Broadband Internet Performance:
A View from the Gateway

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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

Last Mile
ISP Network

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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6 Mbps Down, 512 Kbps Up

Last Mile

ISP Network

speedtest.net: 4.4 Mbps, 140 Kbps
Netalyzr: 4.8 Mbps, 430 Kbps
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

http://networkdashboard.org
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

10 seconds!
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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