



A perspective on Internet Routing Scaling



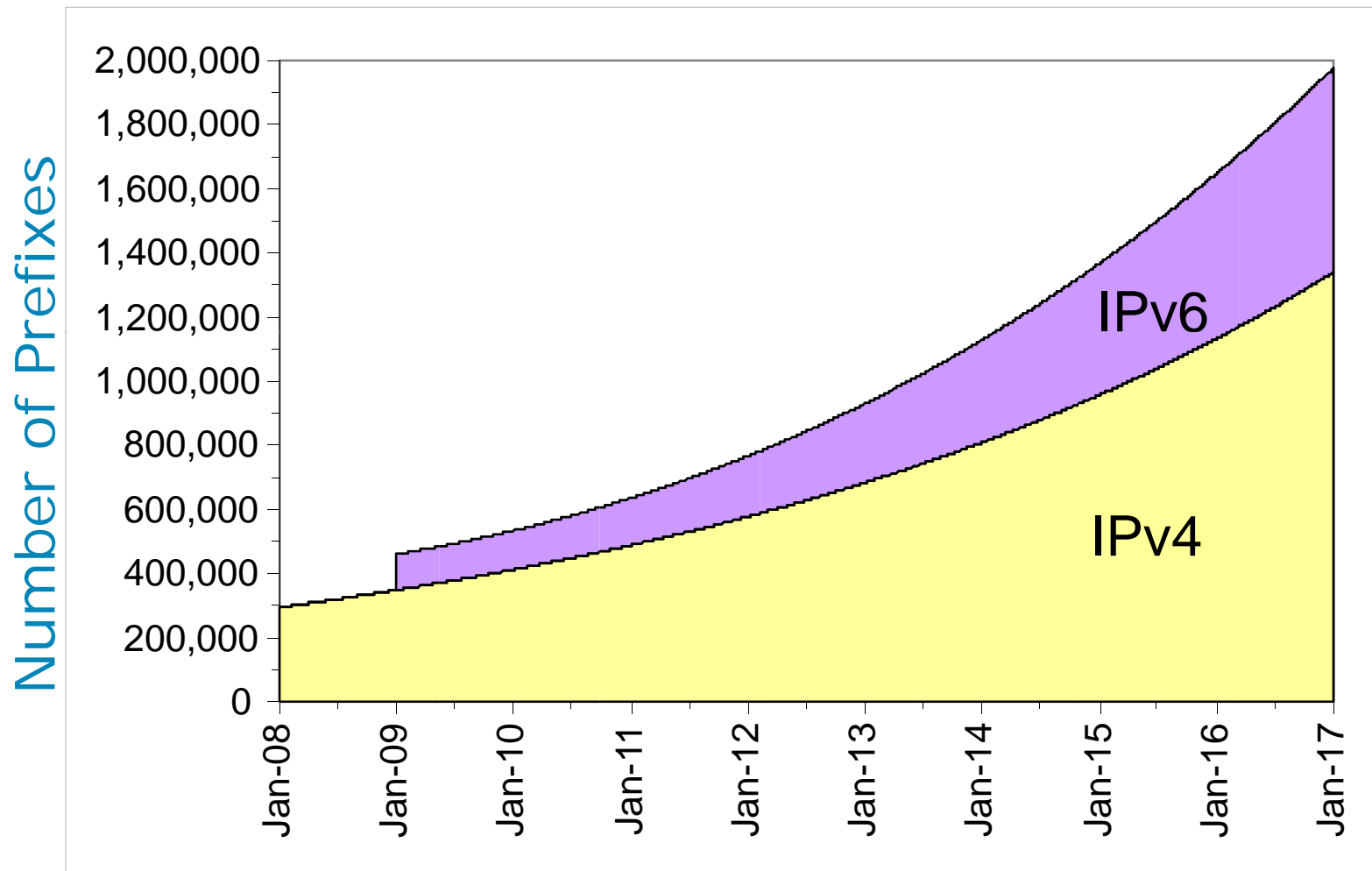
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Agenda

- **Route growth projectons and it's accuracy**
- **Internal/router based scaling solutions**
- **Network based solutions**
 - Local intra-domain solution
 - Global end to end solutions
- **Host based solutions**

Route growth projectons and it's accuracy



*Assumes polynomial growth for both IPv4 and IPv6 (based on historical trend)
Assumes one IPv6 route consumes 2x the IPv4 memory*

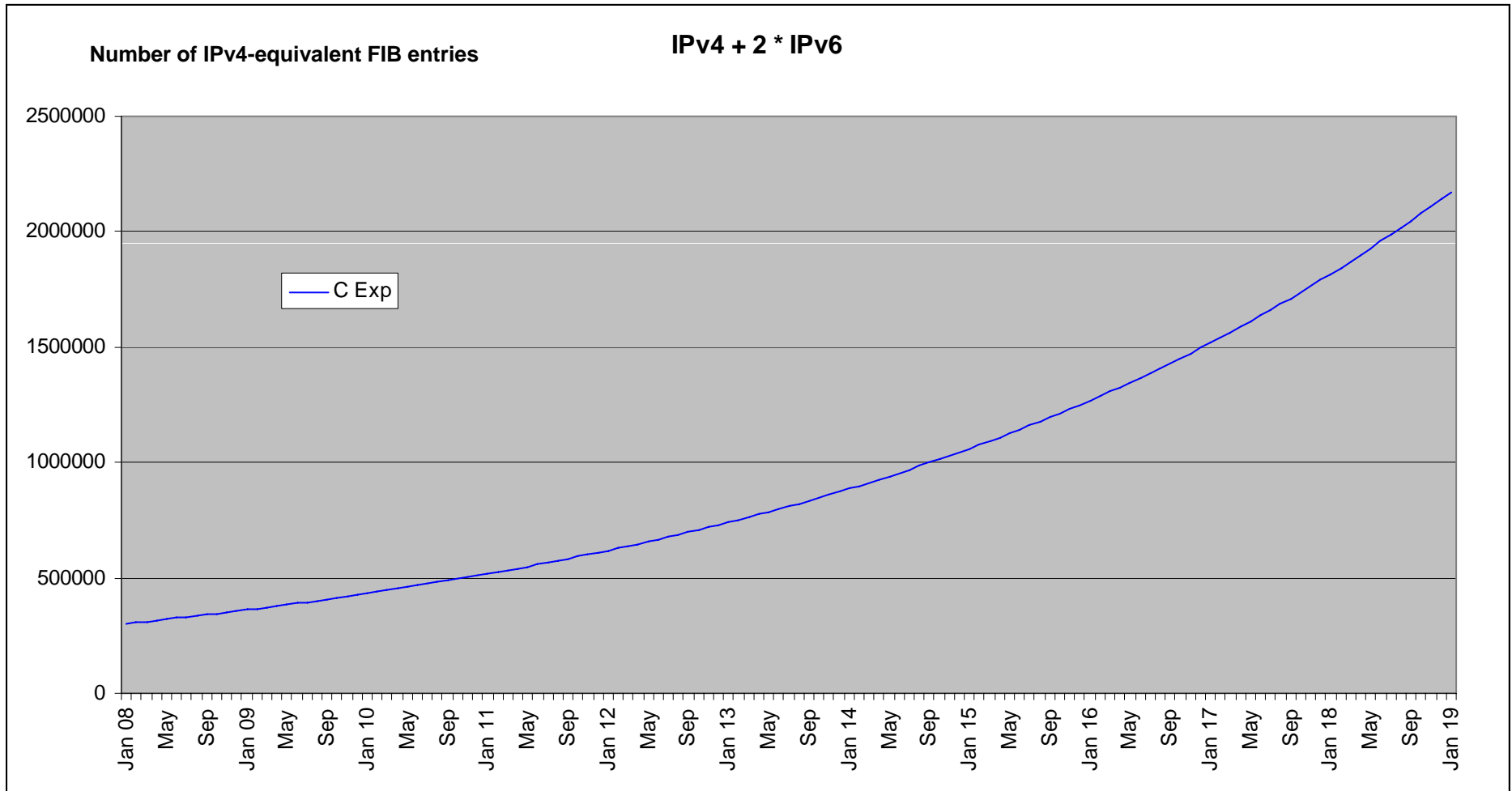
Route growth projectons and it's accuracy

- IPv4 routes growing at rate of approximately 4000 routes/month.
- Global Internet routes growing at rate of approximately 25K/ year.
- IPv4 address depletion may contribute to the increase in number of more specific IPv4 prefixes in the table
- Multihoming is still growing ... Cisco IOS architecture team is proposing a **new BGP „aggregation-info” attribute** to address customer's multihoming topologies with no global Internet table growth impact.

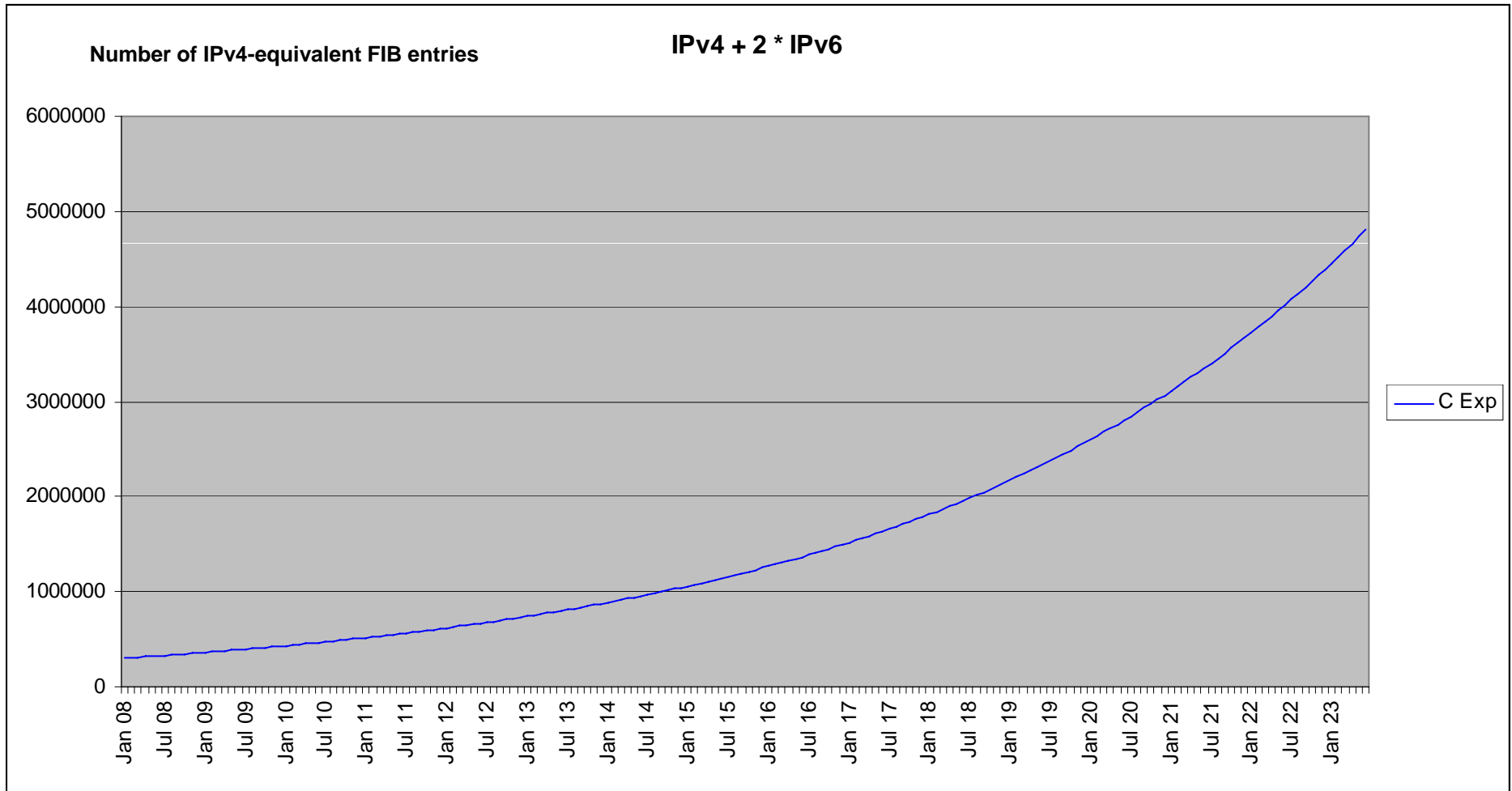
Route growth projectons and it's accuracy

- IPv4 address block trading may slow down IPv6 increase
- Various solutions of IPv6 and IPv4 co-existance or Carrier Grade NATs, A+P,IVI may also contribute to less aggressive IPv6 global introduction.
- Europe and Asia much more willing and open to adopt IPv6 then North/South America.
- ..

Cisco's estimate on FIB size growth projection



Cisco's estimate on FIB size growth projection



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Router based scaling solutions

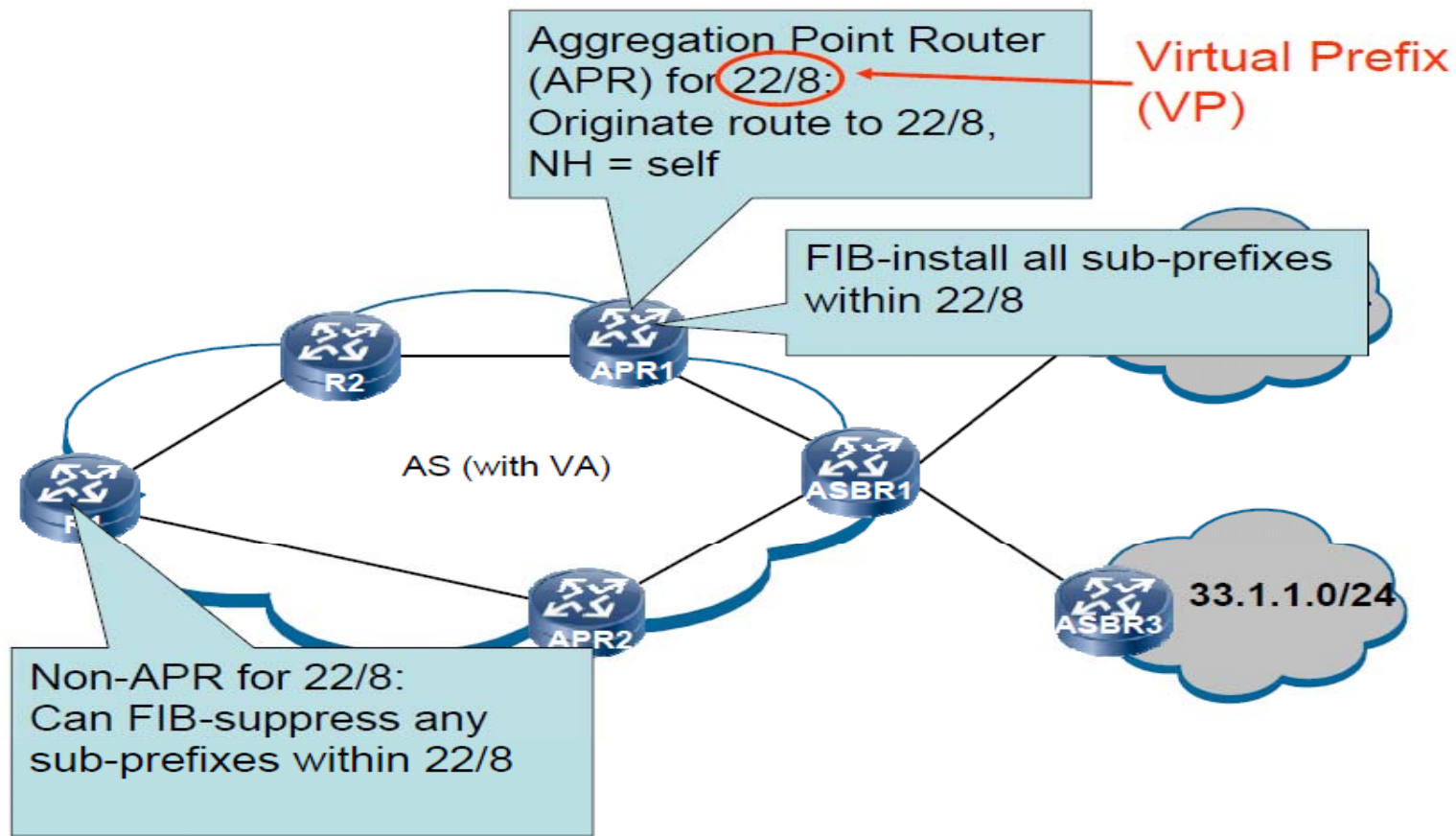
- Selective table download (for VPN routes, for IPv4 vs IPv6)
Gain up to 50%
- FIB mtrie stride change 16-8-8 to 16-4-4-4-4 (IOS 12.0(33)S & 3.7 for XR) → great forwarding memory savings for Internet routes up to 70% !!!
- FIB compression (various proposals in the industry)
Estimated savings in the range of 40% for Internet routes, for VPN routes savings do vary depending on the VPN routing.

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Network based solutions

- Intra-domain **virtual aggregation**
- <http://www.ietf.org/proceedings/75/slides/grow-1.pdf>

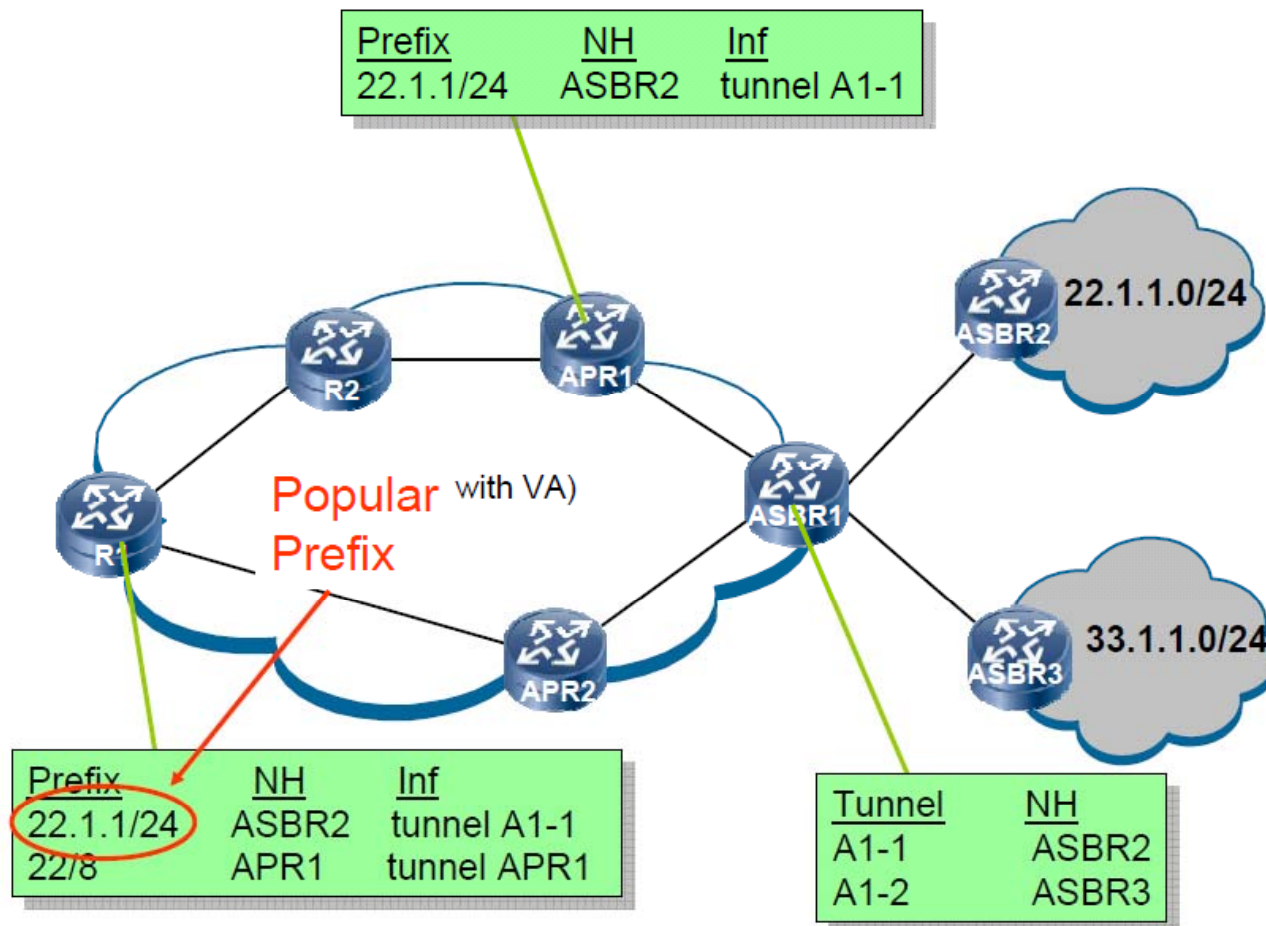


Stockholm IETF, July 2009

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Network based solutions

- Intra-domain **virtual aggregation**
- Concept of „popular prefixes”



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Network based solutions

- Inter-domain tunneling based proposals
- Routing Reserach IRTF WG ongoing work

<http://trac.tools.ietf.org/group/irtf/trac/wiki/RoutingResearchGroup>

- LISP (now a new experimental IETF WG)

<http://www.ietf.org/dyn/wg/charter/lisp-charter.html>

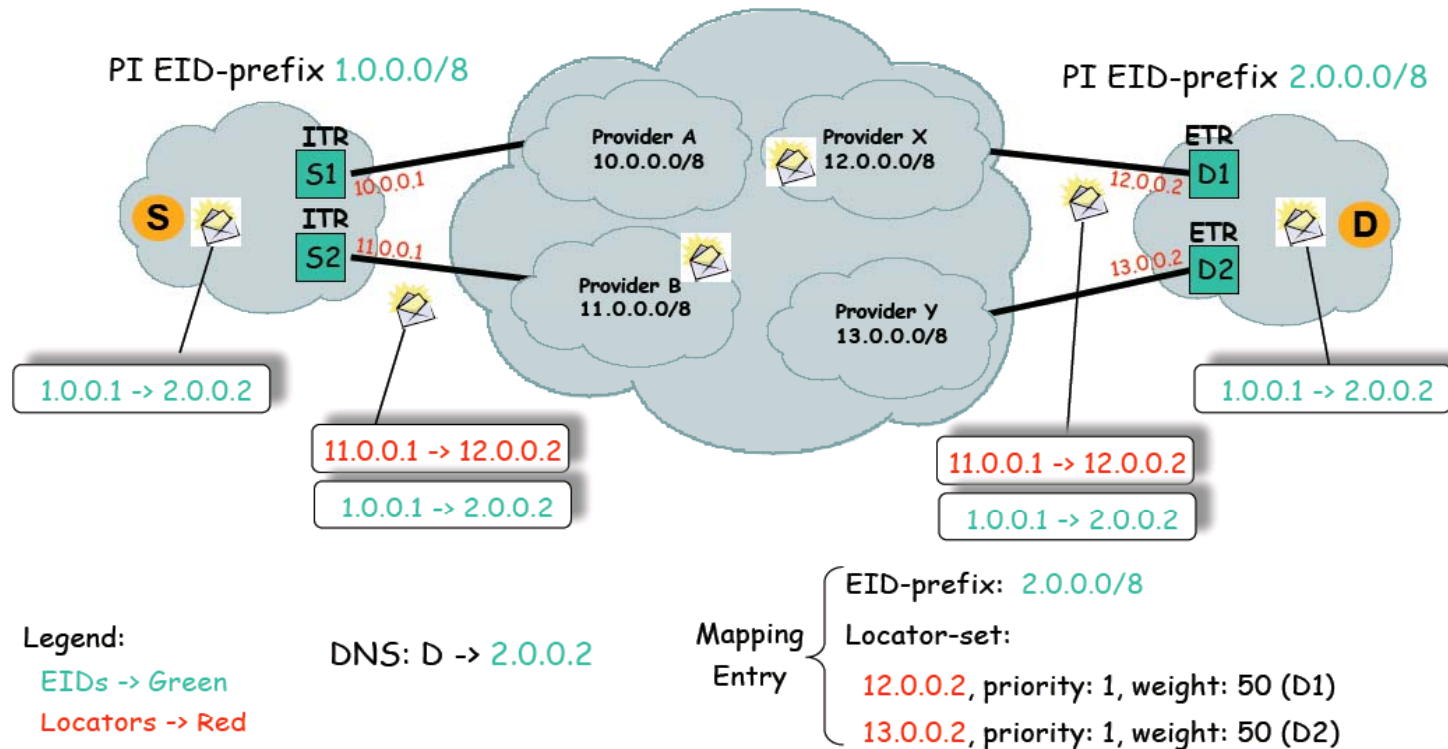
- Other proposals:

- APT (merging with VA), CRIO (similar to inter-domain VA)
- GSE
- Proxied-shim6, proxied-HIP
- IVIP
- Six/One

Network based solutions

- Inter-domain tunneling based proposals
- LISP

Packet Forwarding



LISP Tutorial

Networkers Barcelona - Jan 2008

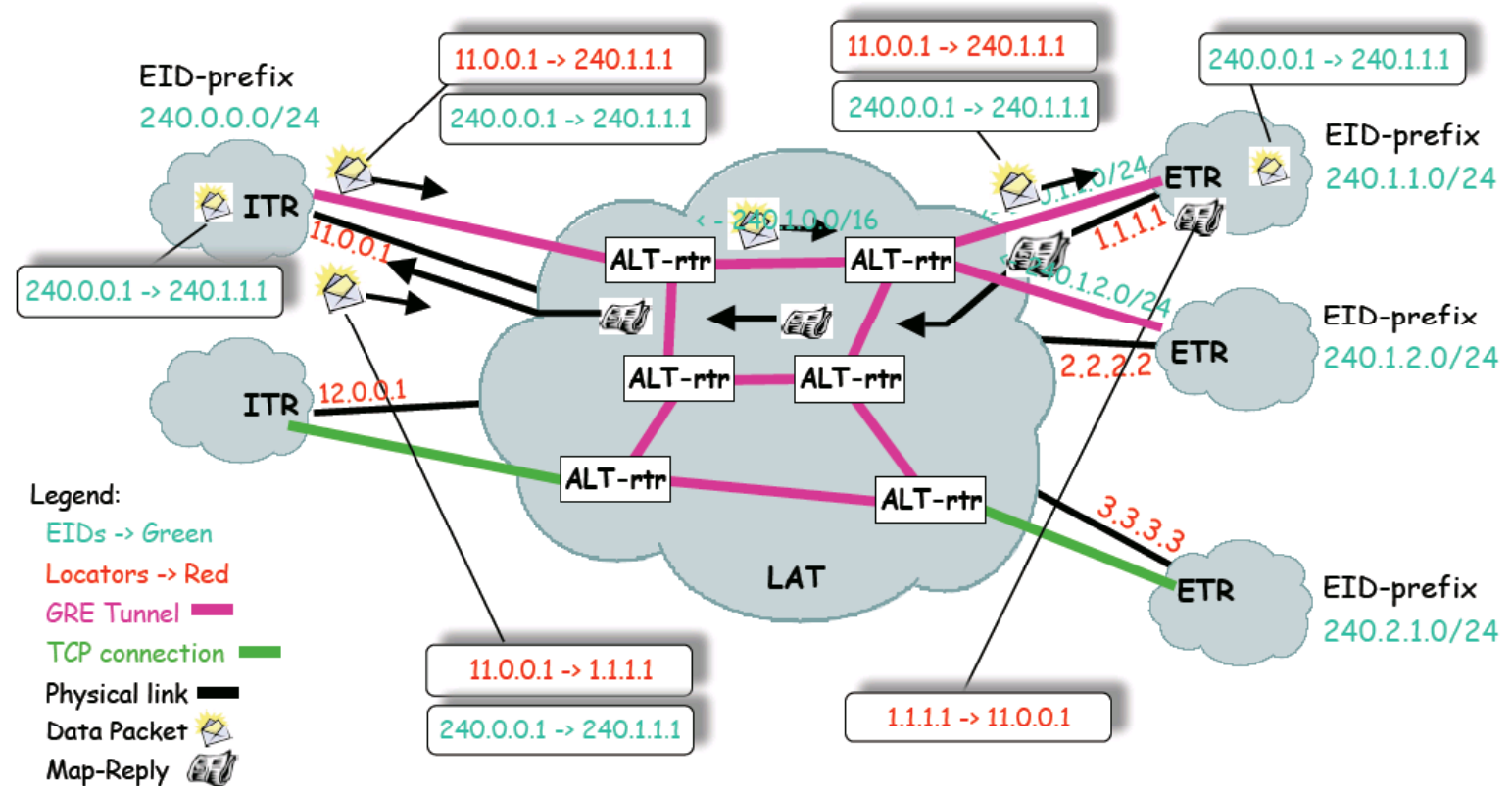
Slide 15

Network based solutions

- Inter-domain tunneling based proposals

- LISP

The LISP Alternate Topology



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Host based solutions

- Shim6, HIP, Six/One, ILNP

ILNP:

<http://www.ietf.org/proceedings/72/slides/RRG-4.pdf>

- ILNP – New namespace proposal
- 64+64 IPv6 address division (routing locator + identifier)
- Simpler 64 bit only lookup required in the transit routers
- Transport session state contains only the identifier
- Requires DNS enhancement
- Supports mobility
- Does not require any new network wide changes
- Can be transparently deployed



Conclusions ...

