

Internet Routing Protocols

Lecture 05

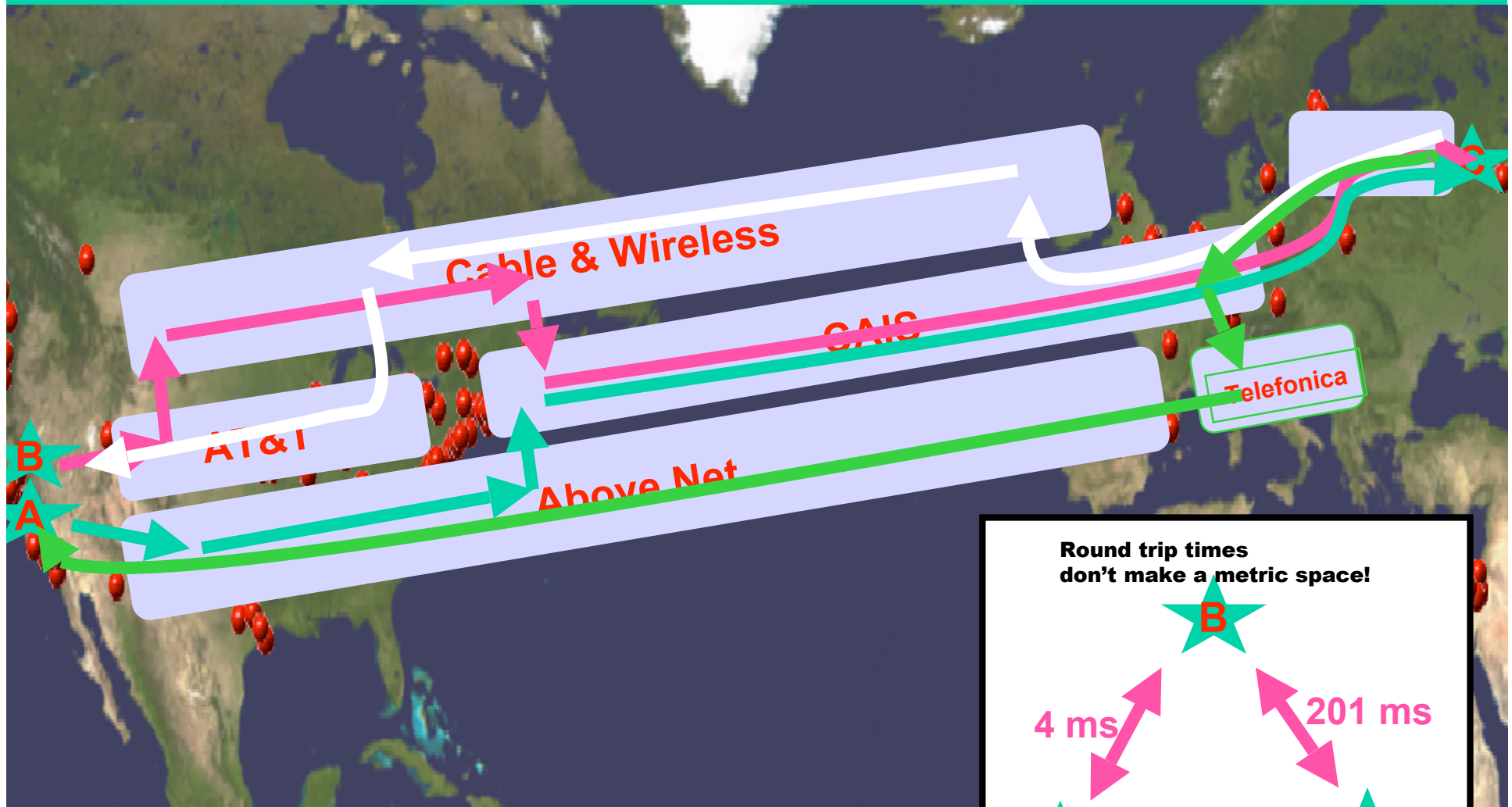
Loc/ID split to the Rescue?

Advanced Systems Topics

Lent Term, 2010

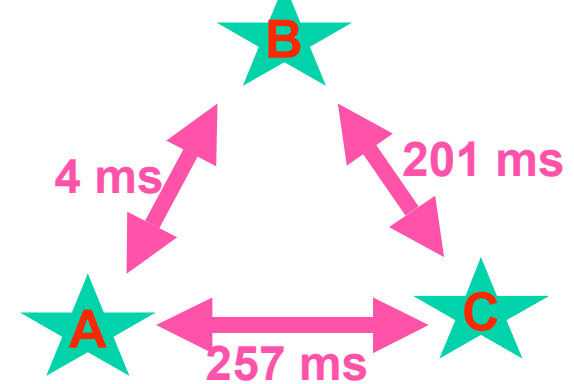
Timothy G. Griffin
Computer Lab
Cambridge UK

Inter-domain routing is often asymmetric



★ **A** = HP Palo Alto ★ **C** = Moscow State U
★ **B** = Intel Berkeley

Round trip times
don't make a metric space!



What is causing BGP Routing Table Growth?

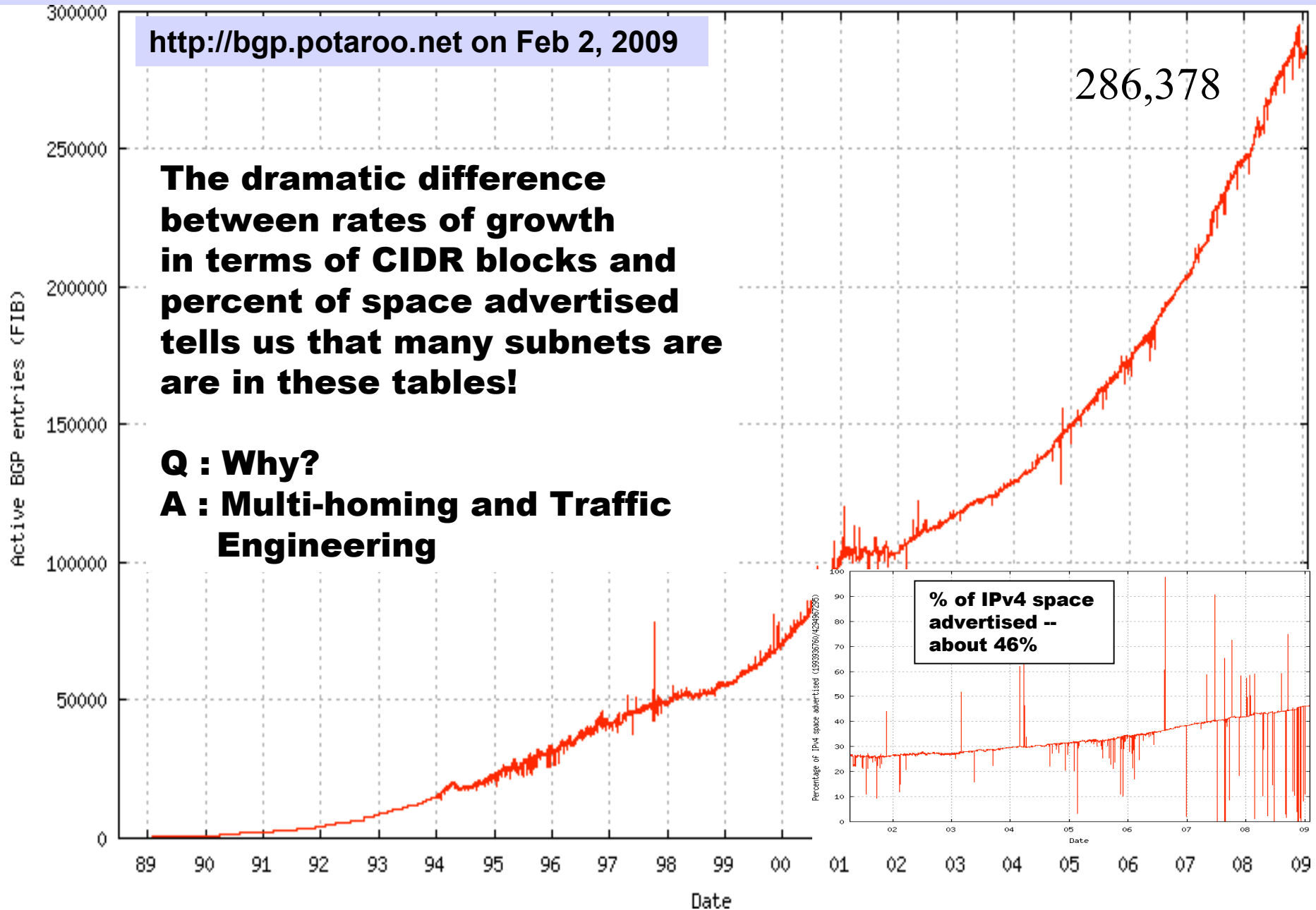
<http://bgp.potaroo.net> on Feb 2, 2009

286,378

**The dramatic difference
between rates of growth
in terms of CIDR blocks and
percent of space advertised
tells us that many subnets are
are in these tables!**

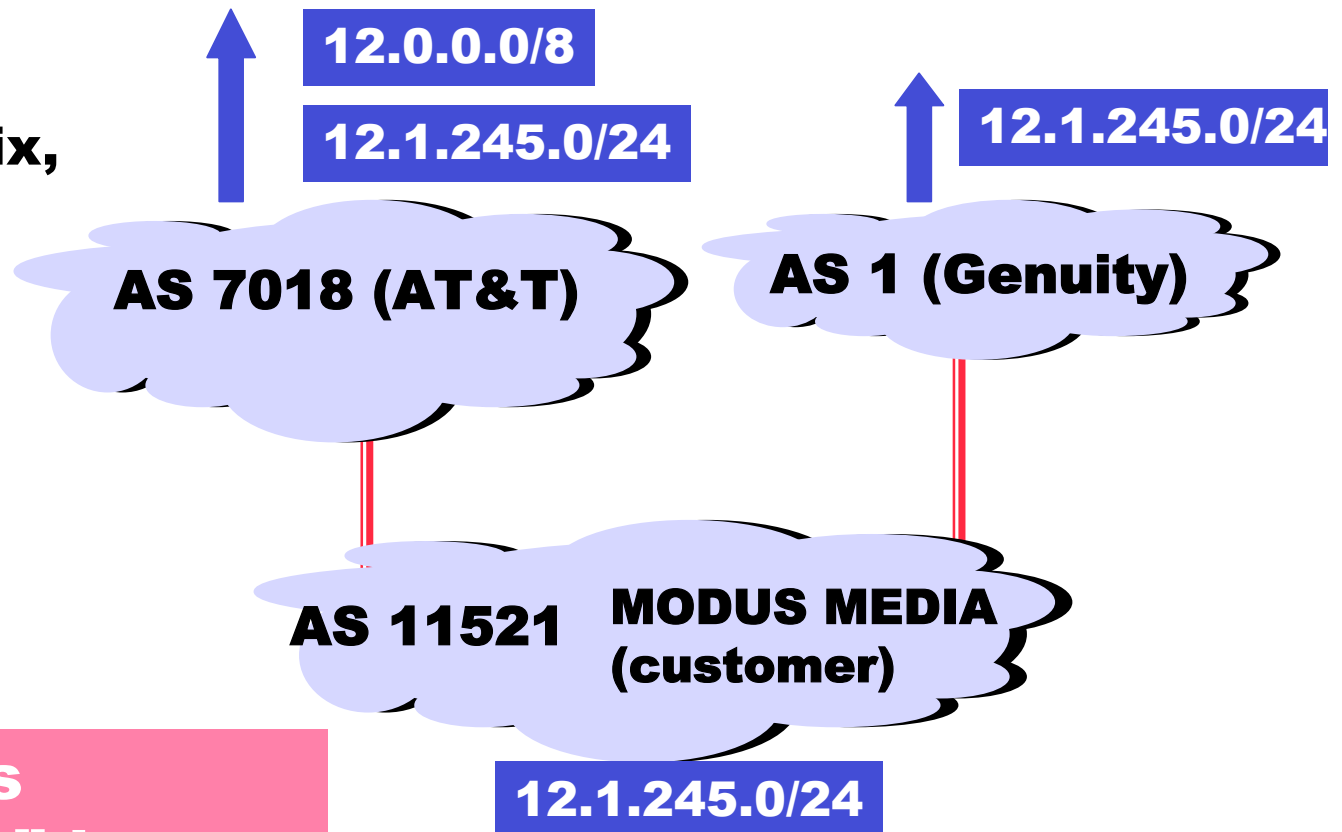
Q : Why?

**A : Multi-homing and Traffic
Engineering**



Deaggregation Due to Multi-homing

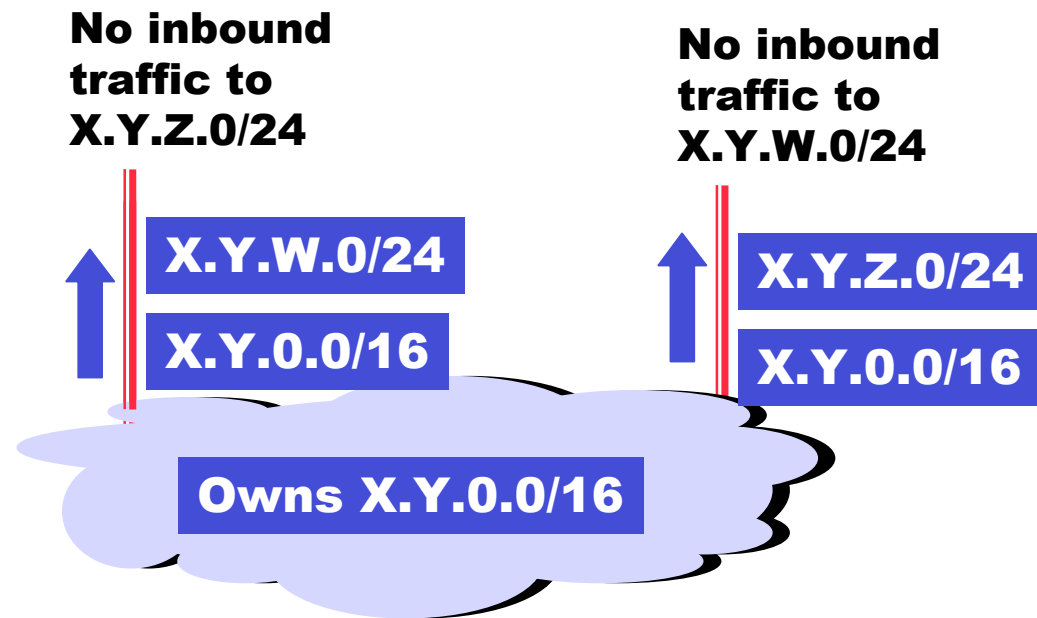
If AT&T does not announce the more specific prefix, then traffic to MODUS MEDIA will go through Genuity because it has a longer match....



MODUS MEDIA is “punching a hole” in the 12.0.0.0/8 CIDR block

Deaggregation Due to “Traffic Engineering”

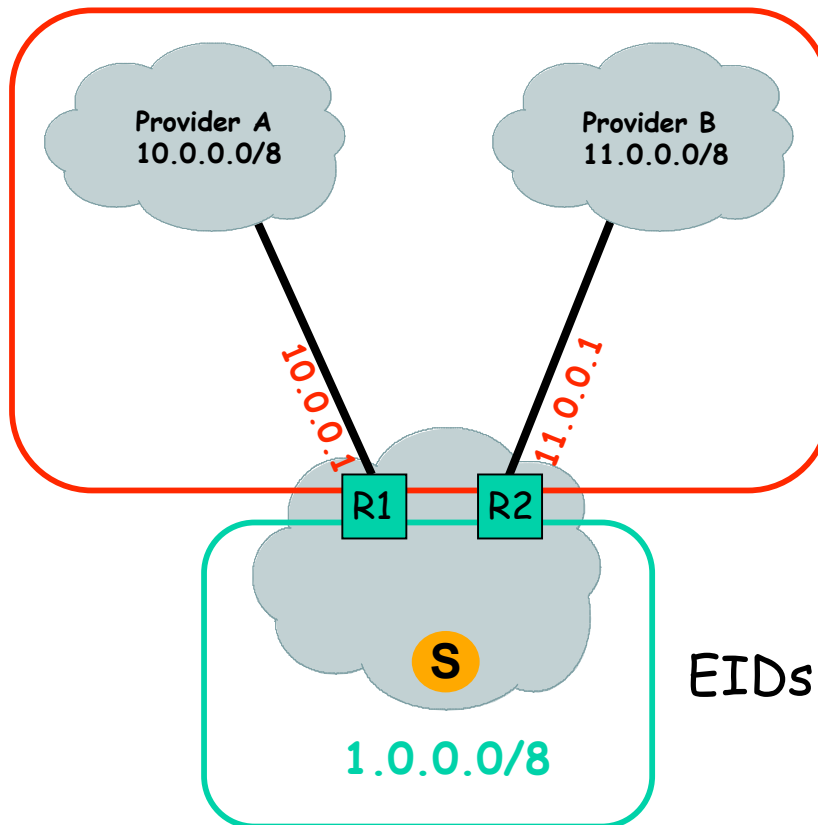
Remember: control of inbound traffic (with outbound routes) is very difficult, so network operators use whatever hacks they can get their hands on!



Loc/ID Split as an Architectural Solution?

- Problem: IPv4 and IPv6 addresses have overloaded semantics
- Conceptually, we have two distinct address spaces
 - Endpoint IDs (EIDs) --- public IP address space
 - Routing Locators (RLOCs) --- infrastructure (backbone routers, links)
- These are conflated today, and EIDs aggregation is failing since it is not congruent with infrastructure topology
- Basic idea of Loc/ID split :
 - Packet to EID destination d hits an Ingress Tunnel Router (ITR) in backbone
 - The ITR finds a mapping (somehow!) of EID d to Locator l
 - The ITR encapsulates packet, sends to l
 - Encapsulated packet reaches Egress Tunnel Router (ETR) at l, which strips off encapsulation and sends traffic on to d
- A Loc/ID split would allow
 - topological addressing for Locators
 - Much smaller routing tables in the backbone
 - More control over inbound traffic (via the mapping function)
- But, would require
 - Control plane: A new means of mapping EIDs to Locators
 - Data plane : Encapsulation in the backbone

Loc/ID split



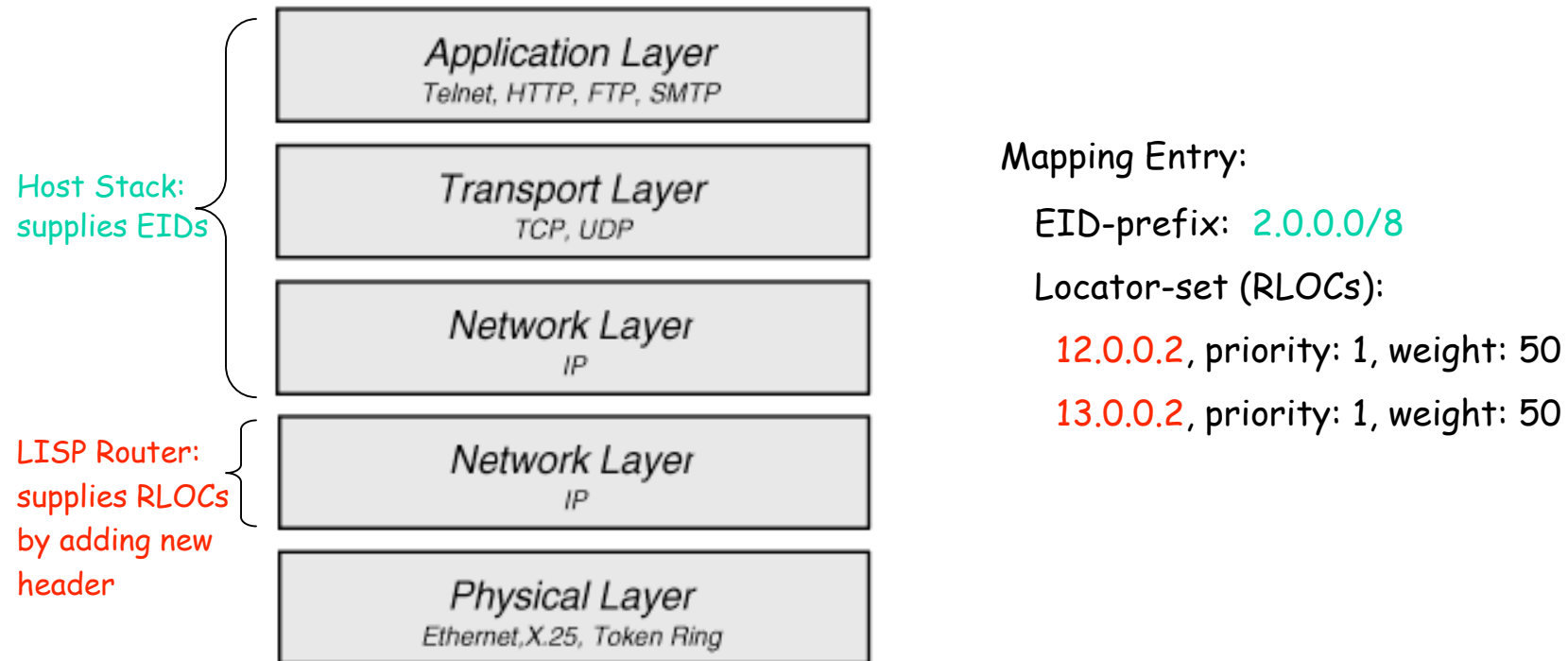
RLOCs used in the core

Mapping Database Entry:

1.0.0.0/8 -> (10.0.0.1, 11.0.0.1)

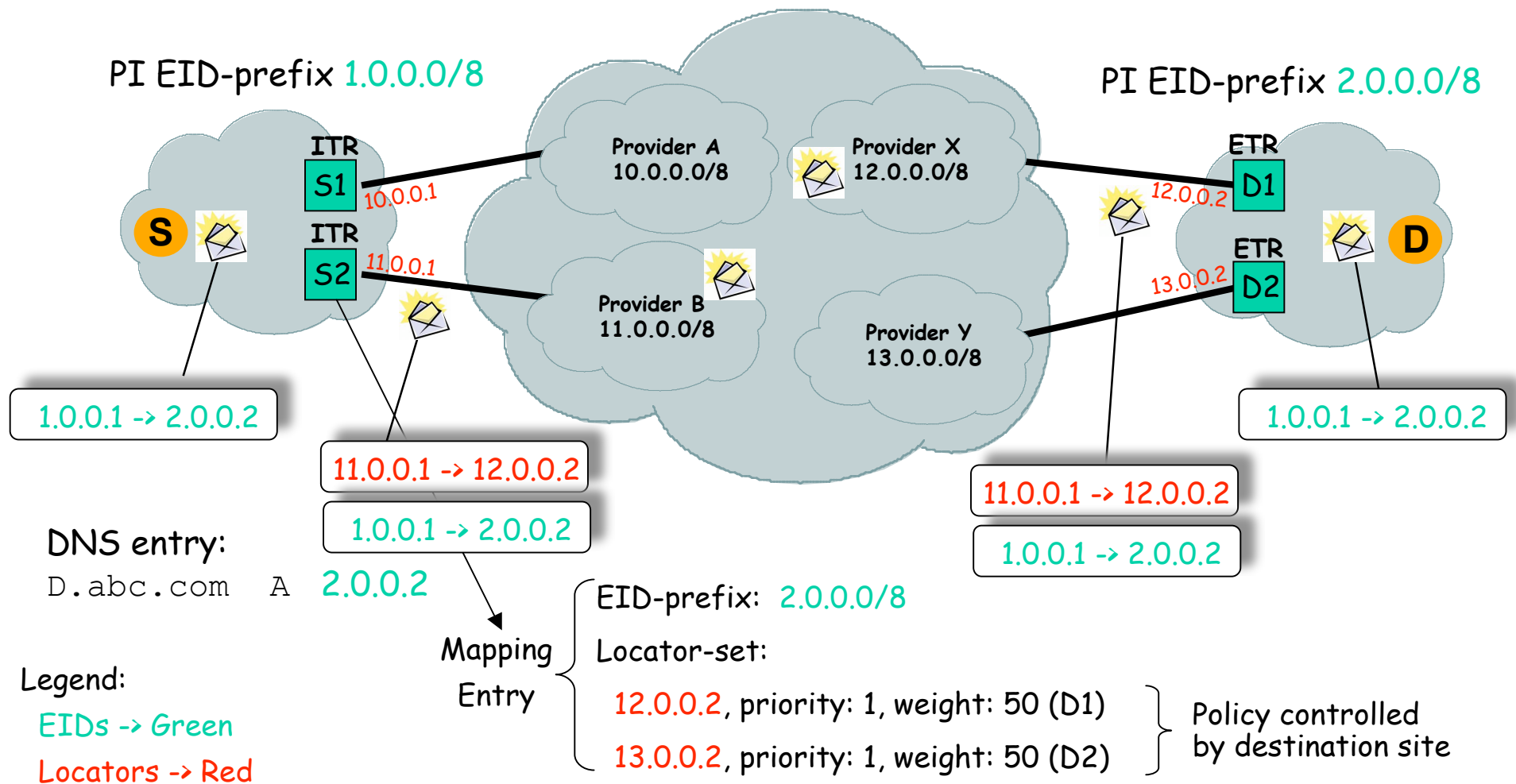
EIDs are inside of sites

Use Map-n-Encap



**The universal solution to all problems in CS :
introduce a layer of indirection!**

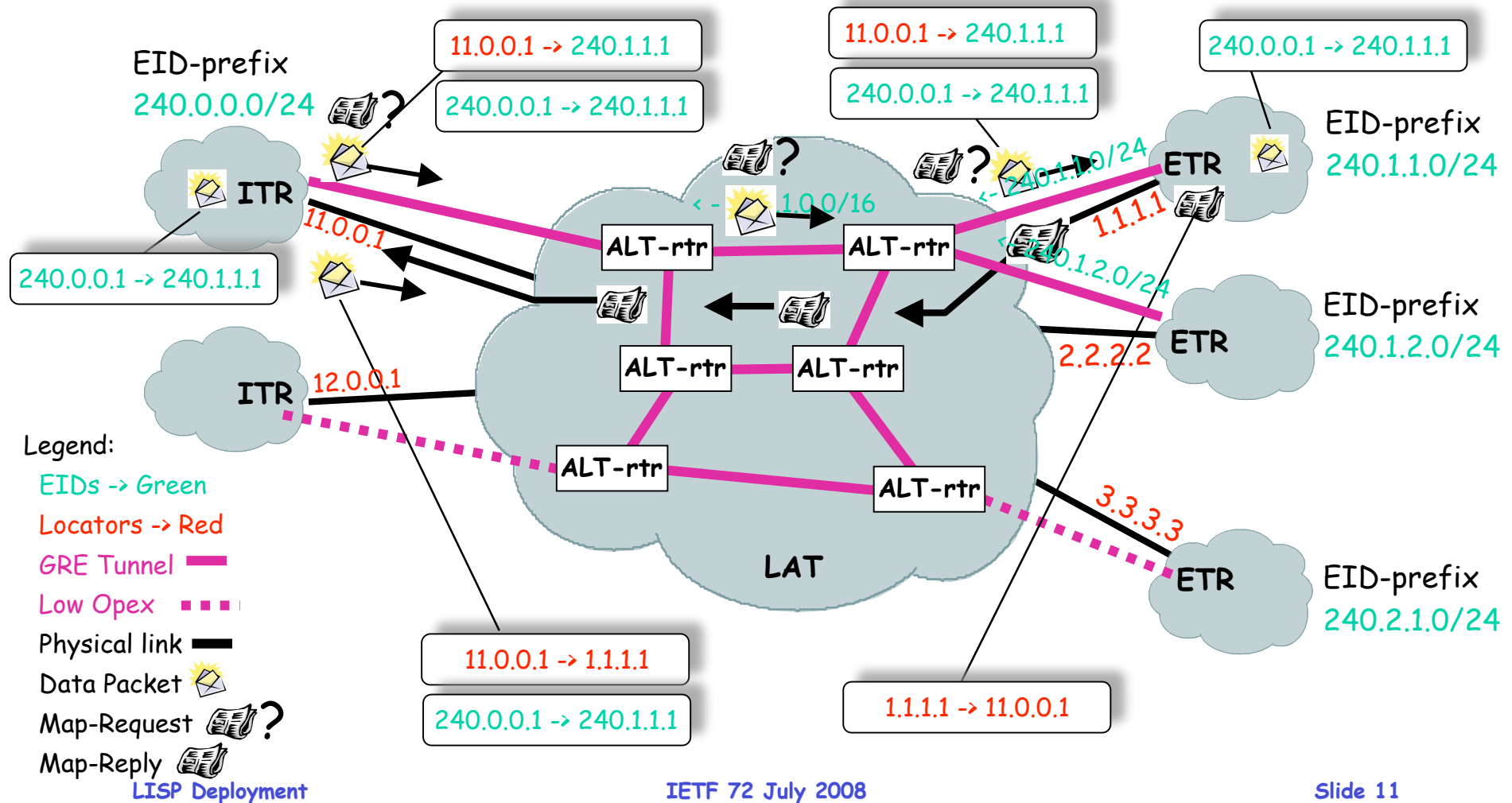
Unicast Packet Forwarding



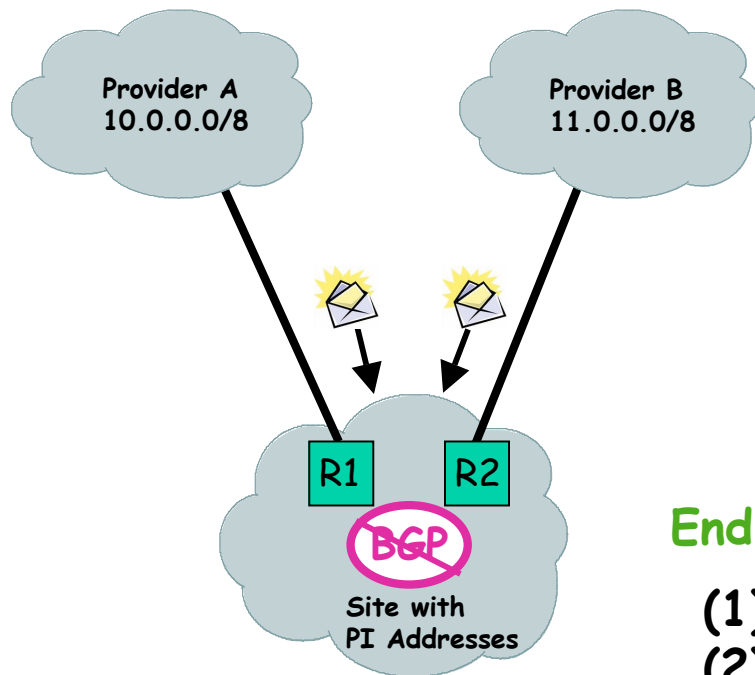
Many problems, many solutions

- A mapping service needs to be implemented
 - Current front-runner is called BGP-ALT
 - Idea : Run two instances of BGP
 - One BGP instance runs on real topology of locators
 - Another (alternate universe) instance of BGP runs on a virtual (overlay) network constructed with tunnels.
 - Assumption (untested, but reasonable) : since this is not tied to real topology, the EID space can be highly aggregated
 - Virtual network is used only for sending mapping requests to mapping servers
- A protocol is needed to communicate mapping info (request/reply)
 - Current front-runner is the Locator Identifier Split Protocol (LISP)
 - Network-based solution
 - No changes to hosts whatsoever
 - No new addressing changes to site devices
 - Very few configuration file changes
 - incrementally deployable
 - Address family agnostic
- Transition
 - Too complicated to get into!

LISP+ALT Control Plane



Other Benefits



Provider Benefit

- (1) Improve site multi-homing
- (2) Improve provider traffic engineering
- (3) Reduce size of core routing tables
- (4) This implies much less update "churn"

End Site Benefit

- (1) Easier Transition to IPv6
- (2) Change provider without address change
- (3) Better control of inbound traffic

For more Loc/Id split info

- Routing Research Group (RRG)
 - <http://tools.ietf.org/group/irtf/trac/wiki/RoutingResearchGroup>
 - LISP Internetworking
 - <http://www.lisp4.net/>
- Some slides of this lecture were lifted from this site