Understanding the Nature of Internet Congestion

Srikanth Sundaresan, Amogh Dhamdhere, kc Claffy, Mark Allman

ICSI
CAIDA
Internet traffic has changed

Netflix alone accounts for a third of US traffic [2014]
As HD Video becomes more popular, this ratio is likely to grow
Is the Internet able to handle all this traffic?

Internet traffic jams are widespread in the US, and are probably about to get a lot worse

"It's not just Netflix and Comcast that are to blame"

Short answer: maybe not
Who’s responsible?

Short answer: it’s complicated
Can we understand the *nature* and pinpoint the *location* of bottlenecks?

- **The nature of throughput bottlenecks**: Was a flow bottlenecked by:
  - An already congested link on the path (possibly a peering link) ?
  - A previously uncongested (possibly access) link that the flow managed to fill up?

- **The location of the bottleneck**: which link was the throughput bottleneck?
  - Can no longer assume that the bottleneck is always the last mile
Understanding where and how congestion occurs is critical

- Increasing number of “core” link congestion events
  - Last-mile bottleneck assumptions no longer valid
- Understanding congestion events can improve content delivery and user experience
  - Congestion in the core: Explore better peering or content delivery options
  - Congestion at the edge: Explore better encoding/rate adaption schemes for content, enable users to make better informed choices about ISPs and service plans
Using TCP RTT signatures

[Data from Measurement Lab]

Cogent-Comcast after Netflix-Comcast peering agreement: likely access link bottlenecked

Cogent-Comcast before Netflix-Comcast peering agreement: likely core link bottlenecked
Using TCP RTT signatures

[Data from Measurement Lab]

Congested core links cause less variance in flow RTT during slow start.

Cogent-Comcast after Netflix-Comcast peering agreement: likely access link bottlenecked

Cogent-Comcast before Netflix-Comcast peering agreement: likely core link bottlenecked
Understanding the location of congestion

• Passive measurements not enough beyond immediate vicinity
• Exploring *in-band* techniques to complement active measurements
  • E.g., In-band TCP traceroutes with a throughput test flow
  • Challenges: conceptually simple but implementing it without disrupting flows is more difficult
Thanks

• srikanth@icsi.berkeley.edu