Crowdsourcing ISP Characterization to The Network Edge

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ISP Characterization

- *What is it?*
  - Understand how various factors affect performance

- *Who needs it?*
  - Subscribers shopping for alternative ISPs
  - Companies providing reliable Internet services
  - Governments surveying the availability of high-speed Internet services to their citizens
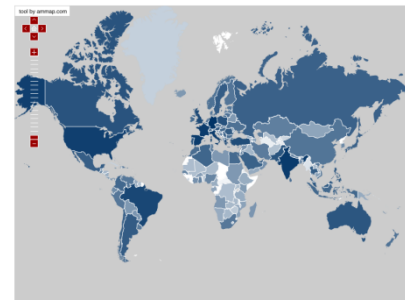
ISPs 'still mislead' on broadband
July 26, 2011

Broadband Speeds Are Largely as Advertised
August 2, 2011

ISP characterization – how should it be done?

- # At scale
  - – To capture the diversity of providers and services

- # Continuously
 - – To capture dynamic changes in management policies, and unscheduled events, …

- # From end users
  - – To guarantee accuracy, reduce bias

- Web-based, user-initiated tests against dedicated or cloud servers

Scale
Continuous
End-user

  – E.g. Netalyzr, Speedtest, …

- End-host monitoring from dedicated servers

Scale
Continuous
End-user

  – E.g. Dischinger et al. (IMC07) , Croce et al. (PAM09)

- Installing special monitoring devices at PoPs or home networks

Scale
Continuous
End-user

  – E.g. BISMark, SamKnows, Keynote

- *An unavoidable tradeoff among vantage points, coverage and continuous monitoring*?
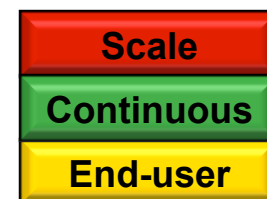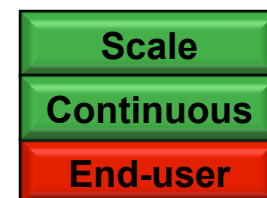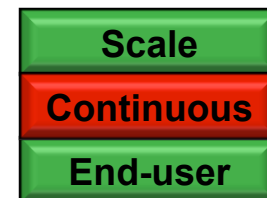
Our Approach

- *Crowdsourcing ISP Characterization to the Network Edge (C2E)*
    - Leverage the views of popular, network-intensive applications from the end-user
        - (e.g. VoIP, P2P, IPTV, gaming, …)
    - Reduce number of active measurements

    - Based on experience of end users
    - Continuous monitoring achieved by combining views of multiple subscribers
    - Application usage can grow with the network edge

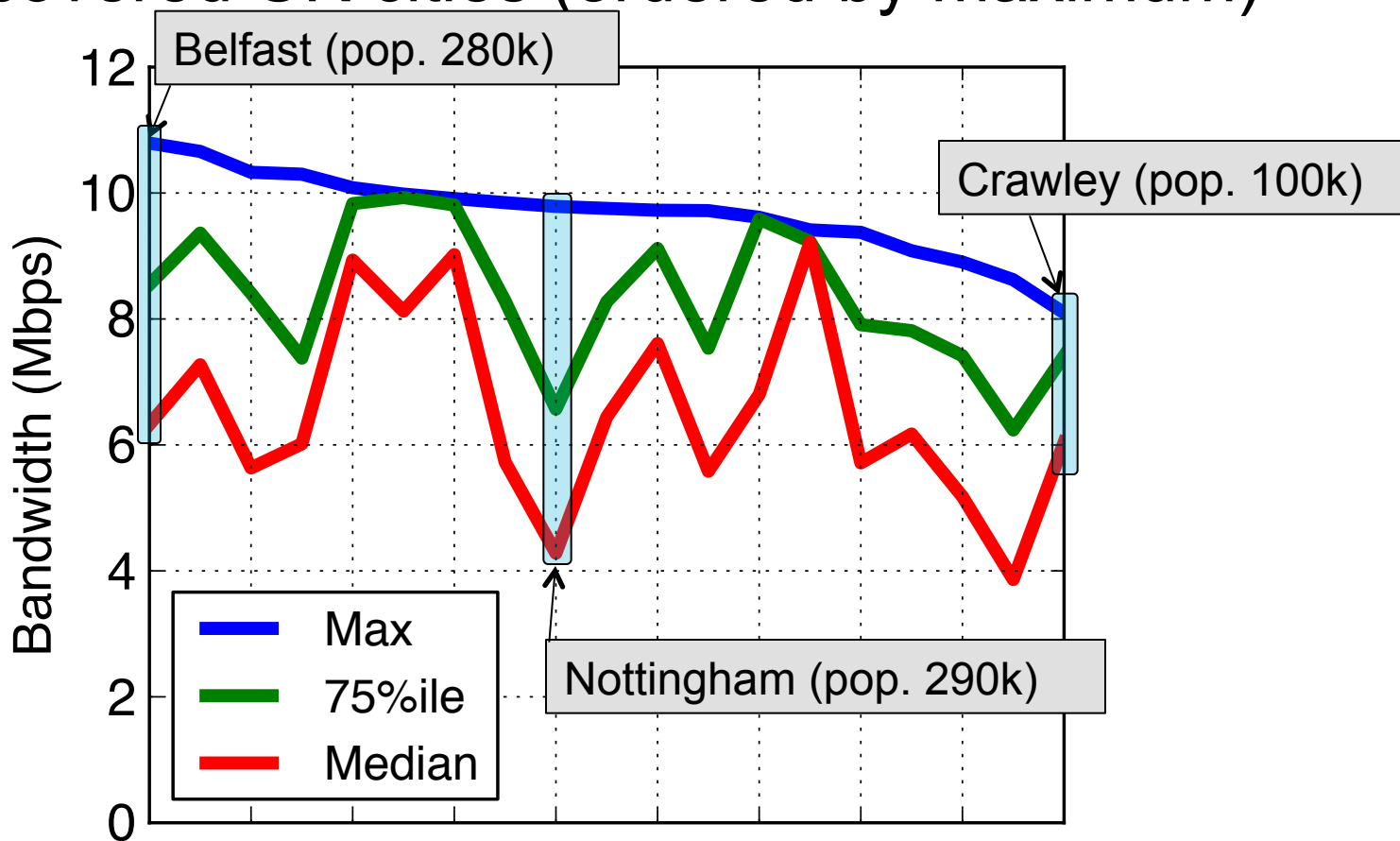| Scale |
| Continuous |
| End-user |
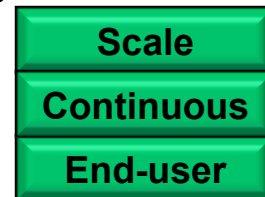
BitTorrent as a Hosting Application

- *BitTorrent*
  - Relatively long session times
  - High bandwidth usage

- *Ono* – client extension for Vuze
  - Aims to improve performance by suggesting "closer" peers
  - Users voluntarily contribute performance statistics
  - In total, about 1.3+ million users world-wide
  - Datasets from November 2009 and 2010

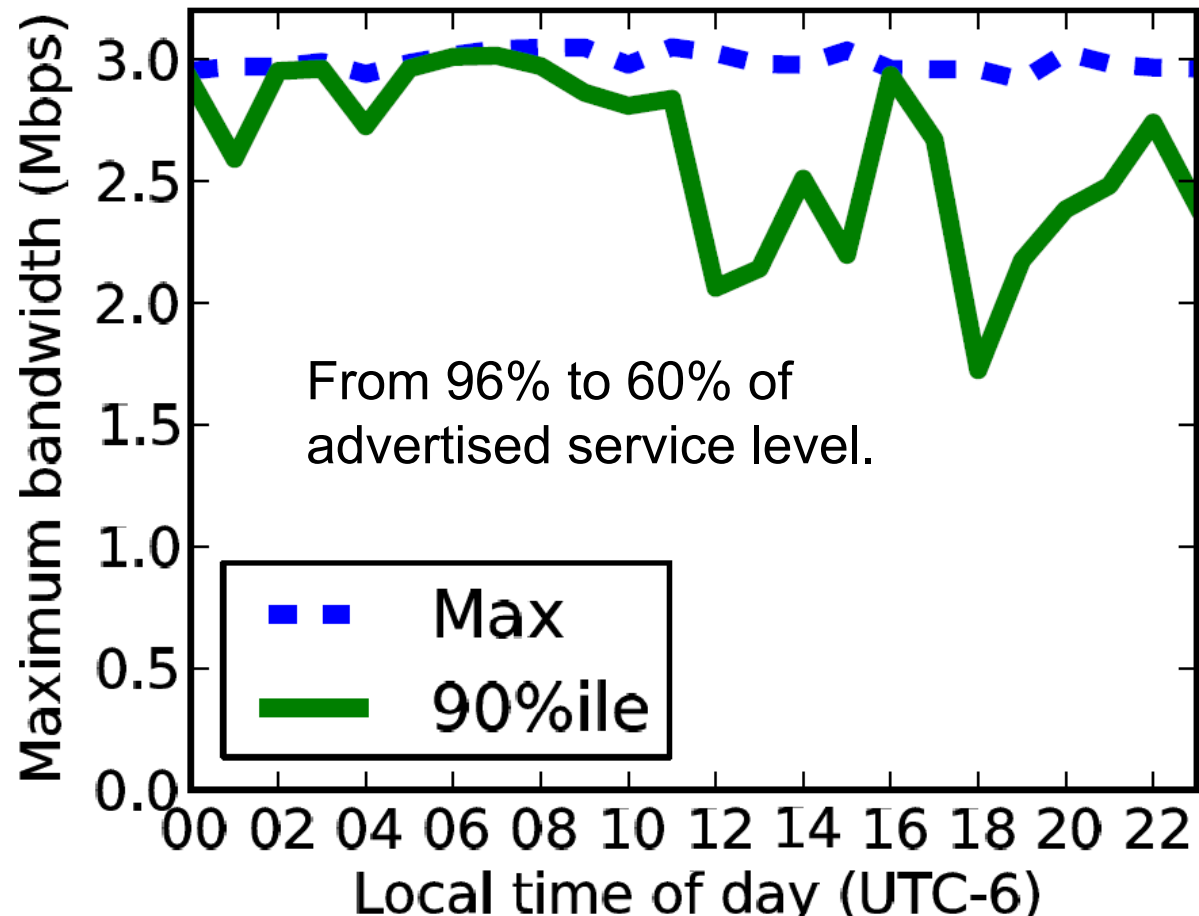- Variations within a service level among 19 Virgin Media covered UK cities (ordered by maximum)

Belfast (pop. 280k)

Crawley (pop. 100k)

Nottingham (pop. 290k)

Bandwidth (Mbps)

- Max
- 75%ile
- Median

19 Cities with Virgin Media Peers

Scale

Continuous

End-user

- Variations on Rogers performance during the day (aggregated over Nov. 2009)

From 96% to 60% of advertised service level.

Scale
Continuous
End-user

Continuous Monitoring

- Virgin Media new throttling policy in effect

Upload rates drop by about 50%

Upload speed before and after new throttling policy.

Daily upload throttling period

Peak Upload Speed (% of Advertised)

Time of Day

No Throttling
Throttling
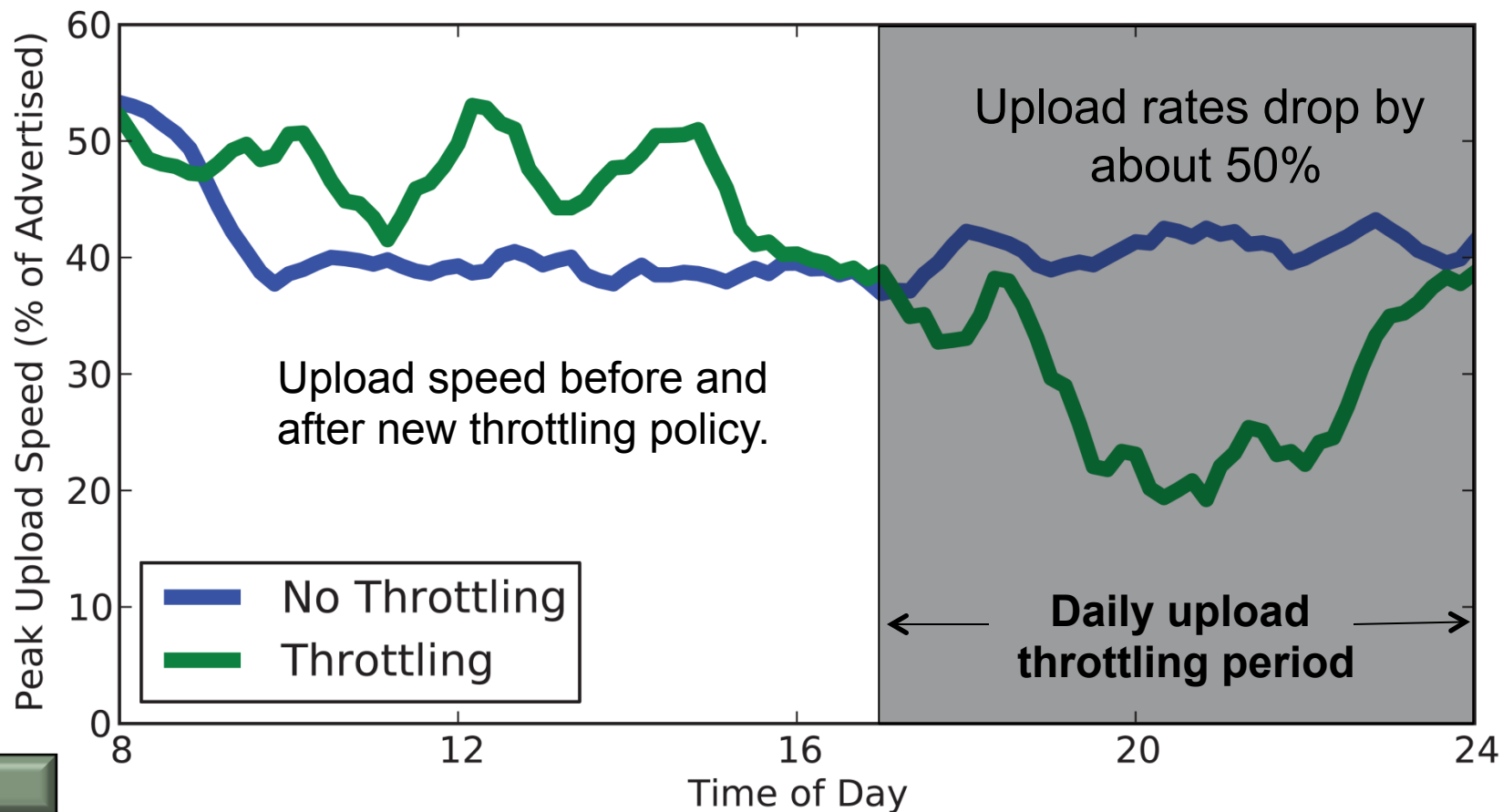
Scale
Continuous
End-user

- ## Capturing the end-user's view

Normalized number of DNS timeouts

DNS servers stop responding and clients give up!

Reported period of Comcast DNS outage

Nov 28, 12:00pm - Nov 29, 12:00pm (EST)   **2010**
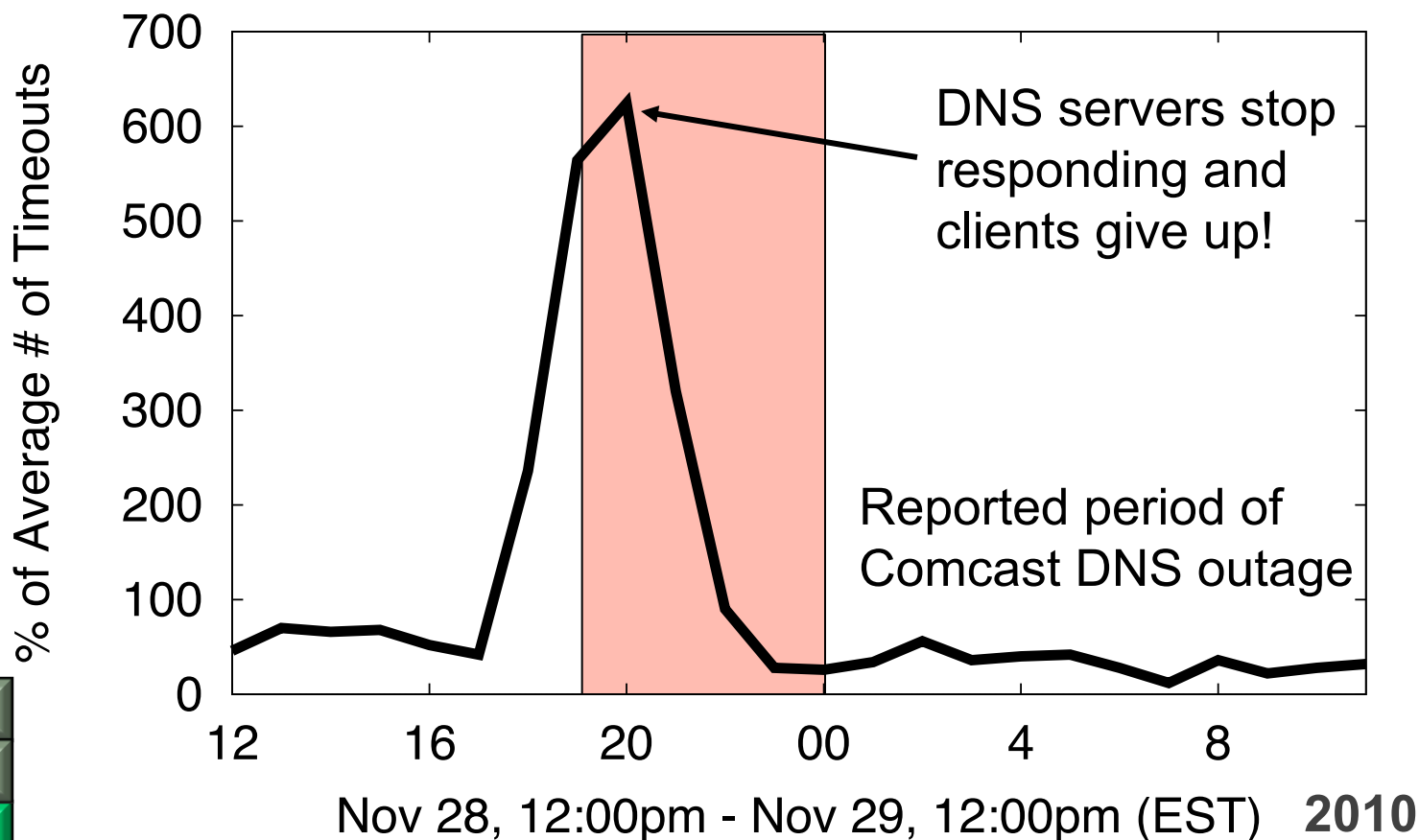
Scale

Continuous

End-user

Beyond single ISP characterization

- Percentage of cities containing at least one ISP providing each category of service
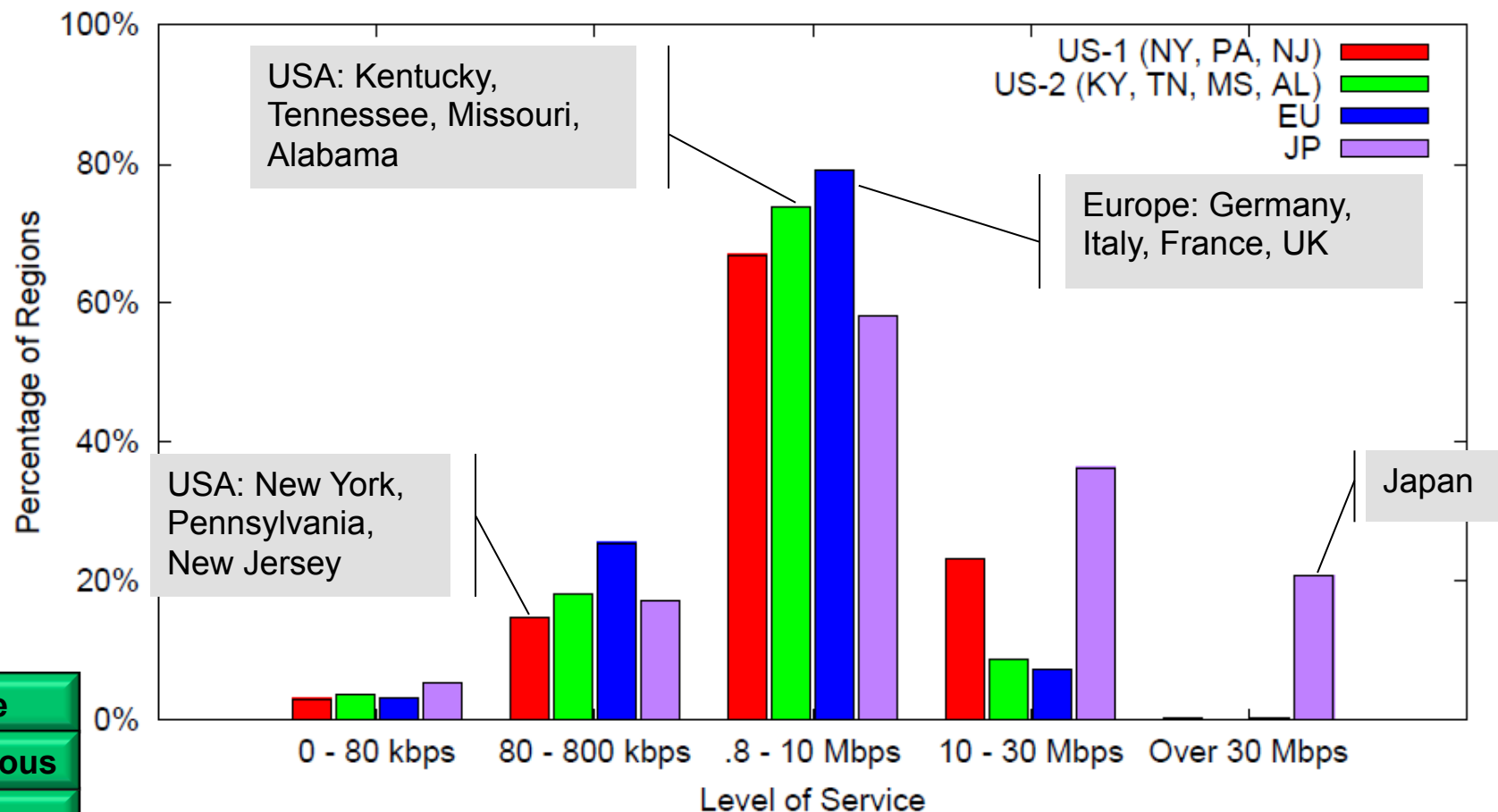
Nov. 2009; mapped with GeoLite

- Looking to leverage other network-intensive applications

- Dasu – C2E implementation
  - Inform users of ISP performance
  - Eliminate confounding factors
    - Cross traffic
    - Wi-Fi or Ethernet?
  - Complementary to SamKnows/BISMark

DASU

Dasu v3