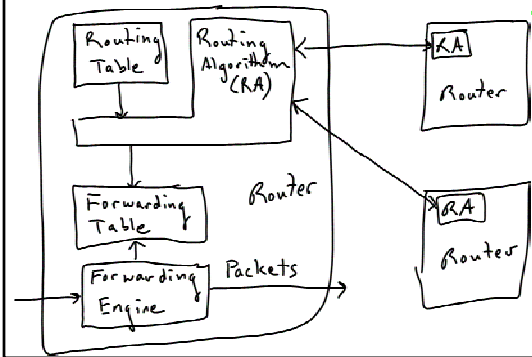


CS519: Computer Networks

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)

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

DNS Routing (versus IP Internet)

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

Distributed Hash Table Routing (versus IP Internet)

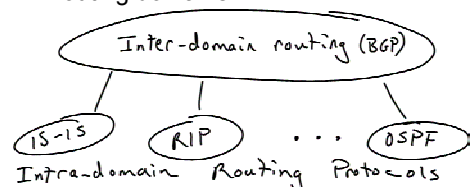
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- o Type of address
 - Hierarchical, flat, coordinate
- o Dynamic versus static
- o Centralized versus distributed
- o Hop-by-hop versus source route
- o Reactive versus proactive
- o Multi-domain versus single-domain

Internet IP Routing Architecture

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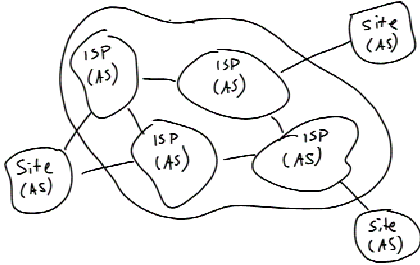
- o The IP routing architecture is domain-based, with two tiers
 - Inter-domain and Intra-domain routing domains



Autonomous Systems (AS) (i.e. routing domains)

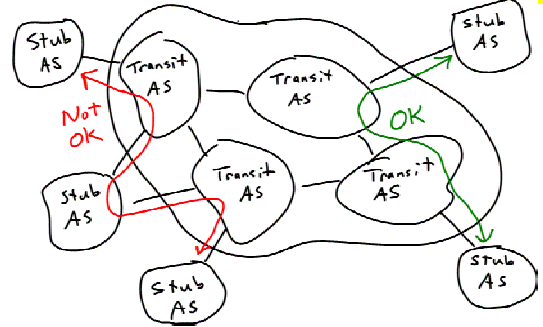
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- But recall that the public Internet has a lot of structure



Transit ASs and Stub ASs (i.e. ISP and Site respectively)

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Transit ASs and Stub ASs


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- 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?

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- 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

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- 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