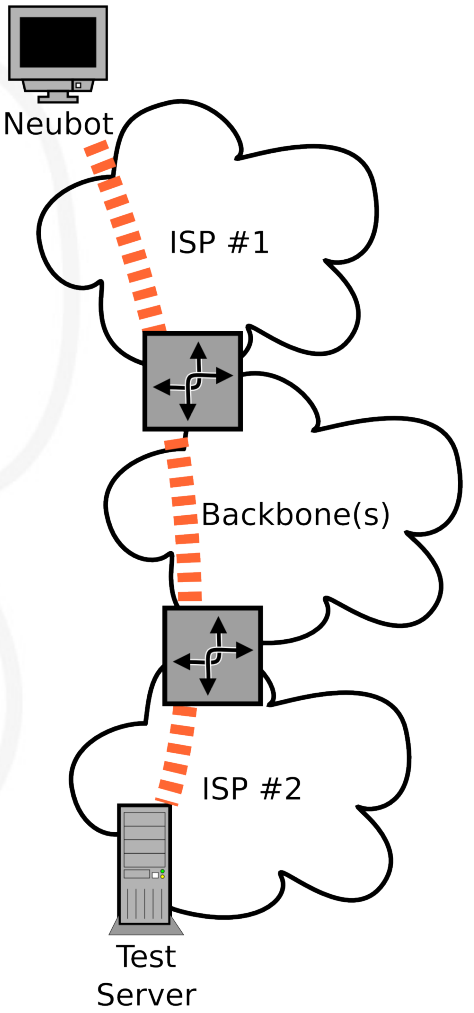
HTTP test implementation (1)

- Two concurrent TCP connections
- **Round-trip time**
  - Time required to connect()
  - Time required to “HEAD” a resource
- **Achievable bandwidth**
  - Measure time *T* required to GET/POST *K* bytes
  - Calculate *bandwidth* = *K* / *T*
  - *K* adapted so that next test would take *T=5* seconds (under current conditions)



HTTP test implementation (2)

- Neubot is a background tool: so tests should be precise and “not too long”
- Let the kernel scale send buffer
- Set recv buffer to 256 KiB
  - To make the test **more predictable**
    - No conflict between *cwin* growth and automatic recv buffer scaling
    - In many OSes the buffer will not scale to “infinite” in any casel
  - As a consequence, Neubot cannot tame “elephants”

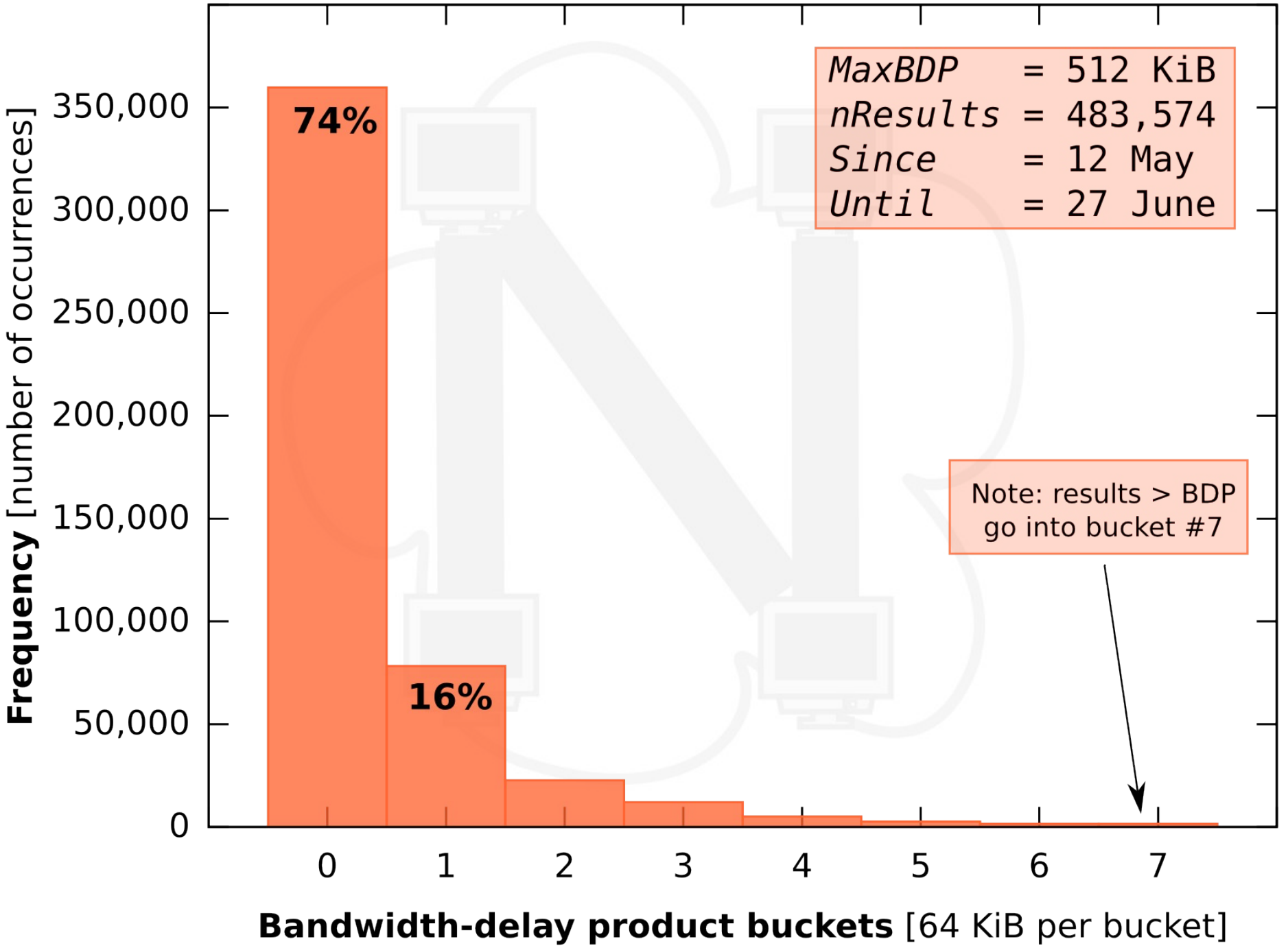


Some numbers

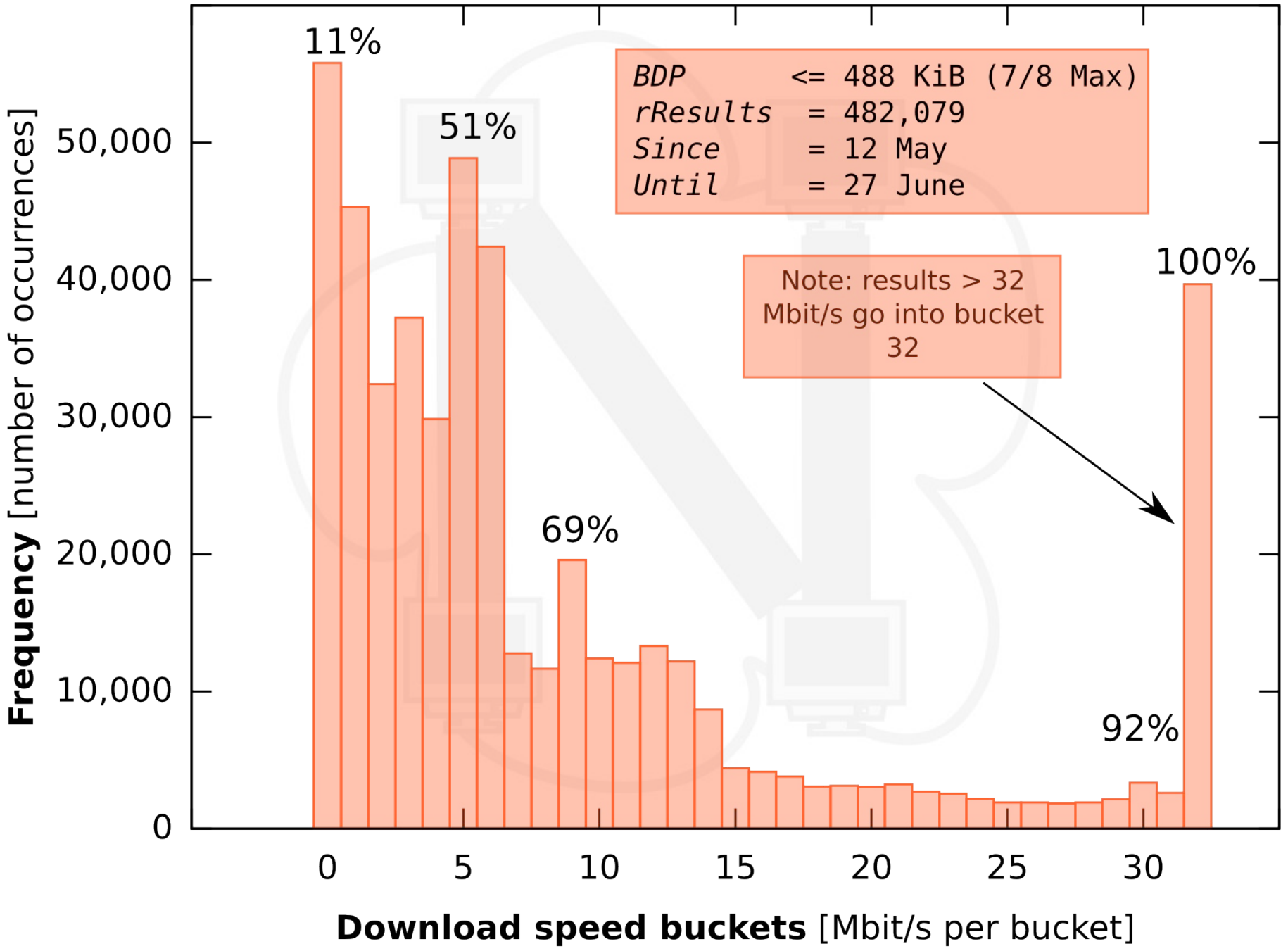
- Data
  - Will release by July
  - #Neubots: 2,246
  - #tests: 1,701,073
  - (privacy issues)
- 5 public releases, since November 2010
  - Version 0.3.7, (20 May 2011) was downloaded 2,138 times

- Latest batch of results
  - 12 May → 27 June
  - #Neubots: 1,409
  - #tests: 483,591
  - **52%** of the Neubots has done **more than 100 tests**
  - 18% of the Neubots has done just one test

Bandwidth-delay product distribution



Download speed distribution



Ongoing & future work

- Ongoing: Geo-scaling
  - Need more servers
  - Applied to **M-Lab**
  - Response pending
- Ongoing: BitTorrent
  - Similar to HTTP test
  - Just one connection
  - “Fill the pipe” first
  - Measure at the receiver
- Ongoing: publish
  - Publish raw DBs
  - Deeper data analysis
- Future: P2P tests
  - Neubot like a *Test Server*
  - Good for geo-scaling
  - More groundwork needed

Thank you!

http://www.neubot.org/

(also on Facebook & Twitter)

http://nexa.polito.it/

References

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[3] http://www.psc.edu/networking/projects/pathdiag/ [2011-06-20]

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[6] Y. Zhang, Z. Mao, and M. Zhang, *"Detecting traffic differentiation in backbone ISPs with NetPolice"*, Proceedings of the 9th ACM SIGCOMM conference on Internet measurement conference, 2009

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[13] http://projectbismark.net/ [2011-06-21]

[14] https://www.misurainternet.it/nemesys.php [2011-06-30]

[15] http://www.nettfart.no/ [2011-06-30]