Broadband Internet Performance: A View from the Gateway

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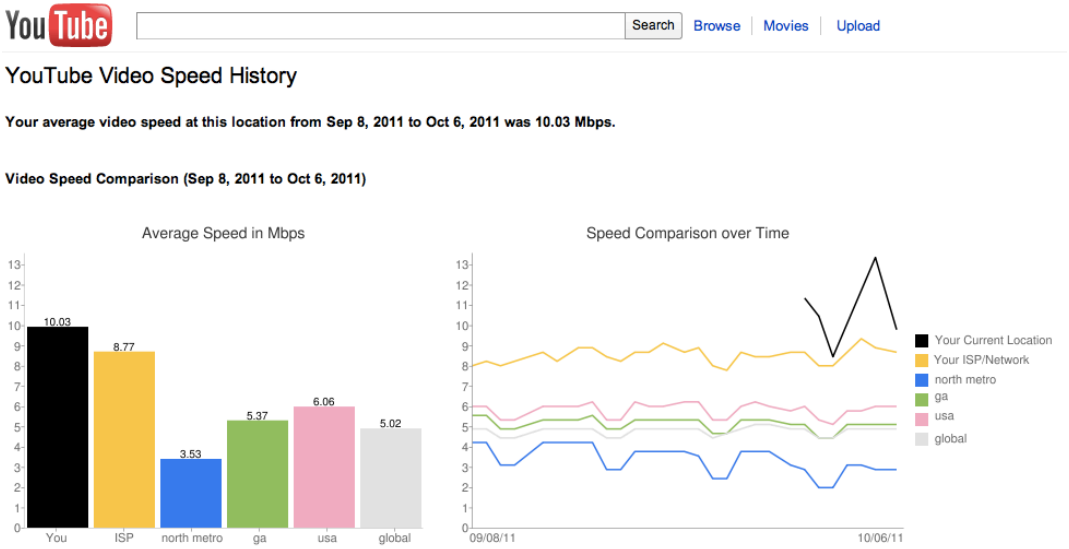
BISmark

http://projectbismark.net

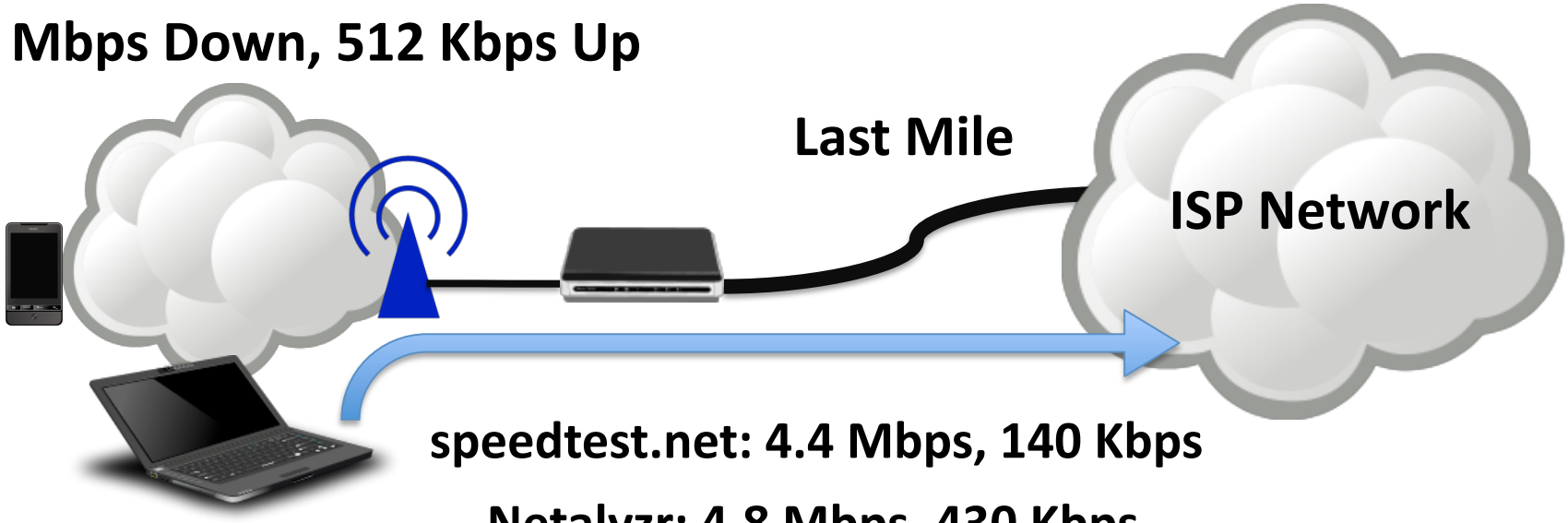
What Performance Do Home Users See?



- **Access ISPs**
  - What performance are customers seeing?
  - Can they gain better visibility into downtimes?
  - Can visibility into problems help reduce service calls?
- **Content Providers**
  - How do content routing or traffic engineering decisions affect end user performance
- Also, consumers and regulators

Most Current Approaches: Not Accurate or Continuous

Home Network: AT&T DSL
6 Mbps Down, 512 Kbps Up



speedtest.net: 4.4 Mbps, 140 Kbps

Netalyzr: 4.8 Mbps, 430 Kbps

End host measurements are not continuous, and affected by *confounding factors*

Measurements from the Home Router: Continuous, Direct

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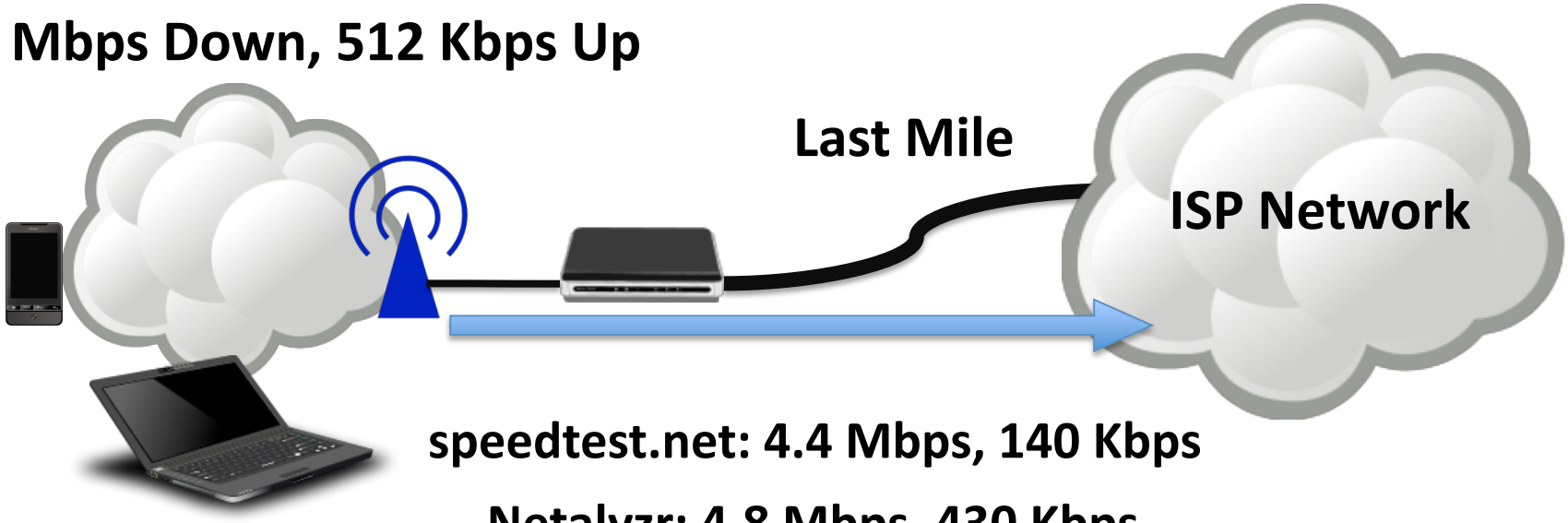

speedtest.net: 4.4 Mbps, 140 Kbps

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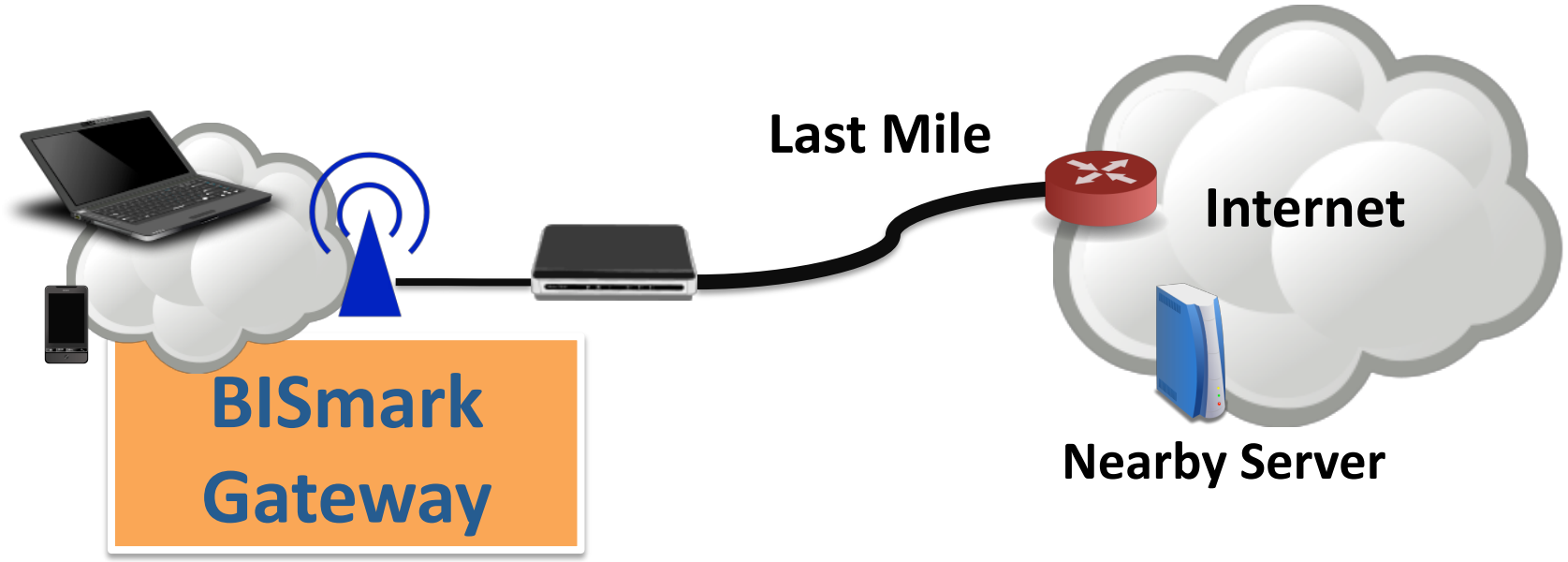
Home Router: 5.6 Mbps, 460 Kbps

Enables periodic measurements, and can account for confounding factors

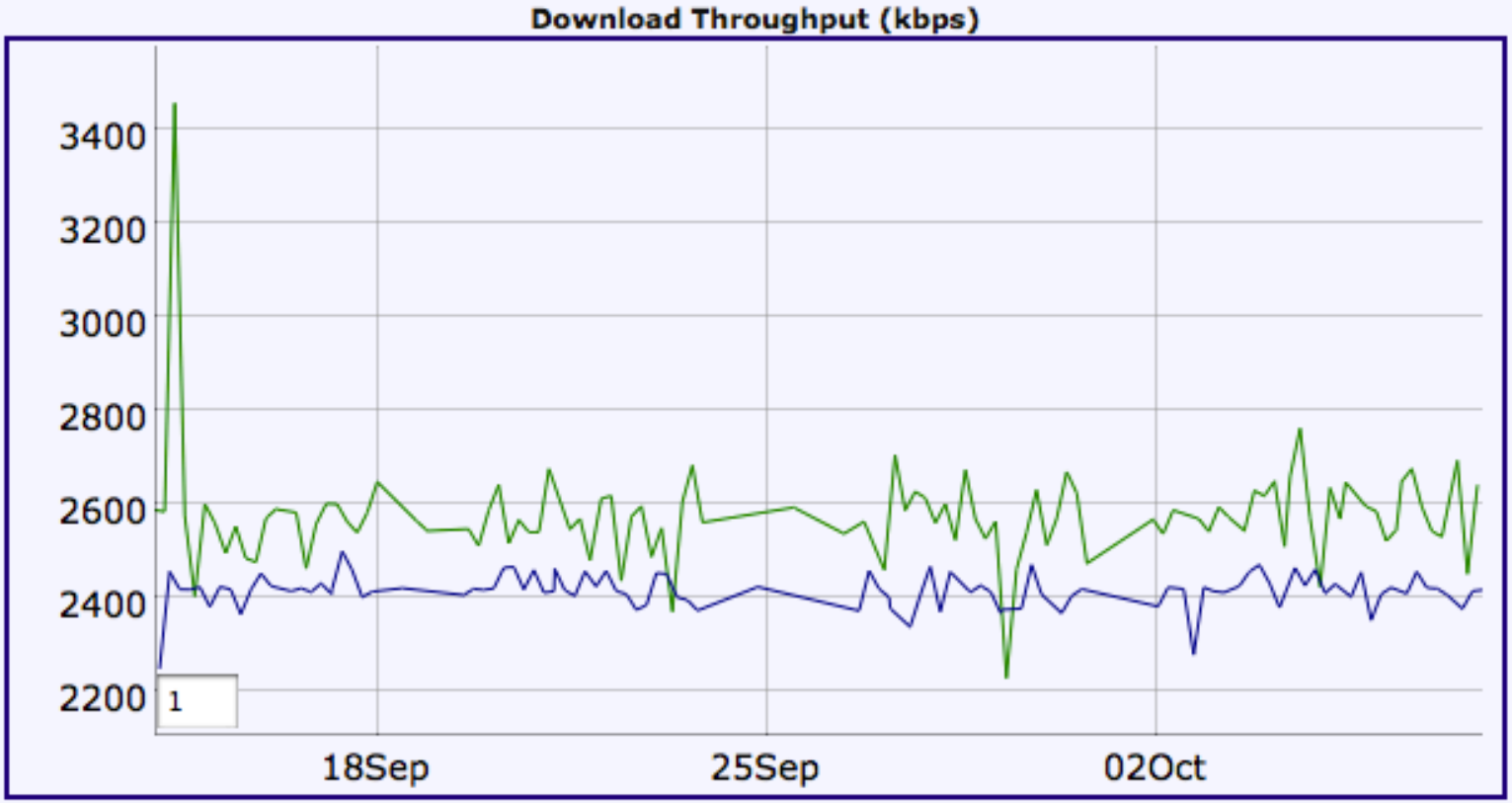
The BISmark Platform



- OpenWrt firmware with custom measurement suite
  - Periodic active measurements of access link, home network
  - Metrics: Throughput, latency, jitter, packetloss
- Current hardware: Netgear 3700v2 router
  - Planned support for other hardware platforms

Downstream Throughput: AT&T DSL

http://networkdashboard.org



Downstream Throughput: Comcast

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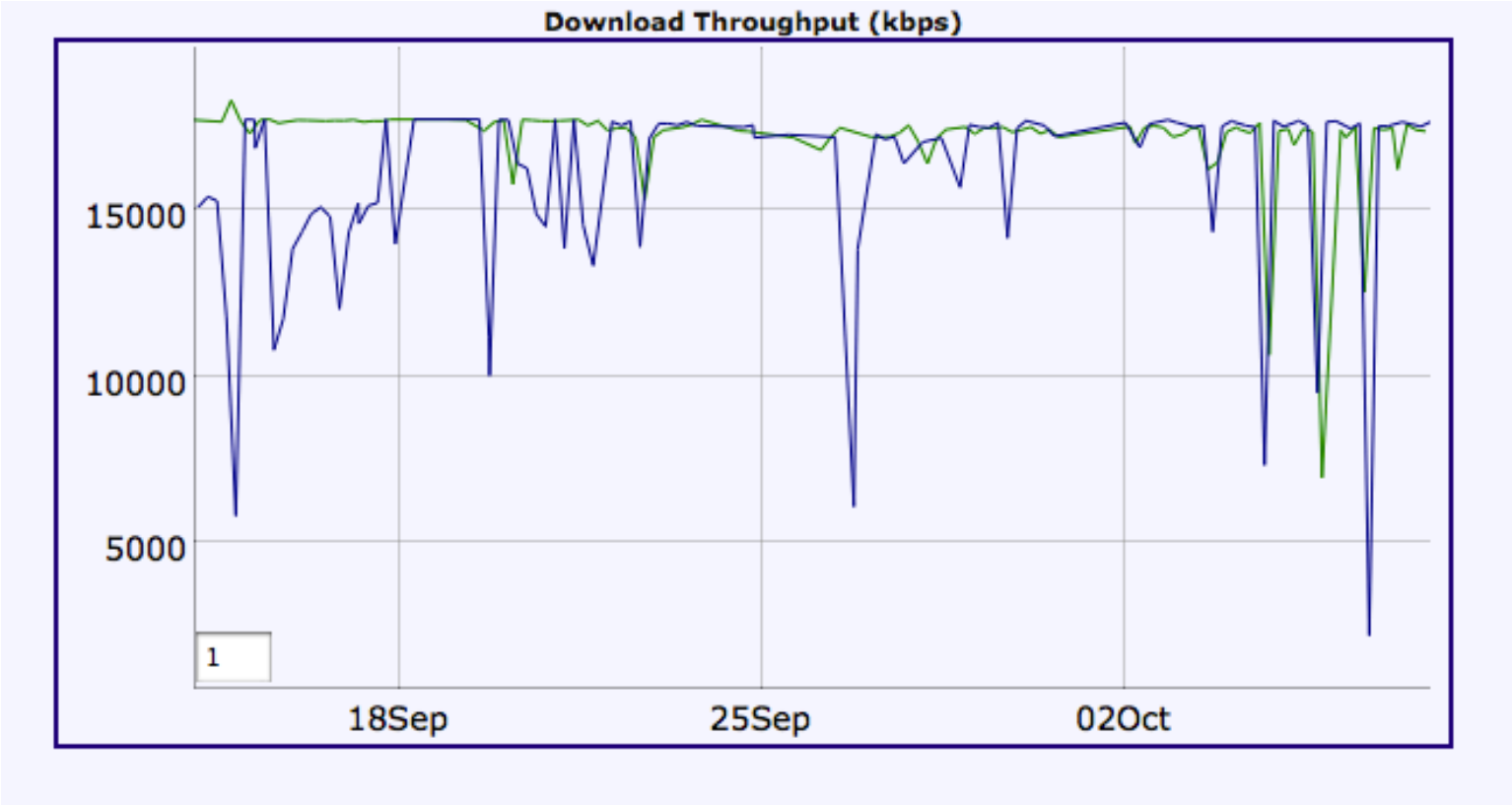
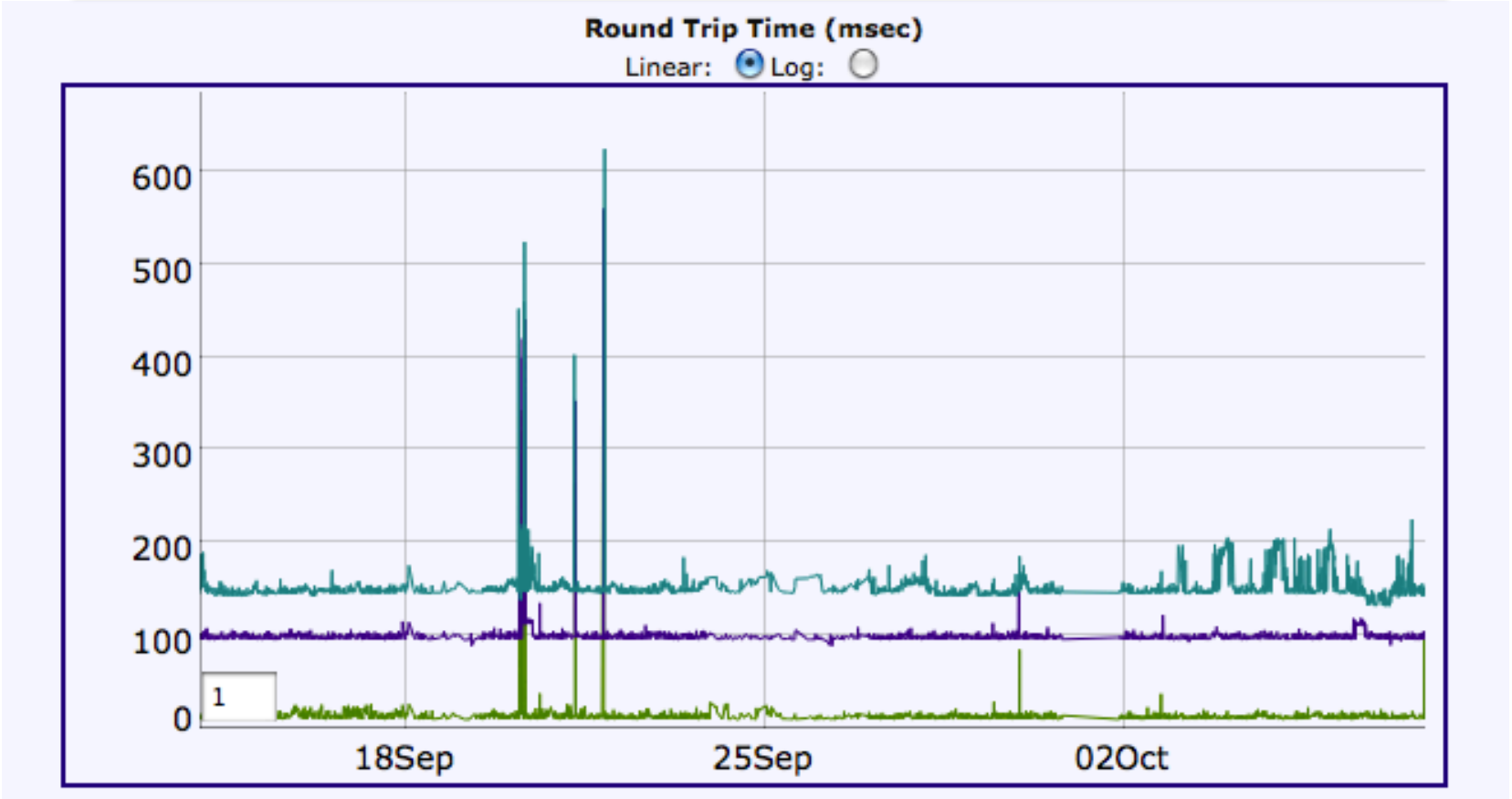


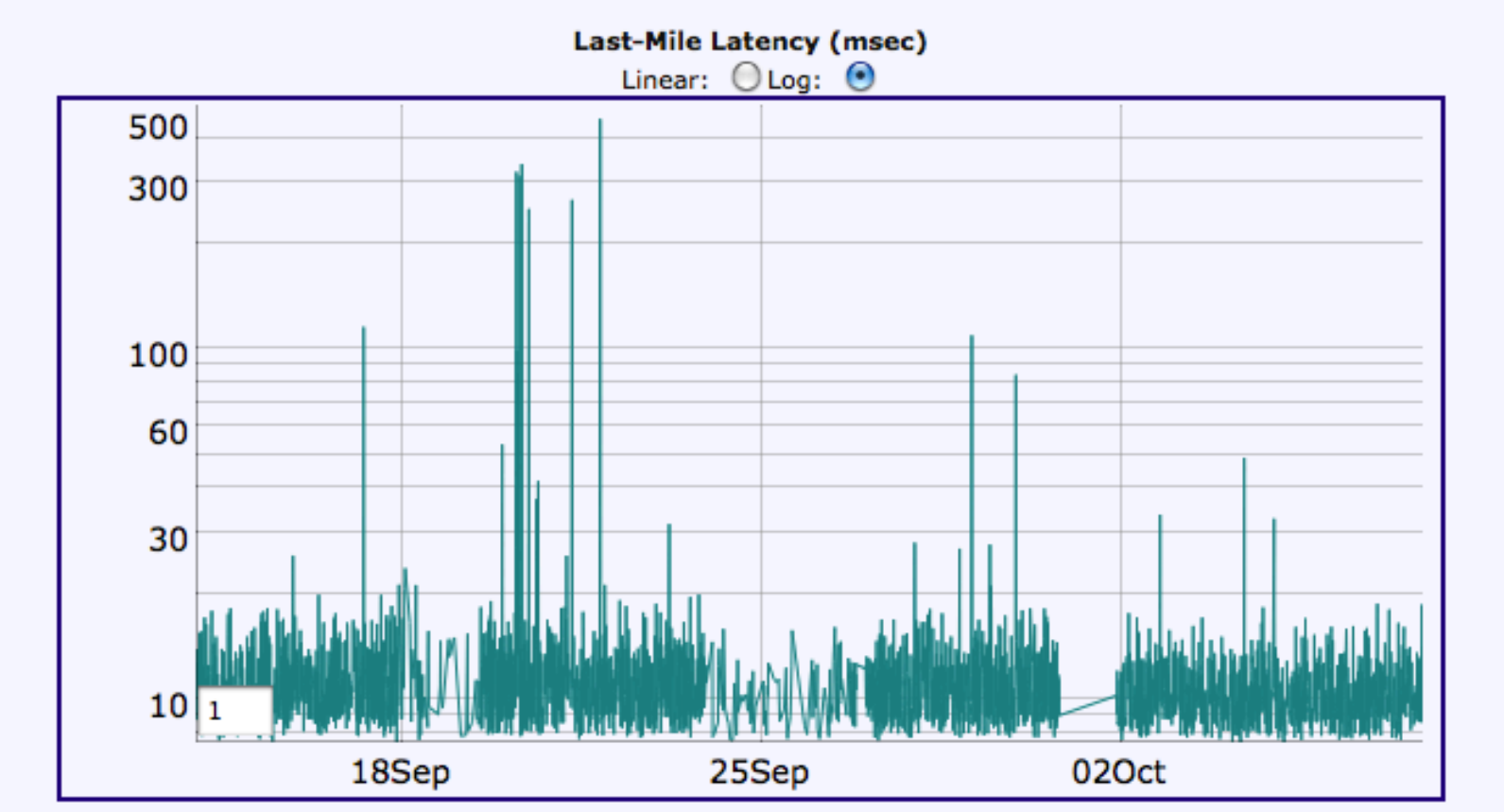
Latency: Comcast Customer

http://networkdashboard.org



Last-Mile Latency: Comcast

http://networkdashboard.org



BISmark's Measurements

- **Throughput:** iperf, netperf, curl, shaperprobe
- **Latency:** ping, fping, httping
- **Other:** traceroute, tcptraceroute, paris-traceroute, nslookup, D-ITG
- The parameters of each of these tests can be configured at the control server

Customizable Measurements

- Routers periodically download scripts from a central control server
  - Periodic updates over SSL
- Each router could, in theory, run custom tests
  - Upload results to control server

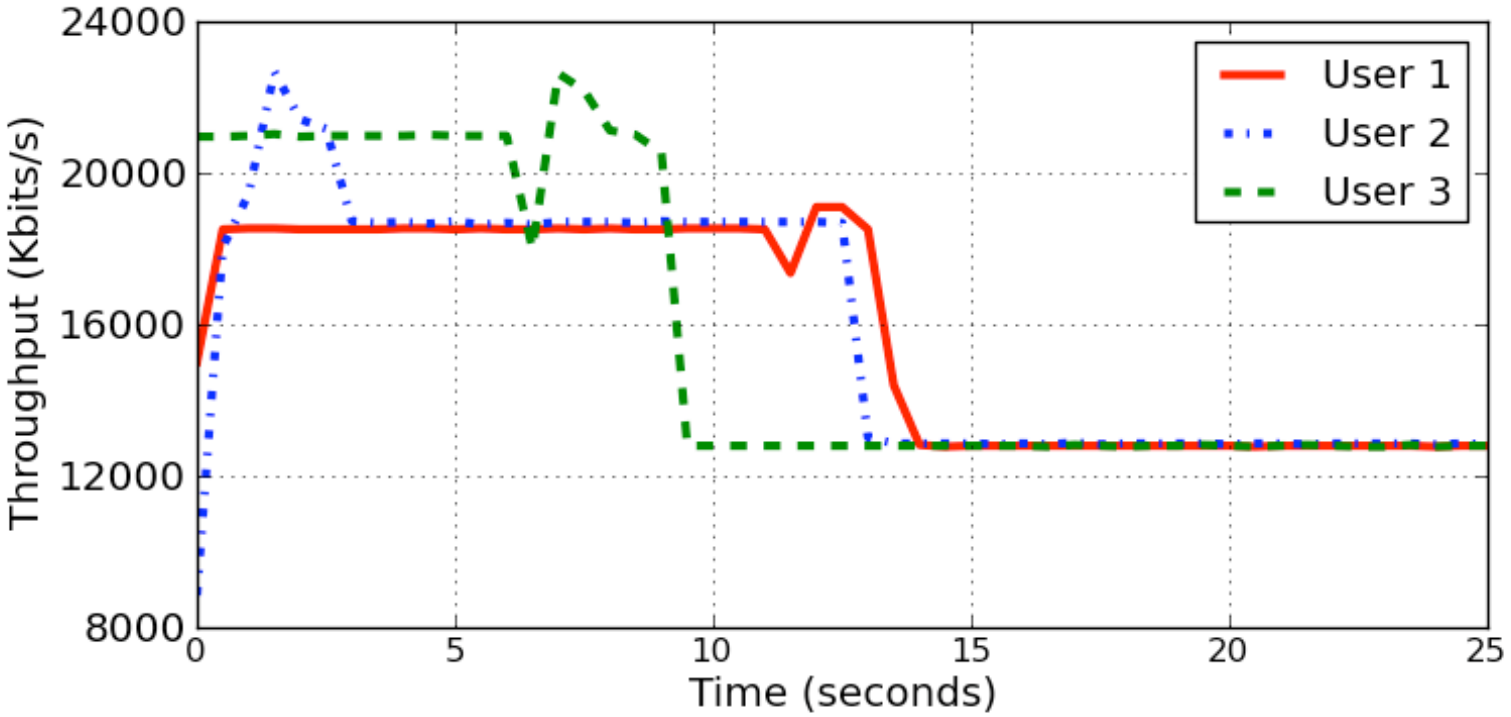
Management and Measurement

- Central control server at Georgia Tech
  - Listens for periodic heartbeats from routers
  - Pushes configuration updates, on-demand test scripts
  - Receives measurement data
  - Stores in postgres database for network dashboard
- Measurement servers
  - In Georgia Tech, University of Napoli, University of Cape Town
  - Measurement Lab servers to be commissioned soon

BISmark: Hardware and Software

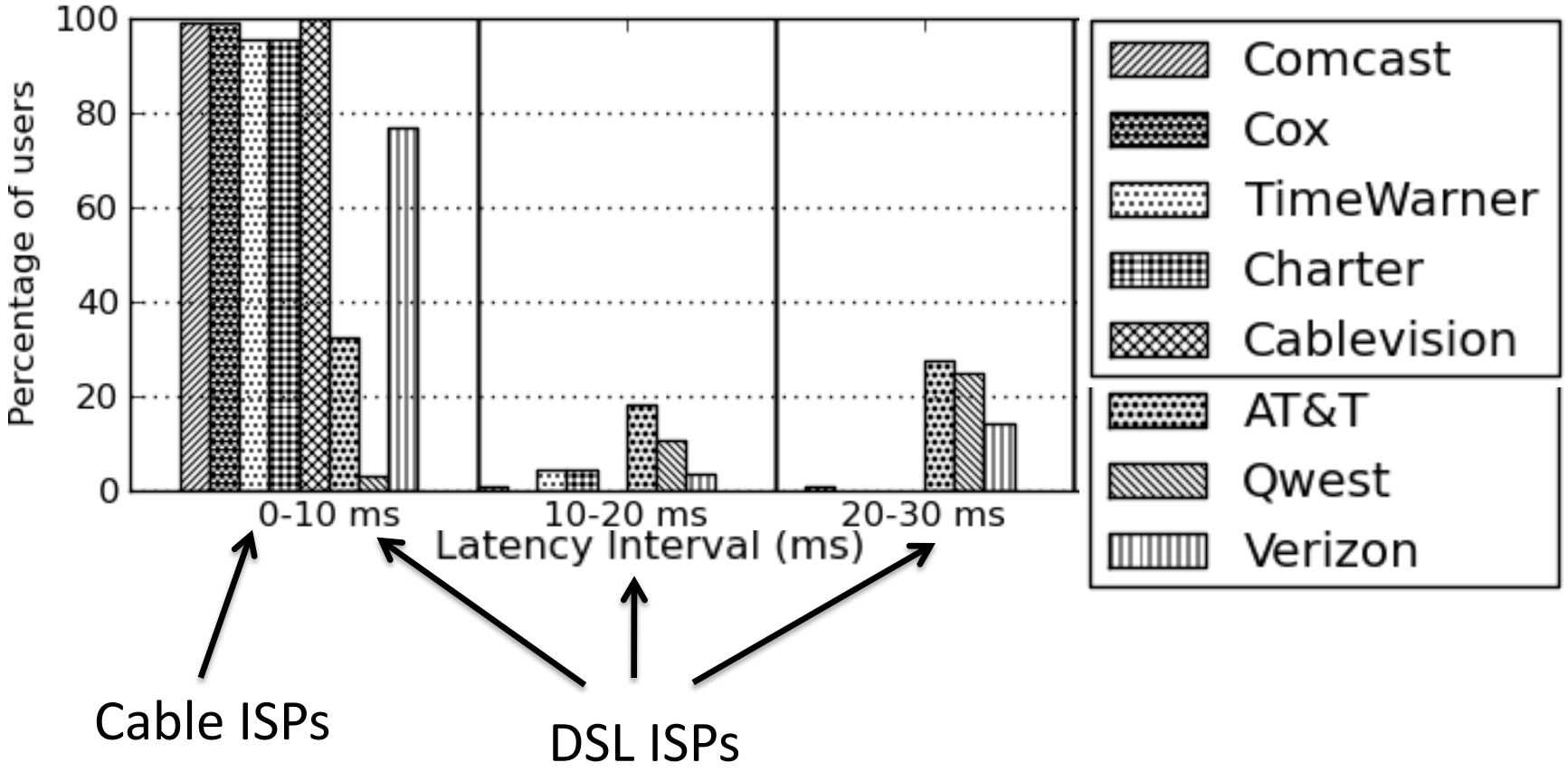
- Firmware
  - OpenWrt, with luci web interface
  - IPv6-capable
- Netgear 3700v2 router
  - Atheros chipset
  - MIPS processor, 16 MB flash, 64 MB RAM
  - Gigabit ethernet
  - 2.4 GHz *and* 5 GHz radio

Case Study 1: Traffic Shaping



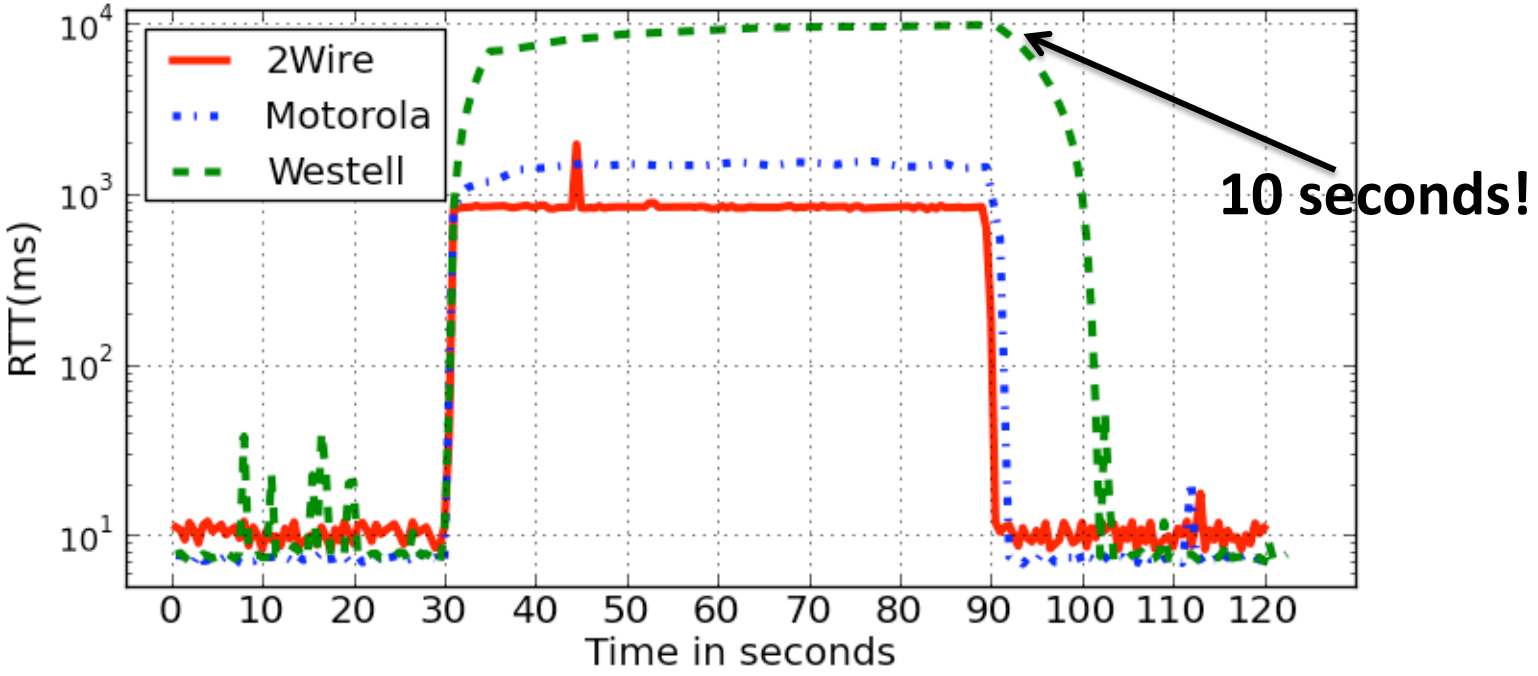
Short-term throughput significantly different from sustainable throughput

Case Study 2: Last-mile Latency



DSL last-mile latencies can be high

Case Study 3: Modem Buffers



Modem buffers can introduce significant latency

State of BISmark Deployment

- 20+ nodes in U.S., 10+ in South Africa
  - Currently shipping to U.S. locations
- Plans to deploy in Europe and Asia
- Support for TP-Link 1043 and Atom forthcoming

Ongoing Work

- A view from the edge for transit and access ISPs
  - Effect of peering on performance
  - IPv6 performance
  - Effect of CDN location, traffic engineering on application performance
  - Want to help? Need server deployments!
- Understand home networks better
  - Effect of wireless
  - When is the problem *not* the ISP's fault?

Get Involved!

- Host BISmark routers
  - Get a high-end wireless router for free!
- Host measurement servers
  - Geographic diversity is important for reliable measurements
- Contribute measurement tests
  - Open-source, capability to run on-demand scripts
  - All code is currently available at http://github.com/bismark-devel

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