Growth Analysis of a Large ISP

Andrew Ferguson, Jordan Place, and Rodrigo Fonseca
Cogent Communications

1. One of the world’s largest IP networks, covering 3 continents
2. Public map (below) provides a static snapshot at the city-level
3. Since Jan. 2012, we made weekly snapshots at the router interface-level

Inferred Router Growth

Number of Routers

Week 2013
Inferred Router Growth

\[ r = 10.265w + 3873.7 \]

\( R^2 = 0.986 \)
Interface Growth

![Graph showing interface growth over time with physical and virtual counts]

Count (x1000)

Week

2012

2013

Physical

Virtual
Physical Interface Breakdown

Count (x1000)

Week

FastEth 10GigE 1GigE Serial Eth ISM POS

2012 2013
1. Infer connection between two routers sharing appropriate /30 subnets
2. Nodes are sized according to the number of paths passing through them
3. Layout above is force-directed (no geographical information used)
How did we do this?
Cogent’s DNS Records

$ host 154.54.80.85
te2-1.ccr01.jfk01.atlas.cogentco.com
Cogent’s DNS Records

$ host 154.54.80.85
te2-1.ccr01.jfk01.atlas.cogentco.com

Ten Gigabit Ethernet
Port 1
Slot 2
Router
Metro
Infrastructure
Cogent’s DNS Records

$ host 154.54.80.85
  te2-1.ccr01.jfk01.atlas.cogentco.com

$ host 154.54.25.17
  te2-2.ccr01.jfk01.atlas.cogentco.com

Ten Gigabit Ethernet

Port 1

Slot 2

Router

Metro

Infrastructure
Cogent’s DNS Records (2)

$ host 38.112.5.17
fa0-2.na01.b003070-1.sfo04.atlas.cogentco.com
Cogent’s DNS Records (2)

$ host 38.112.5.17
fa0-2.na01.b003070-1.sfo04.atlas.cogentco.com

100 Mbps Ethernet

Router

Metro
Cogent’s DNS Records (2)

$ host 38.112.5.17
fa0-2.na01.b003070-1.sfo04.atlas.cogentco.com

100 Mbps
Ethernet

Router

Metro

$ host 38.112.5.18
Tetratech.demarc.cogentco.com
Cogent’s DNS Records (2)

$ host 38.112.5.17
fa0-2.na01.b003070-1.sfo04.atlas.cogentco.com

100 Mbps
Ethernet

Router

Metro

Pair in /30 Subnet

$ host 38.112.5.18
Tetratech.demarc.cogentco.com

California
ing engineering firm

Related business
entities
Weekly Surveys

1. Perform 20+ million reverse DNS queries weekly for Cogent-owned IPs
2. Issued from ~100 PlanetLab locations across the globe
3. Also run iffinder on the previous week’s discovered interfaces (~55k)
Weekly Surveys

1. Perform 20+ million reverse DNS queries weekly for Cogent-owned IPs
2. Issued from ~100 PlanetLab locations across the globe
3. Also run iffinder on the previous week’s discovered interfaces (~55k)
1. Can we believe this data?
2. How high is the coverage?
Validation Approaches

1. Compare with iffinder
2. Check Cogent’s public information
3. Use complete set of IPv4 DNS records
Comparison with iffinder

iffinder — a well-known solution to the “alias resolution” problem with a low rate of false positives
Comparison with iffinder

iffinder — a well-known solution to the “alias resolution” problem with a low rate of false positives
Comparison with iffinder

iffinder — a well-known solution to the “alias resolution” problem with a low rate of false positives

Good!
Comparison with iffinder

iffinder — a well-known solution to the “alias resolution” problem with a low rate of false positives

Bad!
Co-authors

- Jordan Place
- Rodrigo Fonseca

systems.cs.brown.edu/cogent

Andrew Ferguson
adf@cs.brown.edu