

# 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

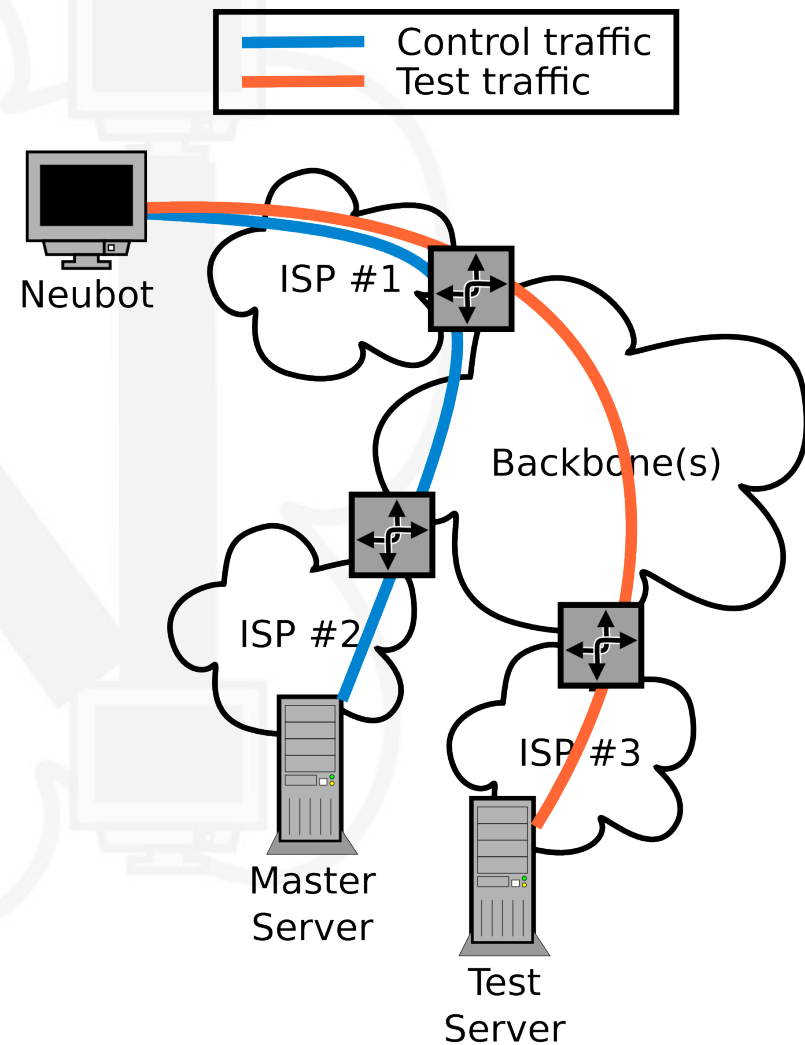
- **M-Lab**: Distributed server platform for active tools [12]

# 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

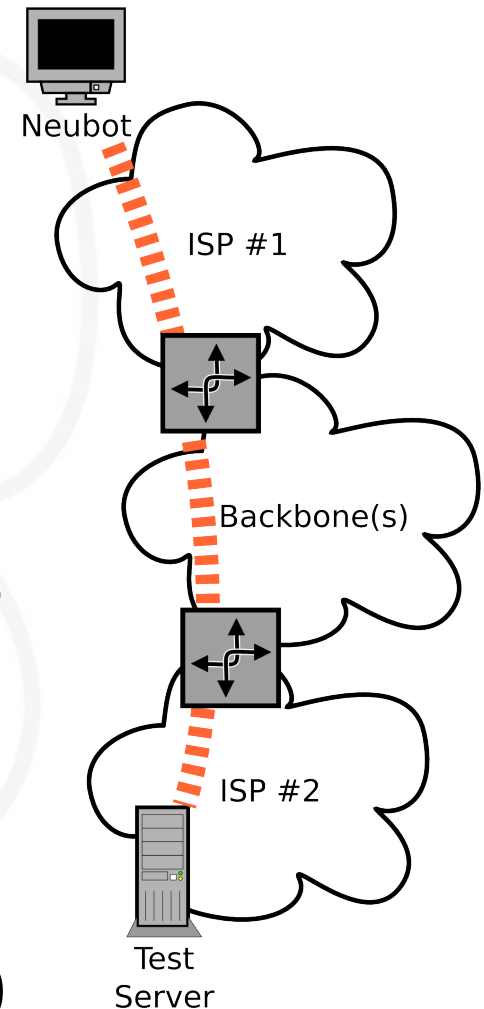
# Architecture

- **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*



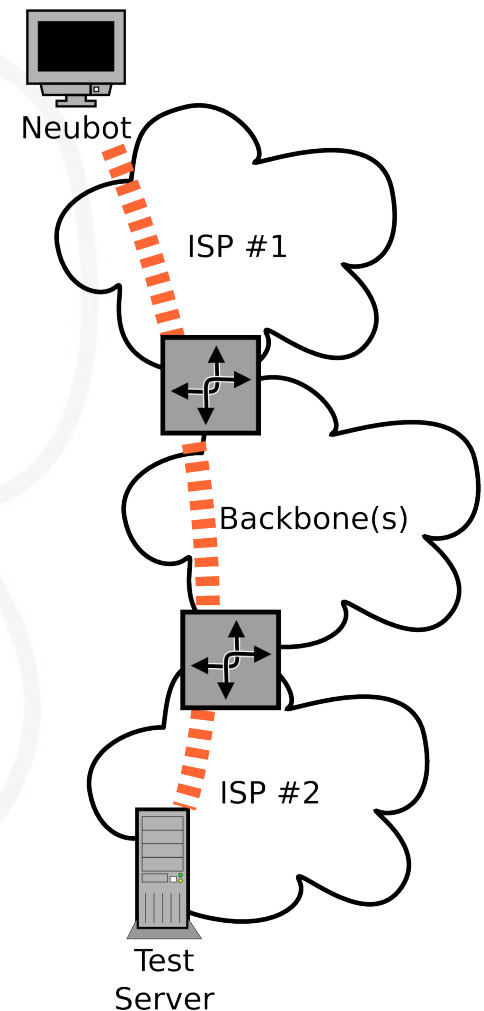
# HTTP test implementation (1)

- 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)

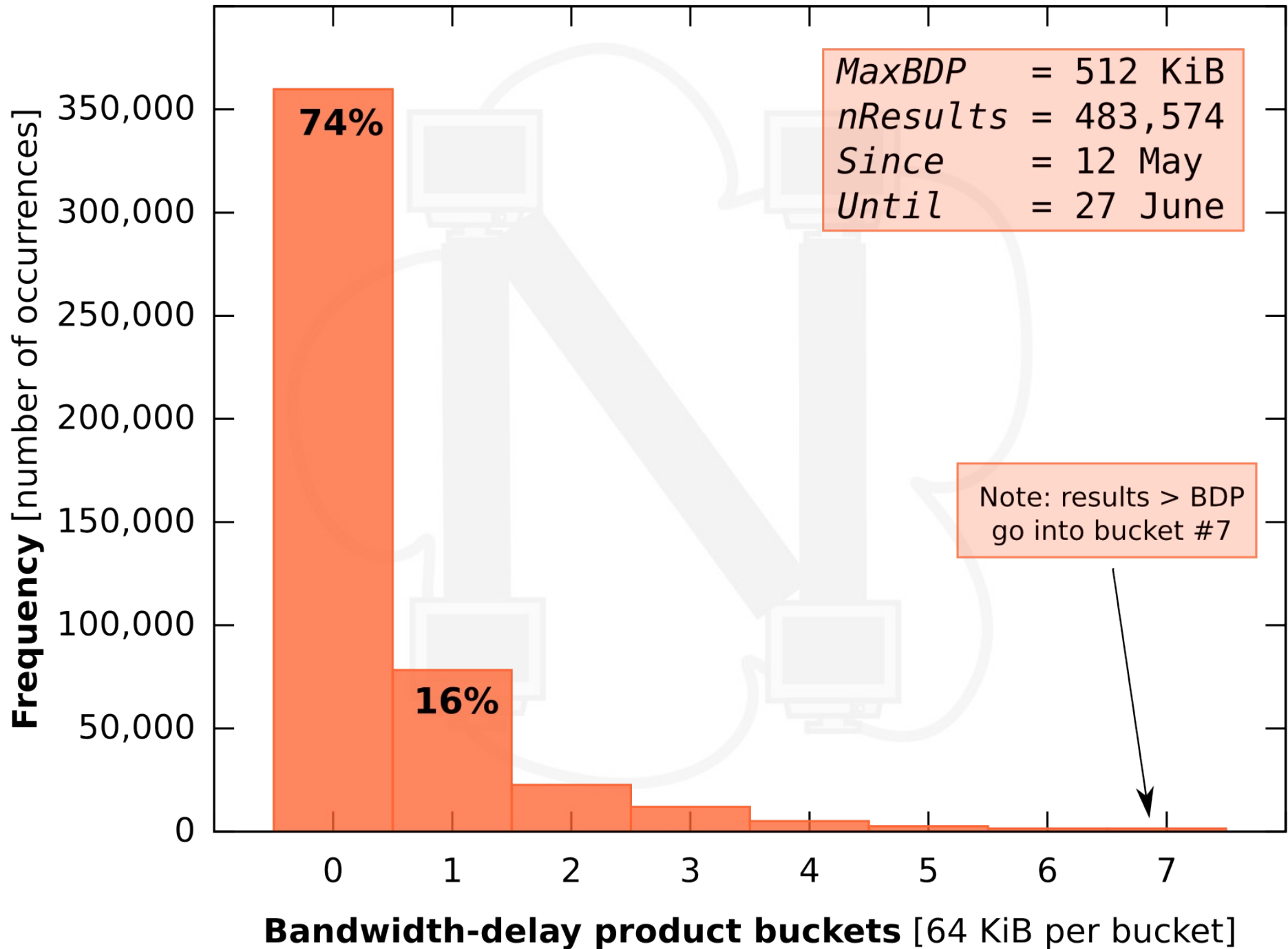
- Neubot is a background tool: so tests should be precise and “not too long”
- Let the kernel scale send buffer
- Set recv buffer to 256 KiB
  - To make the test **more predictable**
    - No conflict between *cwin* growth and automatic recv buffer scaling
    - In many OSes the buffer will not scale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



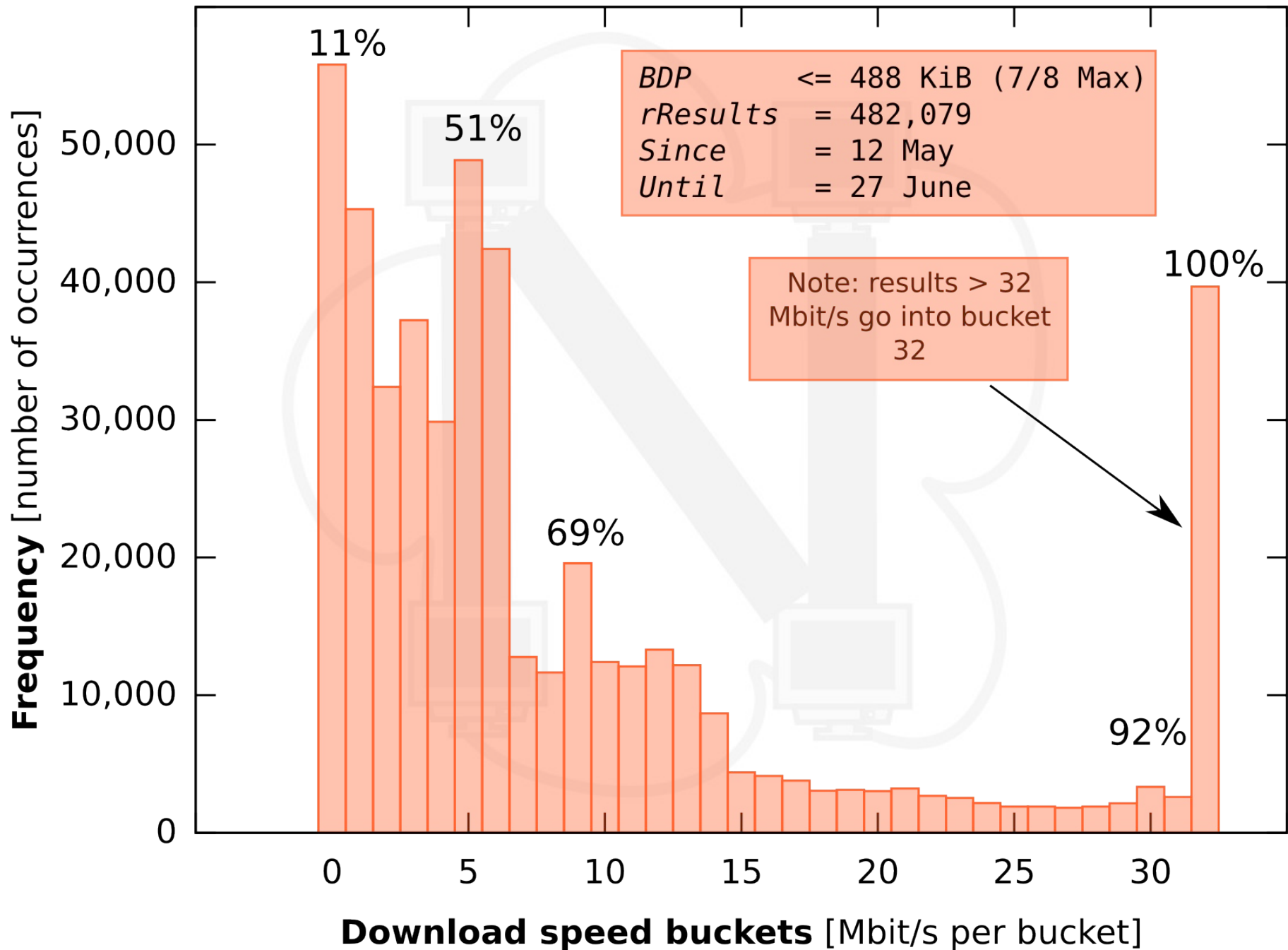
# Some numbers

- 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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- [2] Dischinger, M., Marcon, M., Guha, S. et al., “*Glasnost: Enabling end users to detect traffic differentiation*”, Proceedings of the 7th USENIX conference on Networked systems design and implementation, 2010
- [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
- [7] <http://grenouille.com/> [2011-06-20]
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- [11] <http://www.eff.org/testyourisp/switzerland> [2011-06-20]
- [12] <http://www.measurementlab.net/> [2011-06-20]
- [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]