CS519: Computer Networks

Lecture 4, Part 1: Feb 16, 2004

*Internet Routing*
Routing and Forwarding Revisited
Routing has a huge design space

- Type of address
  - Hierarchical, flat, coordinate
- Dynamic versus static
- Centralized versus distributed
- Hop-by-hop versus source route
- Reactive versus proactive
- Multi-domain versus single-domain
Internet IP routing

- Type of address
  - Hierarchical, flat, coordinate
  - Dynamic versus static
  - Centralized versus distributed
  - Hop-by-hop versus source route
  - Reactive versus proactive
  - Multi-domain versus single-domain
Bridged Ethernet Routing
(versus IP Internet)

- Type of address
  - Hierarchical, flat, coordinate
  - Dynamic versus static
  - Centralized versus distributed
  - Hop-by-hop versus source route
  - Reactive versus proactive
  - Multi-domain versus single-domain
DNS Routing (versus IP Internet)

- Type of address
  - Hierarchical, flat, coordinate
- Dynamic versus static
- Centralized versus distributed
- Hop-by-hop versus source route
- Reactive versus proactive
- Multi-domain versus single-domain
Distributed Hash Table Routing (versus IP Internet)

- Type of address
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  - Dynamic versus static
- Centralized versus distributed
- Hop-by-hop versus source route
- Reactive versus proactive
- Multi-domain versus single-domain
Internet IP Routing Architecture

- The IP routing architecture is domain-based, with two tiers
  - Inter-domain and Intra-domain routing domains

Diagram:

- Inter-domain routing (BGP)
  - IS-IS
  - RIP
  - OSPF

Intra-domain Routing Protocols
Autonomous Systems (AS) (i.e. routing domains)

- But recall that the public Internet has a lot of structure
Transit ASs and Stub ASs (i.e. ISP and Site respectively)
Transit ASs and Stub ASs

- All transit ASs run BGP with each other
  - Border Gateway Protocol
- Stub ASs may or may not run BGP
  - Multi-homed Stubs typically will
- All ASs internally run an intra-domain routing protocol
- A large ISP may structure itself as multiple transit ISs
Why this 2-tier AS structure?

- Why not just have all routers run BGP?
- Answer: Autonomy
- Different domains have different internal routing requirements
  - Must be free to select a routing protocol to run internally
- Inter-domain and Intra-domain routing requirements are quite different
Inter-domain and Intra-domain routing requirements

- Inter-domain routing is mainly about policy
  - ISP A has a contractual obligation to use ISP B
  - ISP A wants to avoid ISP B
- Intra-domain routing is mainly about performance
  - Speed of convergence, traffic engineering, scalability
- This suggests very different approaches