Abilene IPv6 Deployment

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Abilene IPv6 Service

- Native GSR Dual-stack   (5/2002-12/2002)
- Native T640 Dual-stack   (8/2002-Present)
- 7200 Tunnel Service   (1/2000-Present)

- Routing Filters match IPv4 UNI Service.
- No AUP (IE: Commercial allowed.)
- 102 Peers – 37 Support IPv6

Address Space

- /32   2001:468::/32
- /24   3FFE:3700::/24

- Responsible for a LOT of addresses.
- Reverse DNS Duties

Routing Policy
eBGP

- EXACT Same Policy as v4

- Only accept /40's or /48's from customers

- Accept any prefix from peer nets

- Only pass /16 through /32 to peers/customers

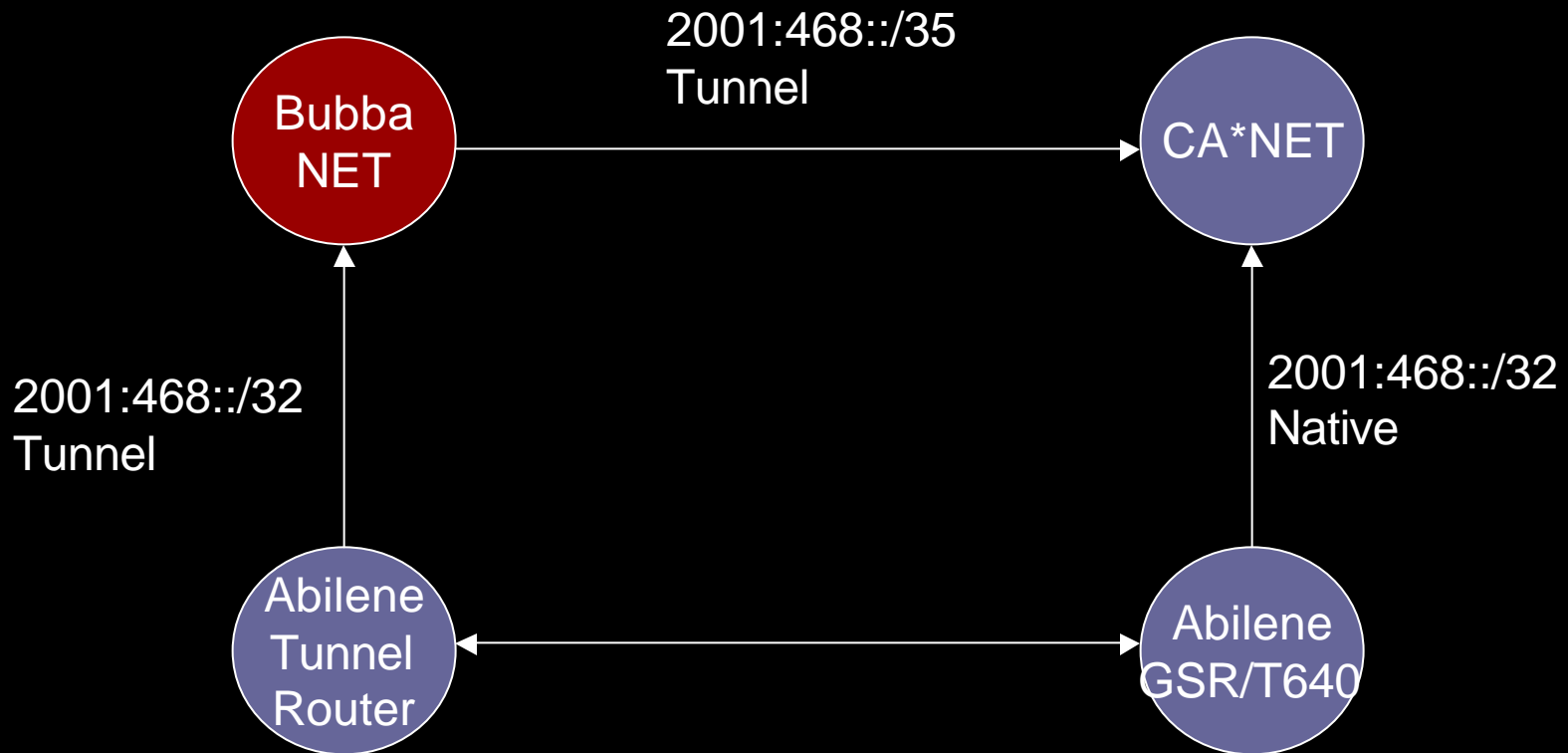- Only accept /16 through /35 from tunnel

- SANITY

Routing Design
IGP

- **Stage 1**
  - OSPF/IPv4   ISIS/IPv4 & IPv6
  - OSPF Preferred via distance/preference
- **Stage 2**
  - ISIS runs IPv4 & IPv6
  - ISIS preferred via distance/preference
- **Stage 3**
  - Removal of OSPF

Problems – Ghost Routes

- BGP Withdraw not Honored, "steals" traffic.

- Advertise a /35, Advertise a /32, withdraw the /35.

- Someone, somewhere, does not honor the withdraw.

- Longest Match: Traffic flows through /35 peer.

- Lots of Tunnels, New Router Code, Lots of router vendors compound the problem.

Problems – Ghost Routes

Bubba NET

2001:468::/35
Tunnel

CA*NET

2001:468::/32
Tunnel

2001:468::/32
Native

Abilene Tunnel Router
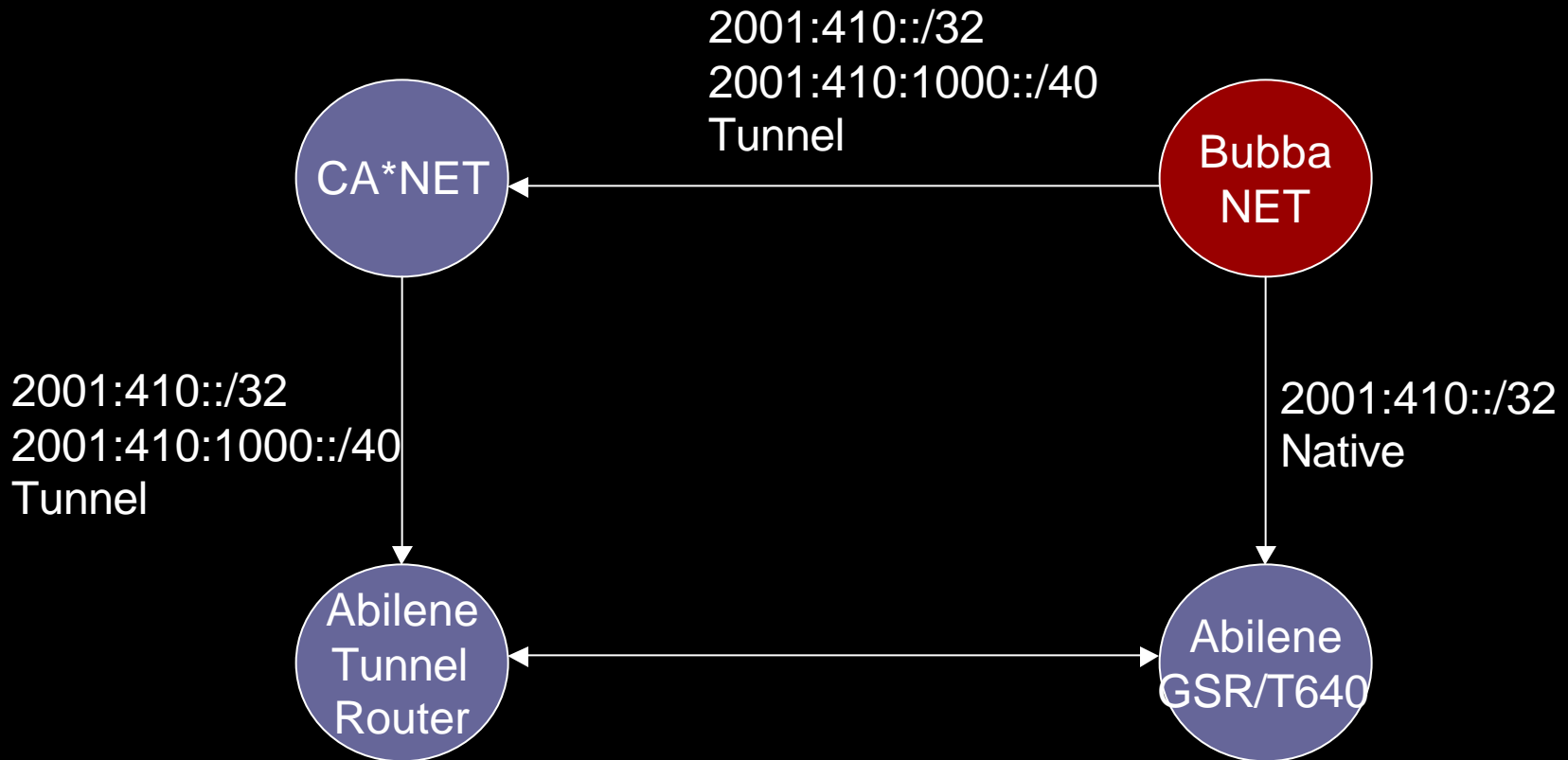
Abilene GSR/T640

Problems – More Specific Routes

- Mis-configured routing "steals" traffic.

- A bad BGP prefix list causes more problems due to the number of machines a prefix represents.

- BUBBA Aggregate advertised to Abilene. BUBBA Aggregate and longer prefix advertised to CA*NET. CA*NET passes BUBBA to Abilene. Traffic flows to CA*NET.

Problems – More Specific Routes

2001:410::/32
2001:410:1000::/40
Tunnel

CA*NET

Bubba NET

2001:410::/32
2001:410:1000::/40
Tunnel

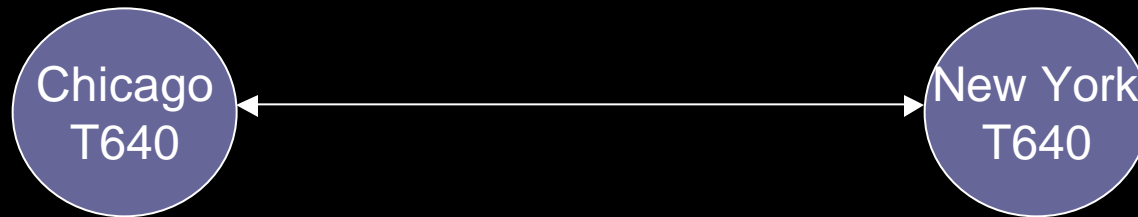2001:410::/32
Native

Abilene Tunnel Router

Abilene GSR/T640

Problems – IGP Distance/Preference (OSPF->ISIS migration/Redistribute)

- Cisco: OSPF 110, ISIS 115

- Juniper: OSPF: 10 (Internal) 150 (external)
- Juniper: ISIS: 15 (L1 internal), 18 (L2 internal), 160 (L1 external), 165 (L2 external)

Problems – IGP Distance/Preference (OSPF->ISIS migration/Redistribute)

Chicago T640 ←———————→ New York T640
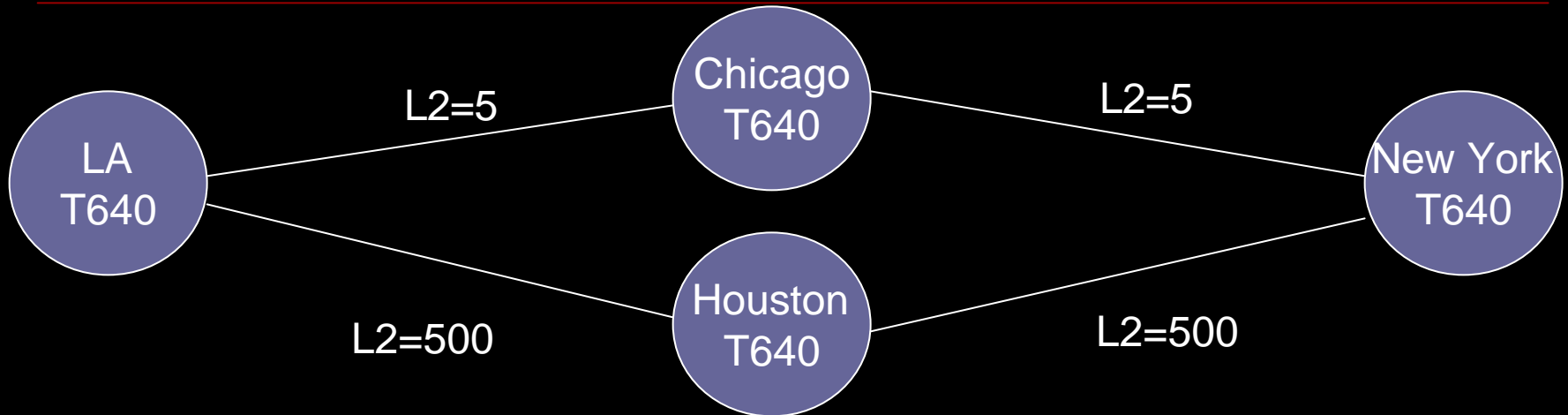
OSPF
134.68.0.0/16 NH=New York

ISIS
134.68.0.0/16 NH=Chicago

BGP Next-Hop can be an IGP route (without NEXT-HOP self)
ISIS Internal Preferred over OSPF External

Problems – ISIS Levels/Metrics

This is an equal cost path from NY to LA. This causes massive
High-bandwidth TCP problems.

Problems – IPv6 Typos

- hstn-gsr#sh ipv6 route is-is | include 2001:468:FF
- I2 2001:468:FF:FC1::/64 [115/1725]
- <…>
- I2 2001:468:FF:1D8D::/64 [115/101455]
- I2 2001:468:FF:1DC1::/64 [115/101455]
- I2 2001:468:FF:1DC2::/64 [115/101455]
- I2 2001:468:FF:1DC3::/64 [115/1456]
- I2 2001:468:1E4A::/64 [115/908]
- hstn-gsr#

Problem – BGP Next Hops

- Sloppy BGP Configs can cause Next-Hop Problems …

- All Our IPv4 BGP Next-Hops were 32.1.4.104 ?!
- Hmmm … That's 2001:0468 in Hex …

- IPv4 Prefixes passed over IPv6 BGP sessions, with the NH being an IPv6 address converted to IPv4.

More Fun with Next Hops

- 2001:268::/32   >fe80::280:42ff:fe11:6620
- 2001:270::/35   >fe80::280:42ff:fe11:6620
- 2001:278::/32   >fe80::280:42ff:fe11:6620
- 2001:238:100::/41 >fe80::280:42ff:fe11:6620
- 2001:238:200::/41 >fe80::280:42ff:fe11:6620
- 2001:238:882::/48 >fe80::280:42ff:fe11:6620
- 2001:238:f82::/48 >fe80::280:42ff:fe11:6620 l
- 2001:238:f84::/48 >fe80::280:42ff:fe11:6620
- 2001:238:f85::/48 >fe80::280:42ff:fe11:6620

Problems – v6 BGP needs v4

- BGP has a 32-bit "Router-Id" Field

- Filled with an IPv4 address
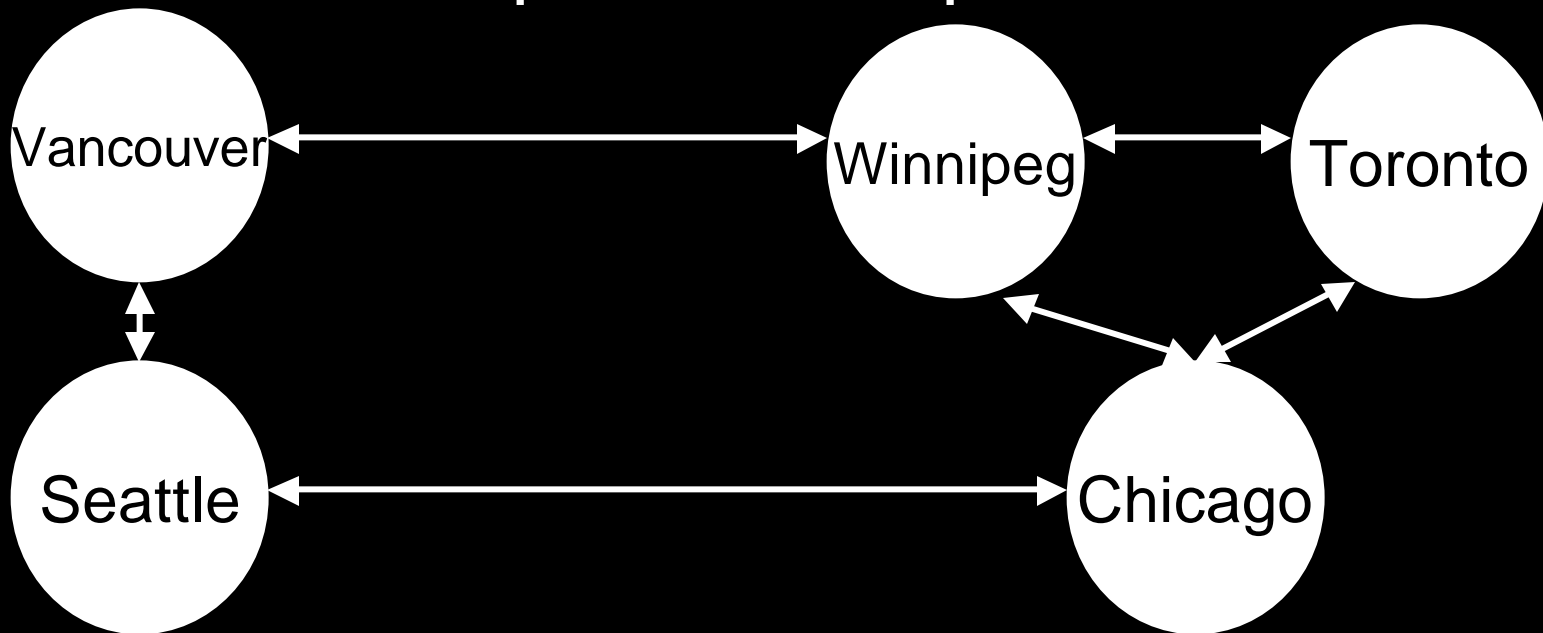
- Need one v4 address per router

Ongoing Issues

- MIB issues

- Operational issues – No Monitoring/CHIN

- Packet Filtering limited to first header

- How much traffic is there?

- Which prefixes do we pass?

- Engineers Scared to Death of IPv6

- Addressing Plan

Ongoing Issues

■ What do we pass to our peers?

Vancouver ⟷ Winnipeg ⟷ Toronto

Seattle ⟷ Chicago

Chicago ⟷ Winnipeg, Chicago ⟷ Toronto

Vancouver ⟷ Seattle

CA*NET, GEANT, NYSERNet, University of Oregon

Internet2/Abilene Resources

- **I2 IPv6 Working Group**
  - ipv6.internet2.edu
- **Abilene NOC**
  - www.abilene.iu.edu
- **Abilene Router Proxy**
  - loadrunner.uits.iu.edu/%7Erouterproxy/abilene/
- **Abilene Visible Backbone**
  - loadrunner.uits.iu.edu/~gcbrowni/Abilene/