CSC2231: Quality of Internet Paths

http://www.cs.toronto.edu/~stefan/courses/csc2231/05au

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Administrivia

• You’ve made it so far!
  – Congratulations!

• P2P stuff from next lecture on

• “mock” PC really soon now
Motivation

• **Routing is a black box**
  – Label packet with destination
  – Put it on the wire
  – Here it goes….

• **Routing path choice subject to:**
  – Traffic engineering
  – ISP peering policies
  – Network topology
  – Poor routing algorithms

• **Question:**
  – How does path selection affect end-to-end performance?
Anectodal Evidence
Methodology

• Basic metric:
  – Let $X =$ performance of default path
  – Let $Y =$ performance of best path
  – $Y - X =$ cost of using default path

• How to find the best path:
  – Measure paths between $N$ nodes
  – Generate synthetic full mesh topology ($N^2$)
  – Find best path on this graph

• Their best path underestimates “true” best path
• Not many dialup, DSL, cable users in their traces
30-55% of default paths have longer RTTs
75-85% of default paths have higher loss rates
Bandwidth

70-80% of default paths have lower bandwidths
Adding it all up

• Plenty of opportunity to improve on quality of routing paths:
  – Why hasn’t this been done before?
  – Can we do this?
RON

Slides © David Andersen
Overlay routes around Internet failures

• Failures:
  – Outages: Configuration/operational errors, backhoes, etc.
  – Performance failures: Severe congestion, denial-of-service attacks, etc.
Redundant links

- Multiple paths between all sites
Redundant links

- But many of them are hidden
Resilient overlay networks

- **Measure** all links between nodes
- **Compute** path properties
- **Determine** best route
- **Forward** traffic over that path
Take home messages

1. RON reduced outages by a factor 5 to 10, and routed around all major outages
2. RON takes 18s (average) to route around a failure, and can do so in the face of flooding attacks
3. Single route indirection delivers the majority RON benefits
Discussion

- Is Internet path selection algorithm optimal?
  - Is this the right question to ask?
Discussion

- **RON**: route around failures
- **SOSR**: single-hop route around failures
- **How about other metrics?**
  - Latency:
    - Do we care?
  - Bandwidth
    - Will it make a difference for end-hosts?
M.S. Project Ideas

- How much does swarming help file downloads?
  - And why?

- Can VoIP benefit from routing around congested links (long latencies?)
  - What are the differences in jitter between routing and optimal paths?