Lecture 12: Aggregation

CSE 123: Computer Networks
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Project 1 due Friday
Lecture 12 Overview

- Finish up Route Aggregation
  - CIDR
Subnet Addresses

- Every (sub)network has an address and a **netmask**
  - Netmask tells which bits of the network address is important
  - Convention suggests it be a proper prefix

- Netmask written as an all-ones IP address
  - E.g., Class B netmask is 255.255.0.0
  - Sometimes expressed in terms of number of 1s, e.g., /16

- Need to size subnet appropriately for each LAN
  - Only have remaining bits to specify host addresses
IP Address Problem (1991)

- Address space depletion
  - In danger of running out of classes A and B

- Why?
  - Class C too small for most organizations (only ~250 addresses)
  - Very few class A – very careful about giving them out (who has 16M hosts anyway?)
  - Class B – greatest problem
Classless Inter-Domain Routing (1993)

- Networks described by variable-length prefix and length
- Allows arbitrary allocation between network and host address

- e.g. 10.95.1.2 contained within 10.0.0.0/8:
  - 10.0.0.0 is network and remainder (95.1.2) is host

- Pro: Finer grained allocation; aggregation
- Con: More expensive lookup: longest prefix match
Route Aggregation

- Combine adjacent networks in forwarding tables
  - Helps keep forwarding table size down

- Send me anything with addresses beginning 200.23.16.0/20
- Send me anything with addresses beginning 199.31.0.0/16

Organization 0
- 200.23.16.0/23

Organization 1
- 200.23.18.0/23

Organization 2
- 200.23.20.0/23

Organization 7
- 200.23.30.0/23

Fly-By-Night-ISP

ISPs-R-Us

Internet
Most Specific Route

- But what if address range is not contiguous?

- Organization 0
  - 200.23.16.0/23

- Organization 2
  - 200.23.20.0/23

- Organization 7
  - 200.23.30.0/23

- Organization 1
  - 200.23.18.0/23

Fly-By-Night-ISP

"Send me anything with addresses beginning 200.23.16.0/20"

ISP-R-U's

"Send me anything with addresses beginning 199.31.0.0/16 or 200.23.18.0/23"

Internet

CSE 123 – Lecture 12: Aggregation
Longest Matching Prefix

- Forwarding table contains many prefix/length tuples
  - They *need not* be disjoint!
  - E.g. 200.23.16.0/20 and 200.23.18.0/23
  - What to do if a packet arrives for destination 200.23.18.1?
  - Need to find the longest prefix in the table which matches it (200.23.18.0/23)

- Not a simple table, requires multiple memory lookups
  - Lots and lots of research done on this problem
  - Our own George Varghese is the master of this domain
(Practical Algorithm to Retrieve Information Coded In Alphanumeric)

- Straightforward way to look up LMP
  - Arrange route entries into a series of bit tests
  - Worst case = 32 bit tests
  - Problem: memory speed is a bottleneck
For Next Time

- Finish up Project 1!
  - Lose a letter grade for each day late.