

Technologies to aid IPv6 Transition and Integration



ISP Workshops

Caveat

- The content in this slide set is largely outdated
 - Work in progress to modernise according to current state-of-the-art in transition work
 - Philip Smith – Dec 2011.

IETF Working Groups

□ “6man”

- The group is for the maintenance, upkeep, and advancement of the IPv6 protocol specifications and addressing architecture.
- <http://datatracker.ietf.org/wg/6man/charter/>

□ “v6ops”

- Develops guidelines for the operation of a shared IPv4/IPv6 Internet and provides operational guidance on how to deploy IPv6 into existing IPv4-only networks, as well as into new network installations.
- <http://datatracker.ietf.org/wg/v6ops/charter/>

IETF Working Groups

□ “behave”

- Creates documents to enable NATs to function in as deterministic a fashion as possible.
- <http://datatracker.ietf.org/wg/behave/charter/>

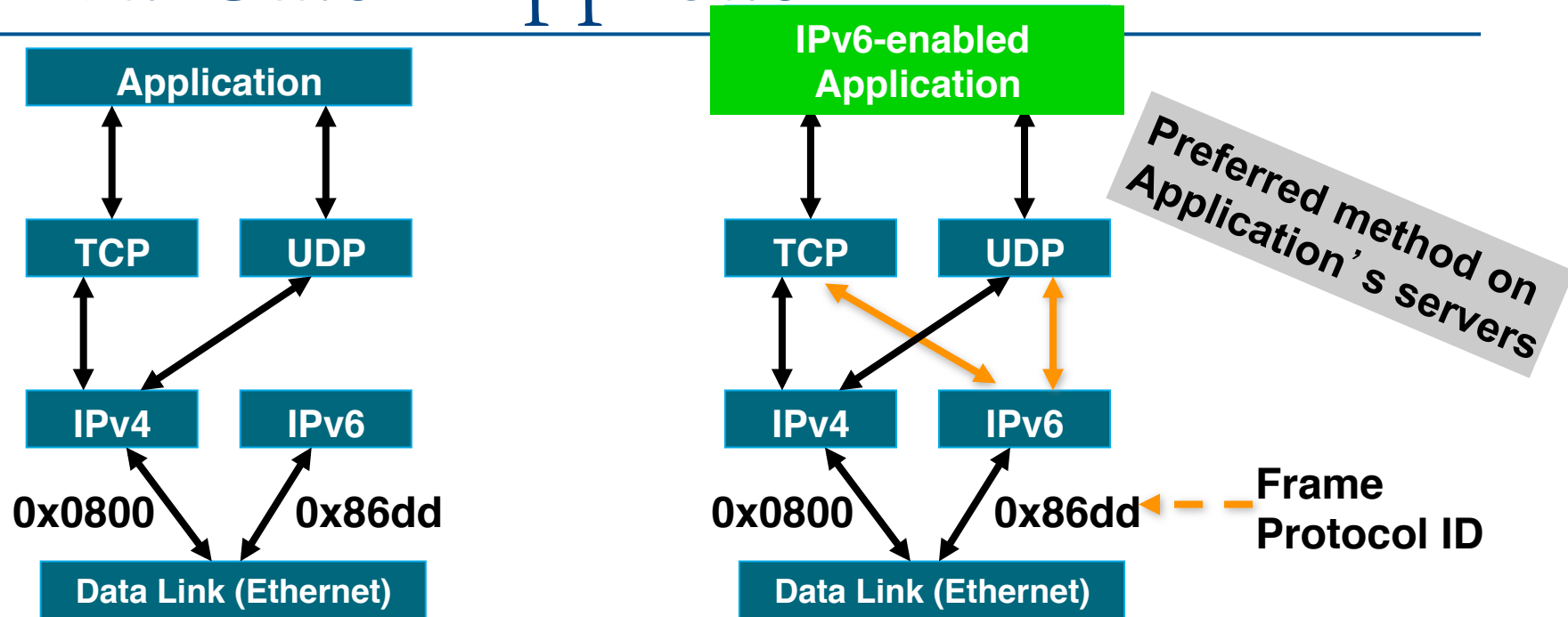
□ “softwires”

- Specifies the standardization of discovery, control and encapsulation methods for connecting IPv4 networks across IPv6 networks and IPv6 networks across IPv4 networks in a way that will encourage multiple, inter-operable implementations.
- <http://datatracker.ietf.org/wg/softwire/charter/>

IPv4-IPv6 Co-existence/Transition

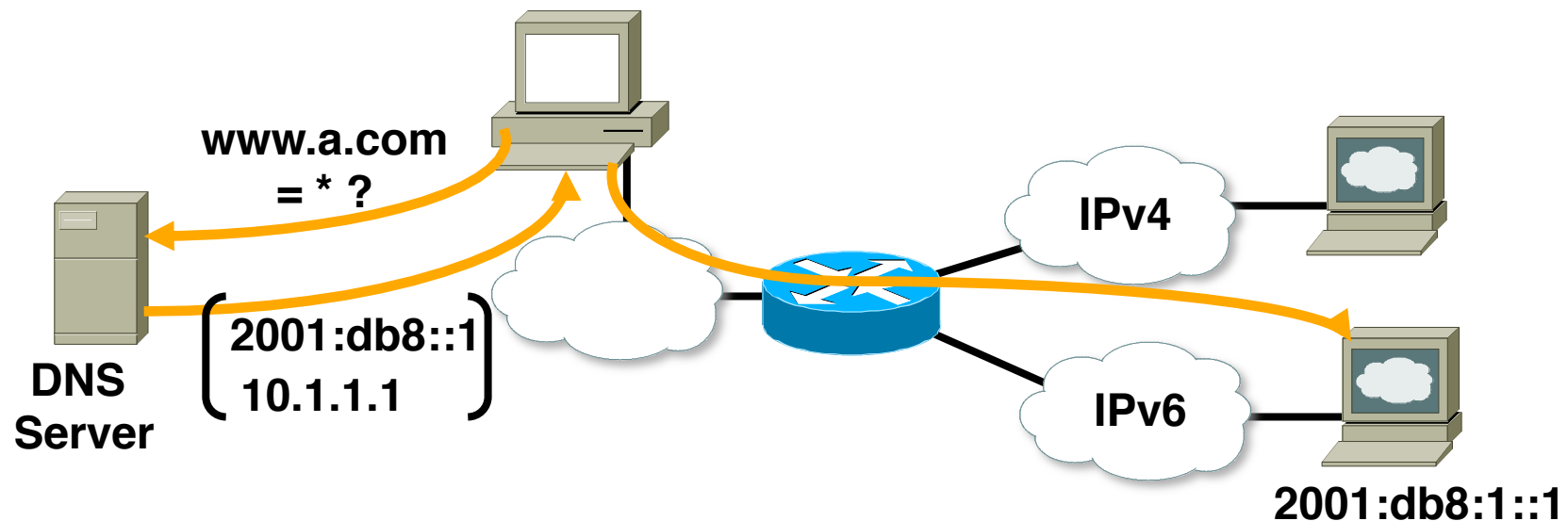
- ❑ A wide range of techniques have been identified and implemented, basically falling into three categories:
 - **Dual-stack** techniques, to allow IPv4 and IPv6 to co-exist in the same devices and networks
 - **Tunneling** techniques, to avoid order dependencies when upgrading hosts, routers, or regions
 - **Translation** techniques, to allow IPv6-only devices to communicate with IPv4-only devices
- ❑ All of these will be used, in combination

Dual Stack Approach



- ❑ Dual stack node means:
 - Both IPv4 and IPv6 stacks enabled
 - Applications can talk to both
 - Choice of the IP version is based on name lookup and application preference

Dual Stack Approach & DNS

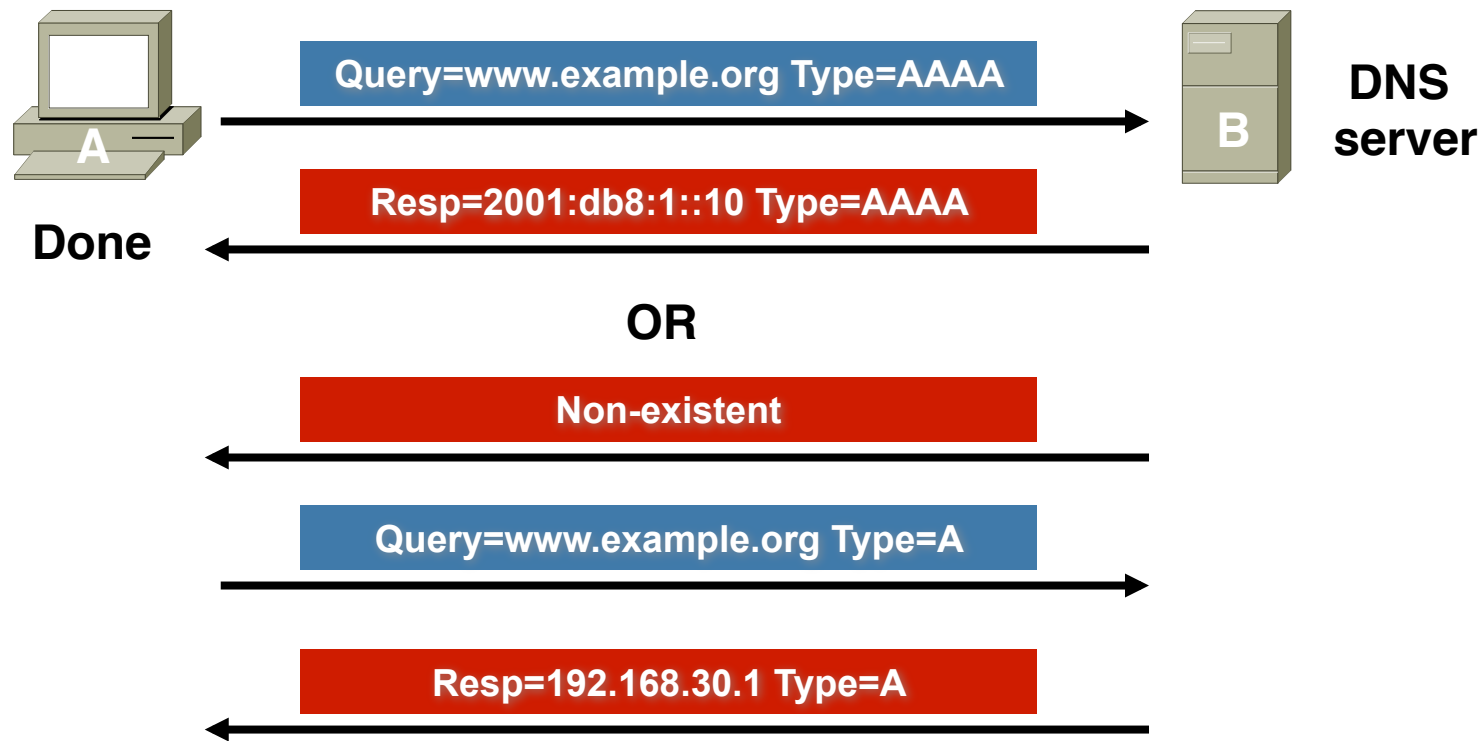


- ❑ In a dual stack case, an application that:
 - Is IPv4 and IPv6-enabled
 - Asks the DNS for both types of addresses
 - Chooses one address and, for example, connects to the IPv6 address

IPv6 DNS Resolver Process

- ❑ Query DNS servers for IPv6/IPv4:
 - First tries queries for an IPv6 address (AAAA record)
 - If no IPv6 address exists, then query for an IPv4 address (A record)
 - When both IPv6 and IPv4 records exists, the IPv6 address is picked first
- ❑ “Happy Eyeballs” resolver
 - Found in MacOS 10.7 onwards
 - Rather than picking IPv6 before IPv4, the IP protocol giving best performance is used
 - ❑ Which can be IPv6
 - ❑ Or it can be IPv4

Example of DNS query

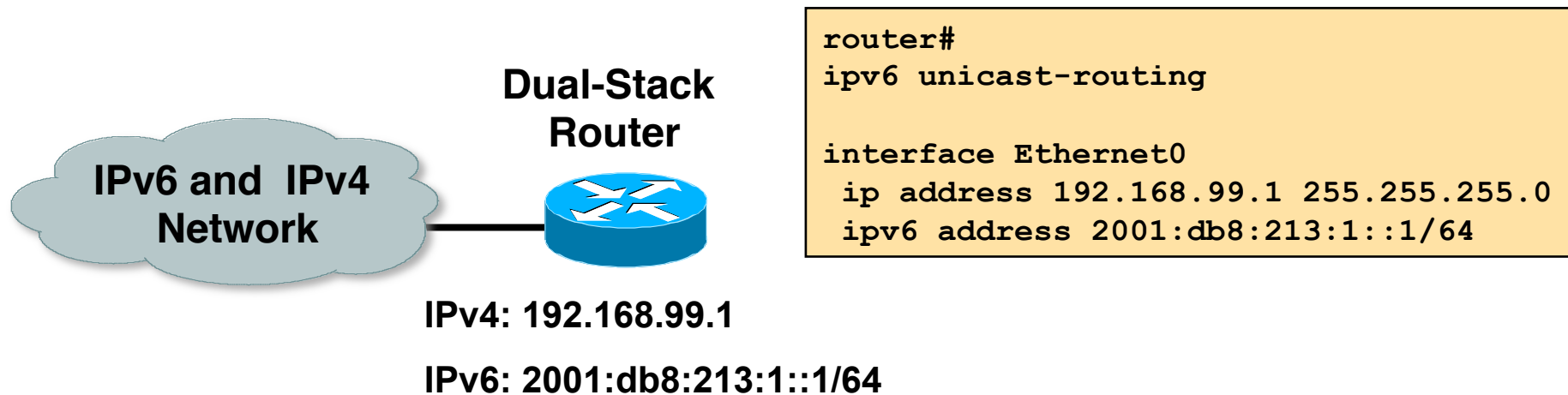


- DNS resolver picks IPv6 AAAA if it exists

IOS DNS configuration

- ❑ DNS commands for IPv6
 - Define static name for IPv6 addresses
 - ❑ `ipv6 host <name> [<port>] <v6addr> [<v6addr> ...]`
 - ❑ Example: `ipv6 host router1 2001:db8:1::10`
 - Configuring DNS servers to query
 - ❑ `ip name-server <address>`
 - ❑ Example: `ip name-server 2001:db8:1::10`

A Dual Stack Configuration

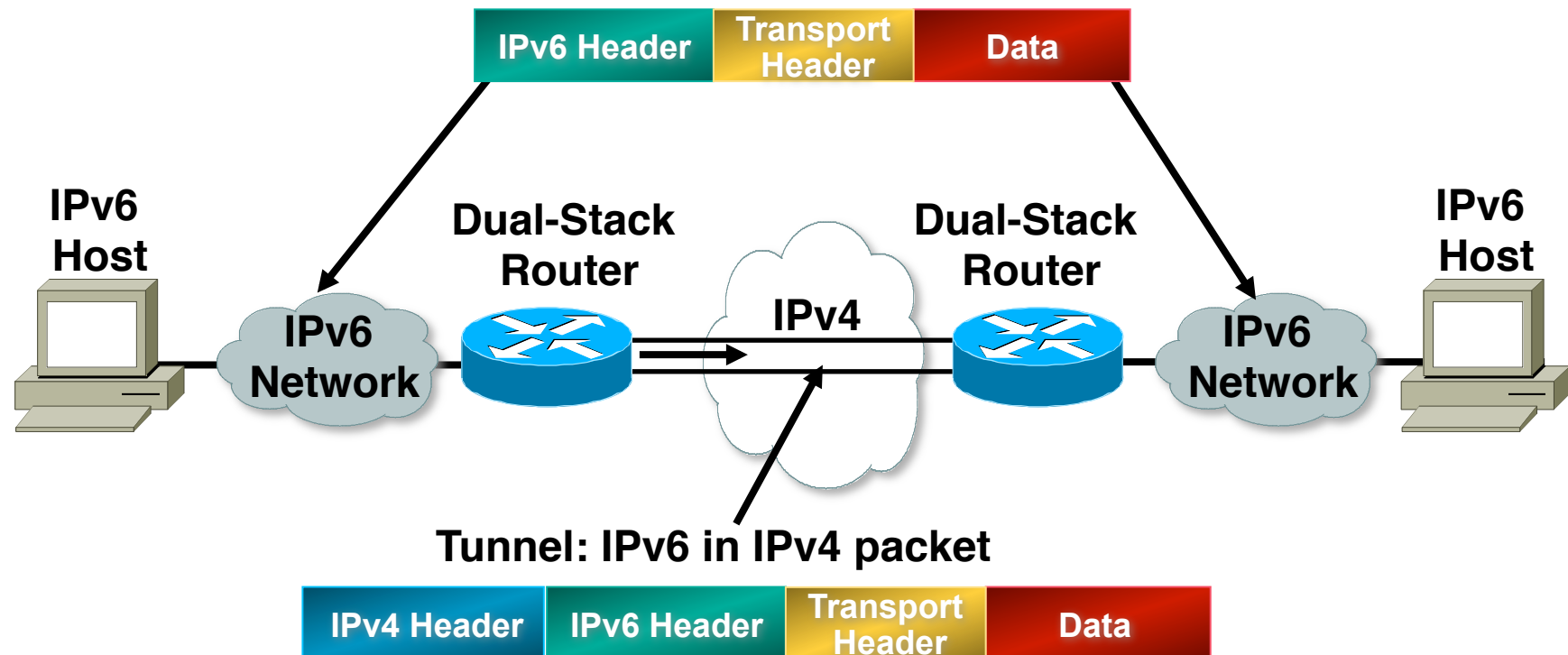


- ❑ IPv6-enabled router
 - If IPv4 and IPv6 are configured on one interface, the router is dual-stacked
 - Telnet, Ping, Traceroute, SSH, DNS client, TFTP,...

Using Tunnels for IPv6 Deployment

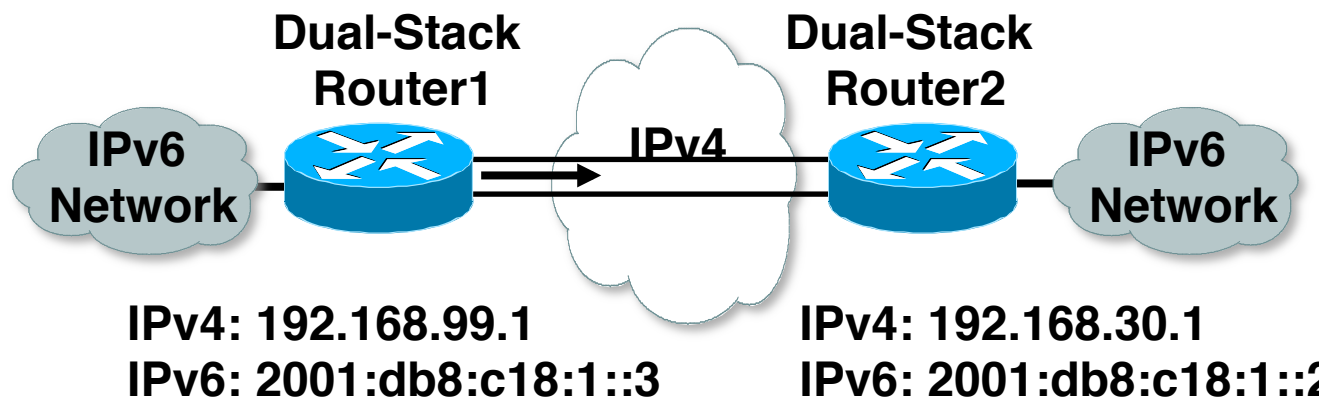
- ❑ Many techniques are available to establish a tunnel:
 - Manually configured
 - ❑ Manual Tunnel (RFC 2893)
 - ❑ GRE (RFC 2473)
 - Semi-automated
 - ❑ Tunnel broker
 - Automatic
 - ❑ 6to4 (RFC 3056)
 - ❑ 6rd
 - ❑ ISATAP

IPv6 over IPv4 Tunnels



- ❑ Tunneling is encapsulating the IPv6 packet in the IPv4 packet
- ❑ Tunneling can be used by routers and hosts

Manually Configured Tunnel (RFC2893)



router1#

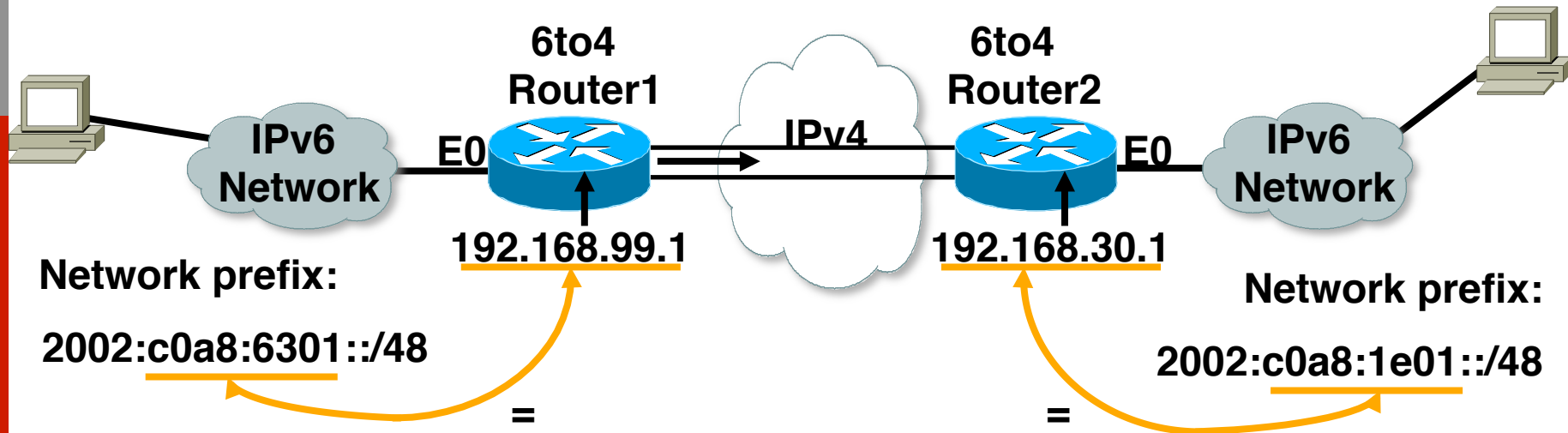
```
interface Tunnel0
  ipv6 address 2001:db8:c18:1::3/64
  tunnel source 192.168.99.1
  tunnel destination 192.168.30.1
  tunnel mode ipv6ip
```

router2#

```
interface Tunnel0
  ipv6 address 2001:db8:c18:1::2/64
  tunnel source 192.168.30.1
  tunnel destination 192.168.99.1
  tunnel mode ipv6ip
```

- ❑ Manually Configured tunnels require:
 - Dual stack end points
 - Both IPv4 and IPv6 addresses configured at each end

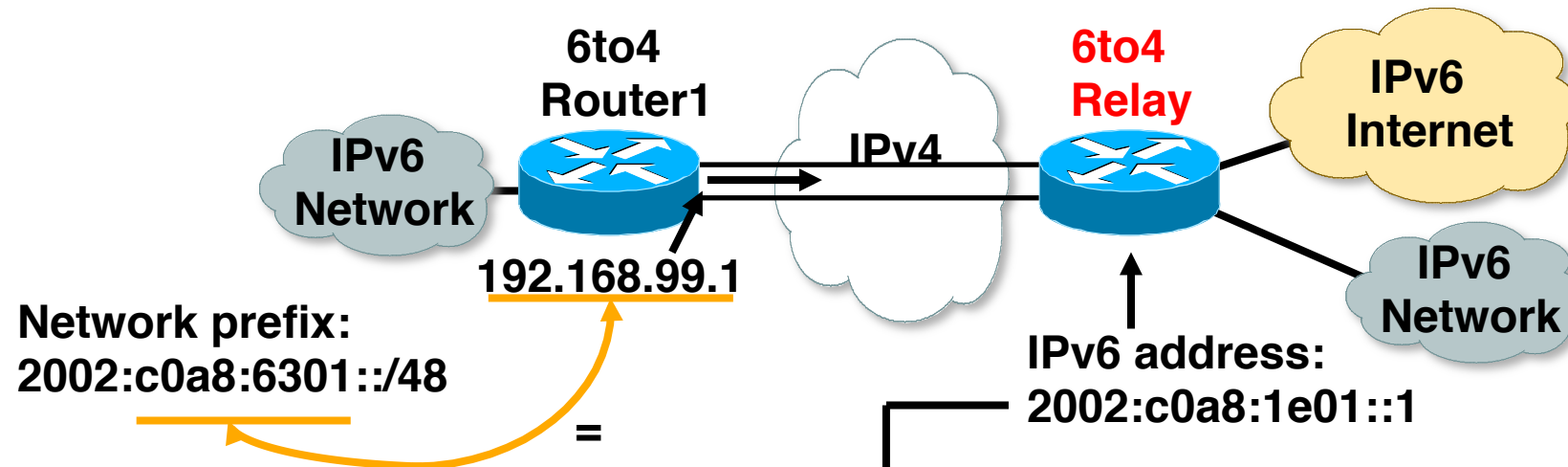
6to4 Tunnel (RFC 3056)



- 6to4 Tunnel:
 - Is an automatic tunnel method
 - Gives a prefix to the attached IPv6 network
 - 2002::/16 assigned to 6to4
 - Requires one global IPv4 address on each Ingress/Egress site

```
router2#  
interface Loopback0  
 ip address 192.168.30.1 255.255.255.0  
 ipv6 address 2002:c0a8:1e01:1::/64 eui-64  
interface Tunnel0  
 no ip address  
 ipv6 unnumbered Ethernet0  
 tunnel source Loopback0  
 tunnel mode ipv6ip 6to4  
  
ipv6 route 2002::/16 Tunnel0
```

6to4 Relay



```
router1#  
interface Loopback0  
 ip address 192.168.99.1 255.255.255.0  
 ipv6 address 2002:c0a8:6301:1::/64 eui-64  
interface Tunnel0  
 no ip address  
 ipv6 unnumbered Ethernet0  
 tunnel source Loopback0  
 tunnel mode ipv6ip 6to4  
  
ipv6 route 2002::/16 Tunnel0  
ipv6 route ::/0 2002:c0a8:1e01::1
```

□ 6to4 relay:

- Is a gateway to the rest of the IPv6 Internet
- Default router
- Anycast address (RFC 3068) for multiple 6to4 Relay

6to4 in the Internet

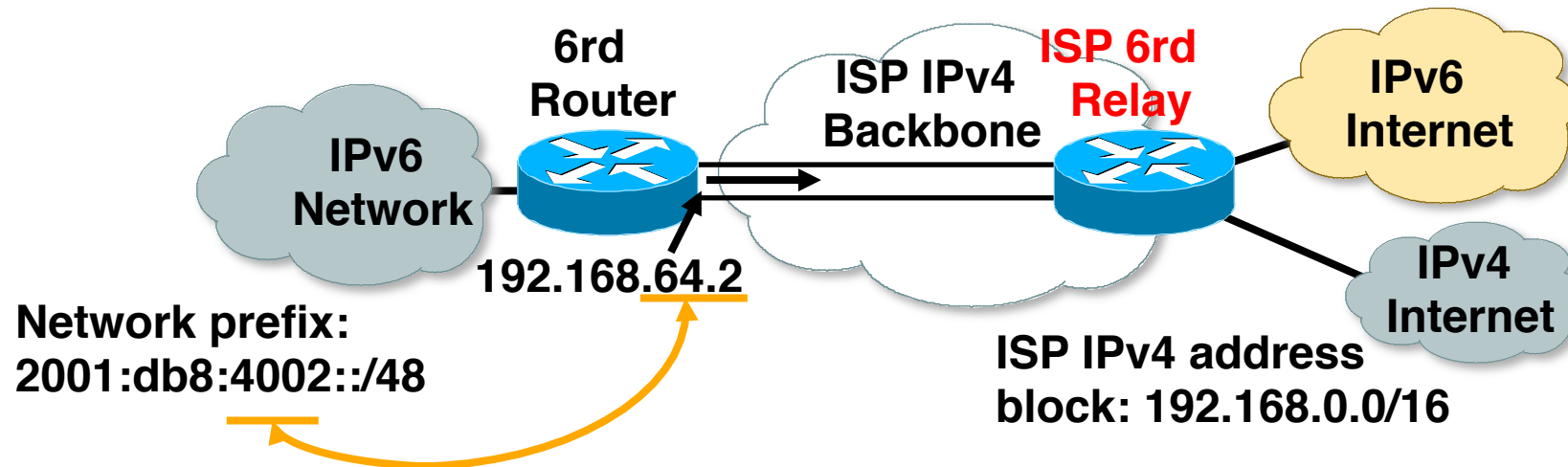
- ❑ 6to4 prefix is 2002::/16
- ❑ 192.88.99.0/24 is the IPv4 anycast network for 6to4 routers
- ❑ 6to4 relay service
 - An ISP who provides a facility to provide connectivity over the IPv4 Internet between IPv6 islands
 - ❑ Is connected to the IPv6 Internet and announces 2002::/16 by BGP to the IPv6 Internet
 - ❑ Is connected to the IPv4 Internet and announces 192.88.99.0/24 by BGP to the IPv4 Internet
 - Their router is configured with local IPv4 address of 192.88.99.1 and local IPv6 address of 2002:c058:6301::1

6to4 in the Internet

relay router configuration

```
interface loopback0
  ip address 192.88.99.1 255.255.255.255
  ipv6 address 2002:c058:6301::1/128
!
interface tunnel 2002
  no ip address
  ipv6 unnumbered Loopback0
  tunnel source Loopback0
  tunnel mode ipv6ip 6to4
  tunnel path-mtu-discovery
!
interface FastEthernet0/0
  ip address 105.3.37.1 255.255.255.0
  ipv6 address 2001:db8::1/64
!
router bgp 100
  address-family ipv4
    neighbor <v4-transit> remote-as 101
    network 192.88.99.0 mask 255.255.255.0.
  address-family ipv6
    neighbor <v6-transit> remote-as 102
    network 2002::/16
!
ip route 192.88.99.0 255.255.255.0 null0 254
ipv6 route 2002::/16 tunnel2002
```

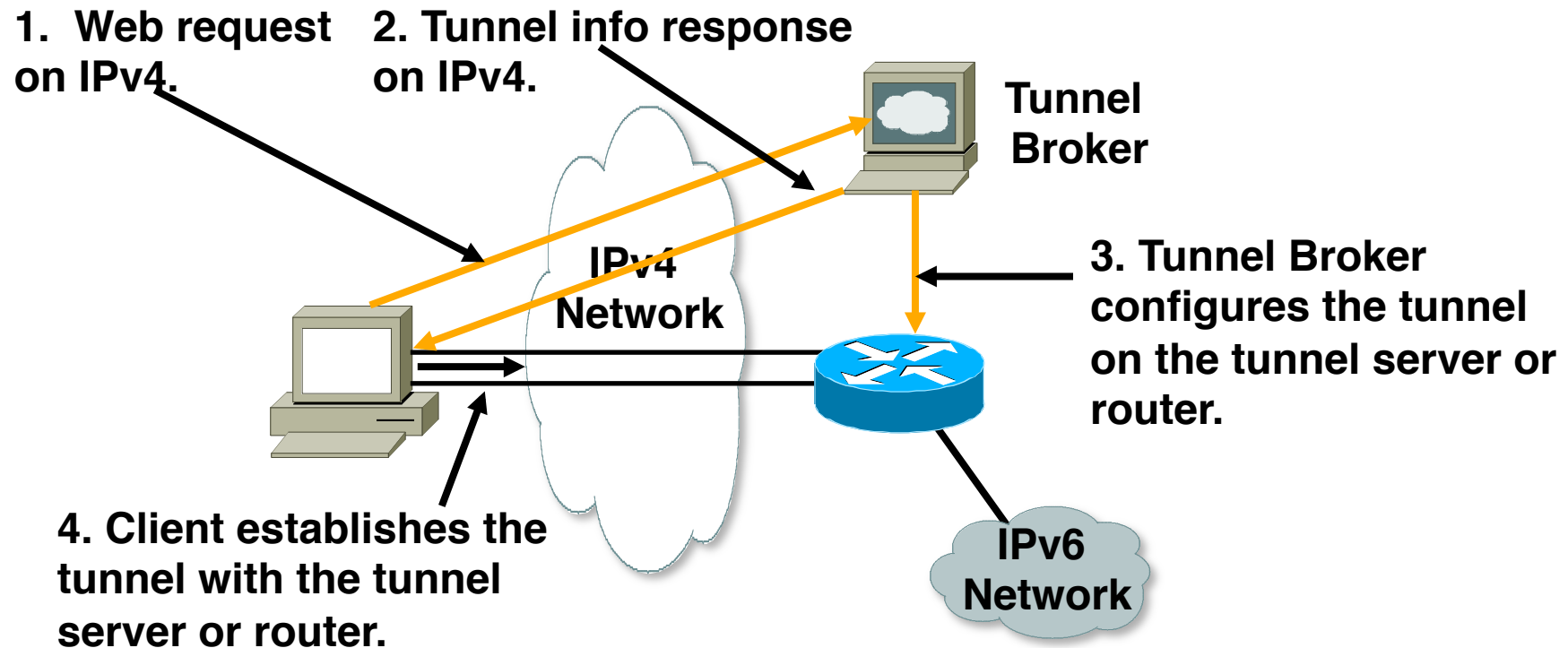
6rd Tunnel



□ 6rd (example):

- ISP has 192.168.0.0/16 IPv4 address block
- ISP has 2001:db8::/32 IPv6 address block
- Final 16 bits of IPv4 address used on customer point-to-point link to create customer /48 → customer uses 2001:db8:4002::/48 address space
- IPv6 tunnel to ISP 6rd relay bypasses infrastructure which cannot handle IPv6

Tunnel Broker



- Tunnel broker:
 - Tunnel information is sent via http-ipv4

ISATAP – Intra Site Automatic Tunnel Addressing Protocol

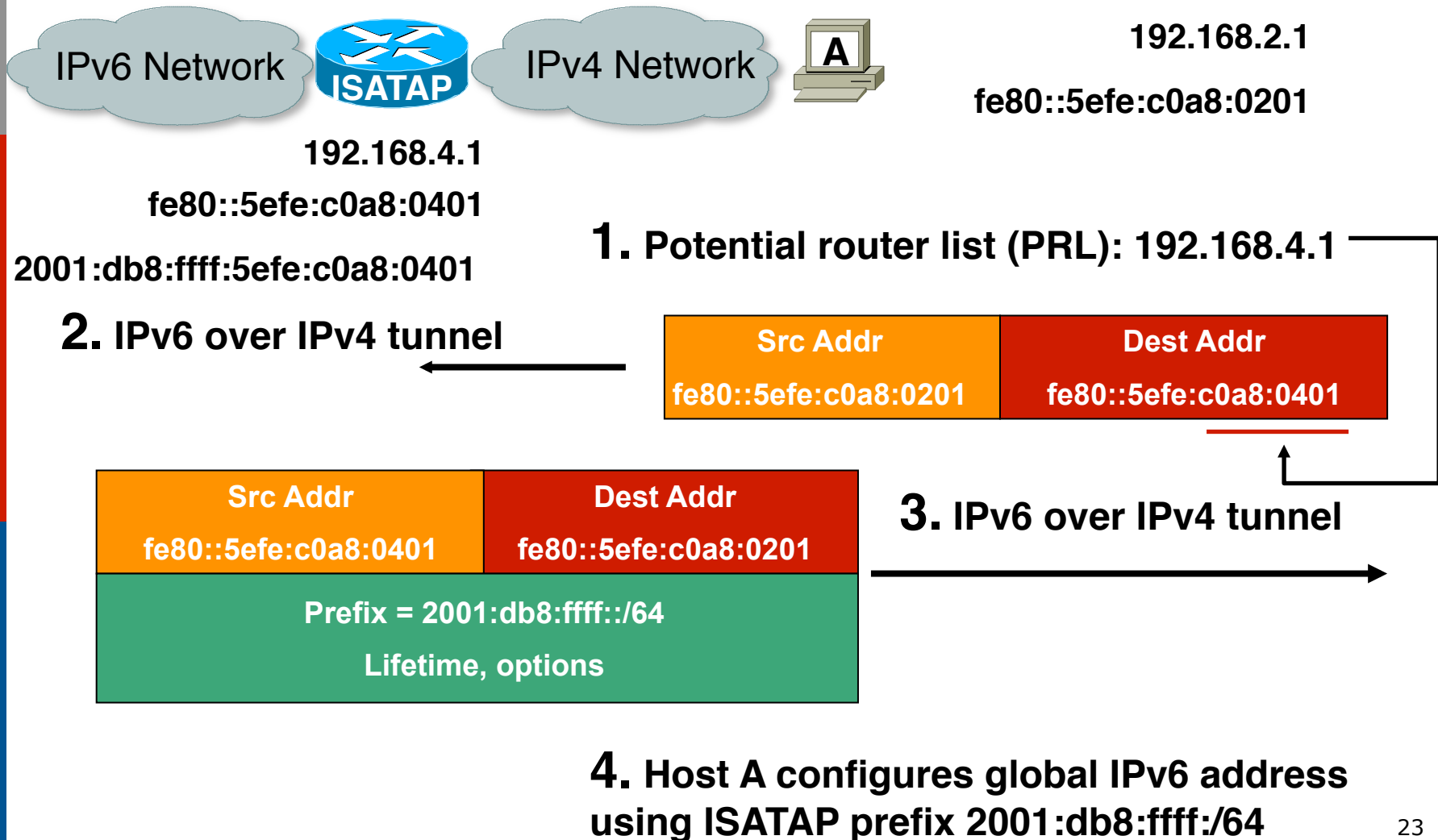
- ❑ Tunnelling of IPv6 in IPv4
- ❑ Single Administrative Domain
- ❑ Creates a virtual IPv6 link over the full IPv4 network
- ❑ Automatic tunnelling is done by a specially formatted ISATAP address which includes:
 - A special ISATAP identifier
 - The IPv4 address of the node
- ❑ ISATAP nodes are dual stack

ISATAP Addressing Format

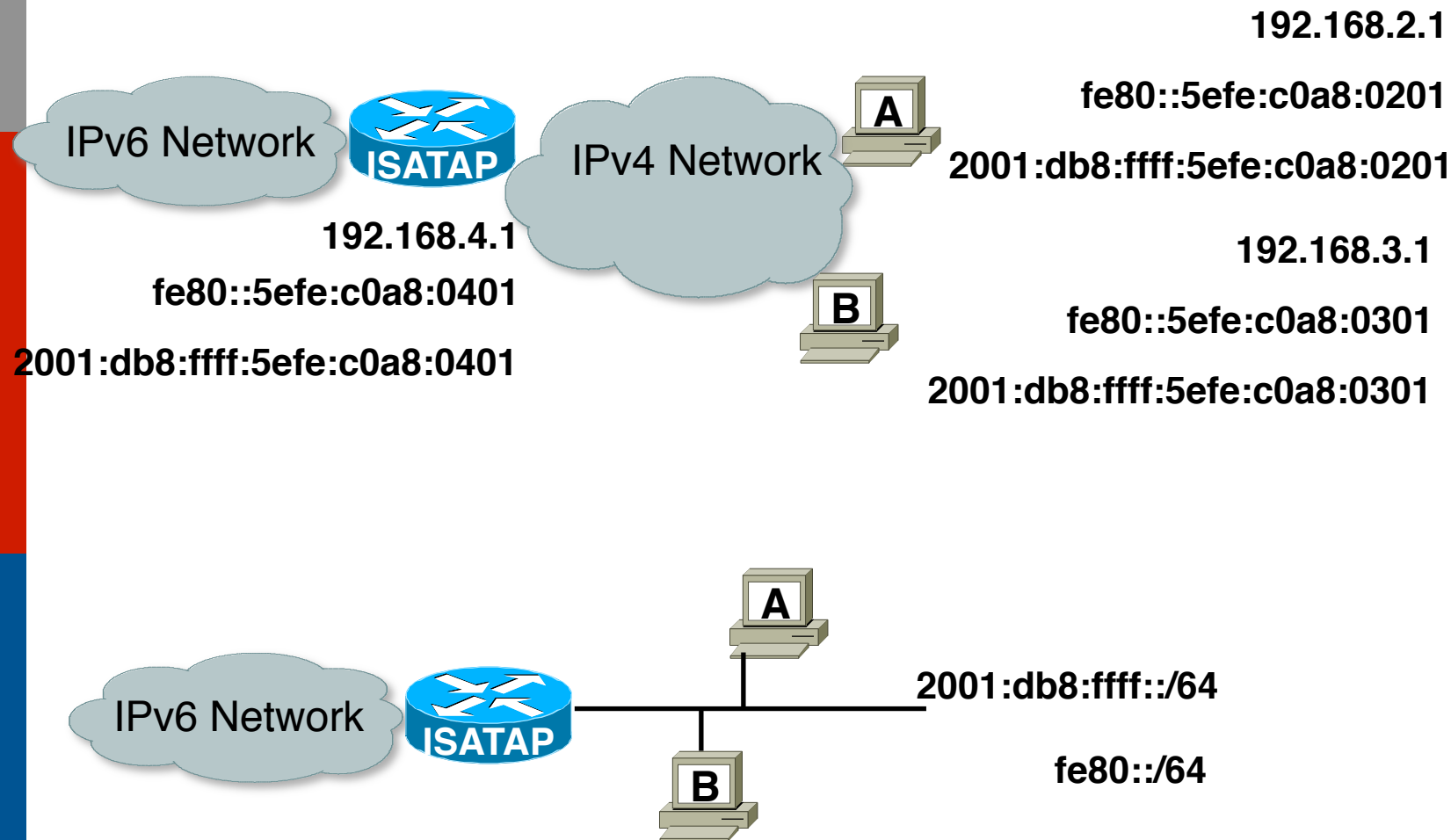
- An ISATAP address of a node is defined as:
 - A /64 prefix dedicated to the ISATAP overlay link
 - Interface identifier:
 - Leftmost 32 bits = 0000:5EFE:
 - Identify this as an ISATAP address
 - Rightmost 32 bits = <ipv4 address>
 - The IPv4 address of the node

ISATAP dedicated prefix	0000:5EFE	IPv4 address
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ISATAP prefix advertisement



ISATAP configuration example

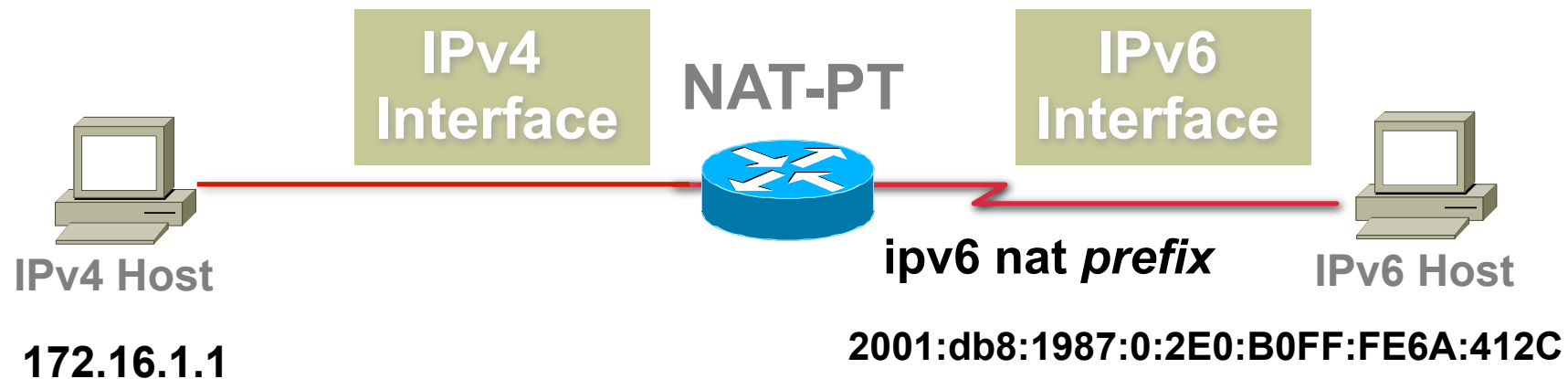


NAT-PT for IPv6

□ NAT-PT

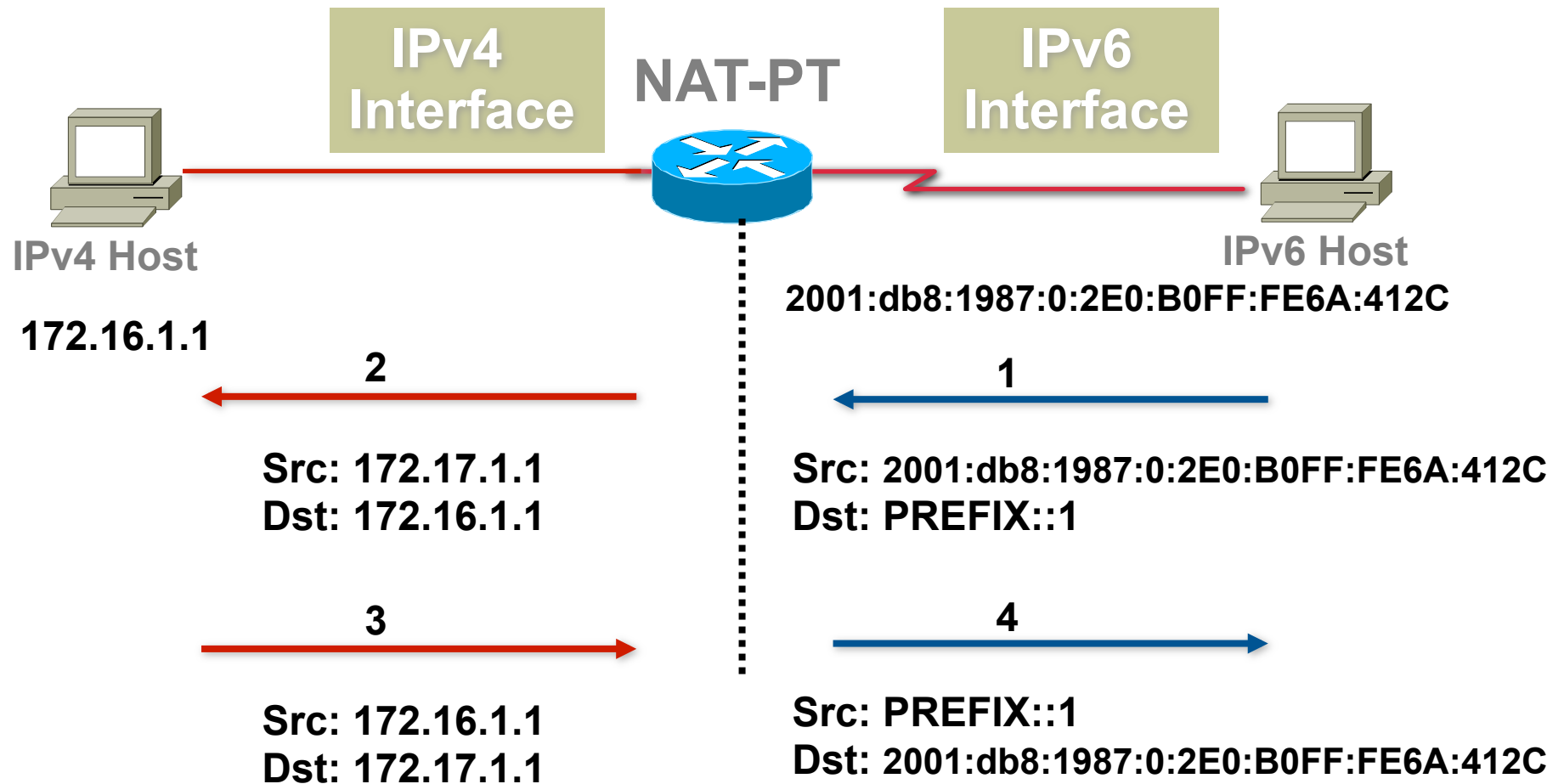
- (Network Address Translation – Protocol Translation)
 - RFC 2766 & RFC 3152
 - Obsoleted by IETF (RFC4966) but implementations still in use
- Allows native IPv6 hosts and applications to communicate with native IPv4 hosts and applications, and vice versa
- Easy-to-use transition and co-existence solution

NAT-PT Concept



- *prefix* is a 96-bit field that allows routing back to the NAT-PT device

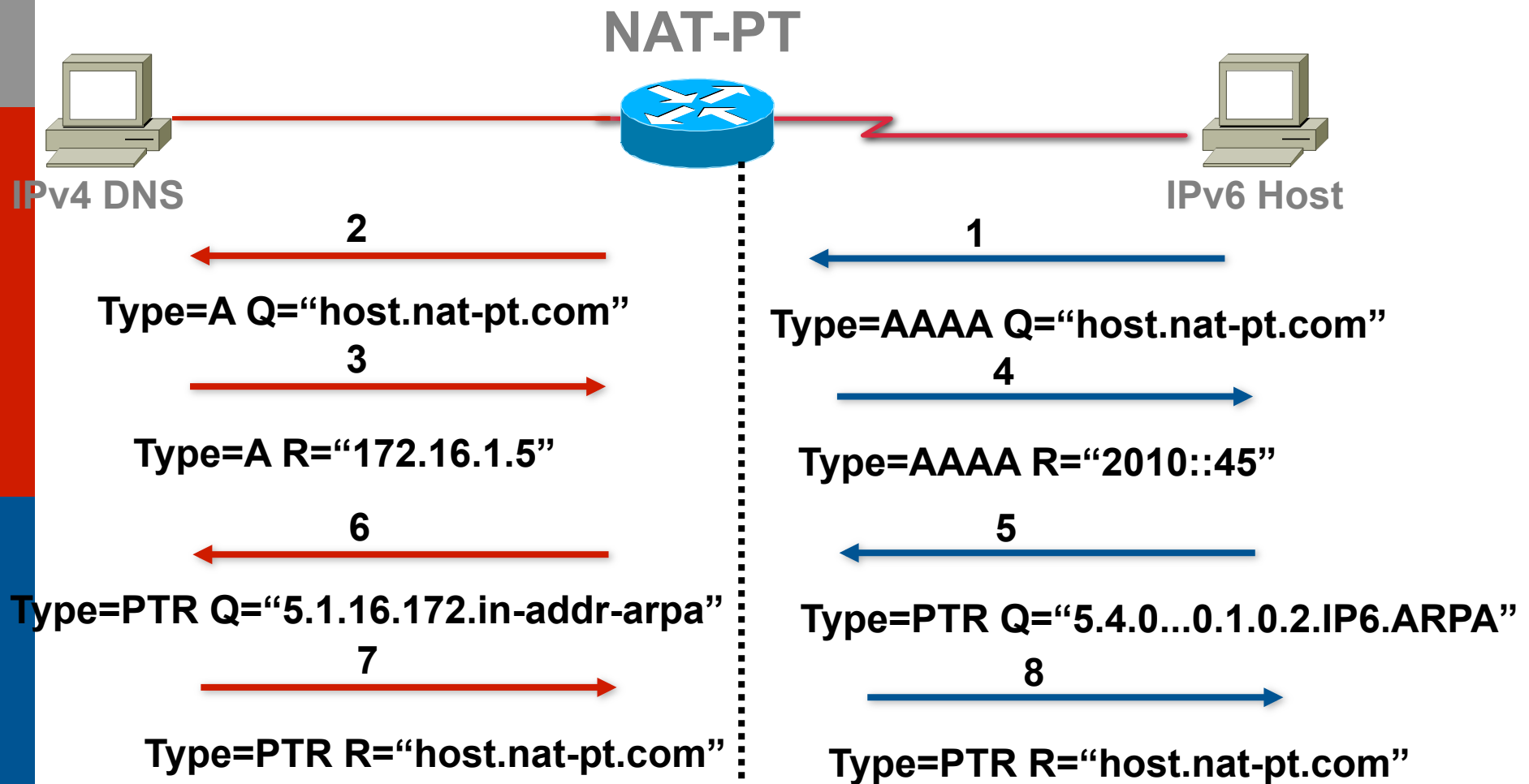
NAT-PT packet flow



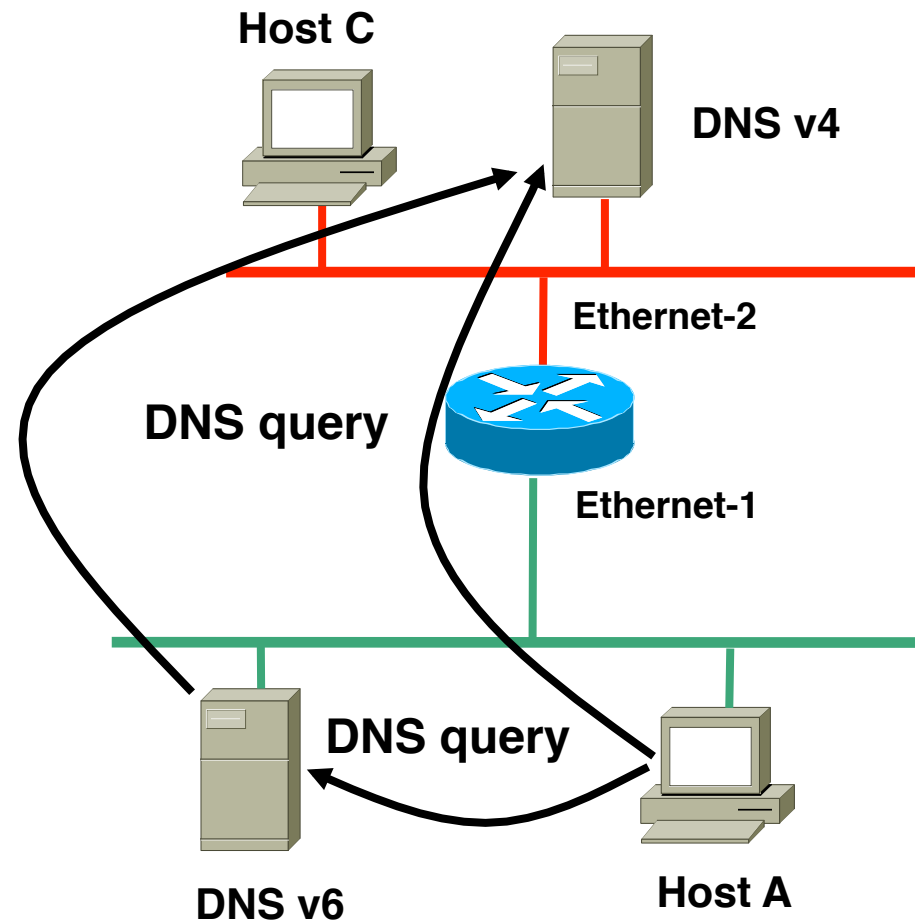
Stateless IP ICMP Translation

<i>IPv6 field</i>	<i>IPv4 field</i>	<i>Action</i>
Version = 6	Version = 4	Overwrite
Traffic class	DSCP	Copy
Flow label	N/A	Set to 0
Payload length	Total length	Adjust
Next header	Protocol	Copy
Hop limit	TTL	Copy

DNS Application Layer Gateway



DNS ALG address assignment



- TTL value in DNS Resource Record = 0

Configuring NAT-PT (1)

- ❑ Enabling NAT-PT

 - `[no] ipv6 nat`

- ❑ Configure global/per interface NAT-PT prefix

 - `[no] ipv6 nat prefix <prefix>::/96`

- ❑ Configuring static address mappings

 - `[no] ipv6 nat v6v4 source <v6 address> <v4 address>`

 - `[no] ipv6 nat v4v6 source <v4 address> <v6 address>`

Configuring NAT-PT (2)

- ❑ Configuring dynamic address mappings

- `[no] ipv6 nat v6v4 source <list,route-map> <ipv6 list, route-map> pool <v4pool>`

- `[no] ipv6 nat v6v4 pool <v4pool> <ipv4 addr> <ipv4addr> prefix-length <n>`

- ❑ Configure Translation Entry Limit

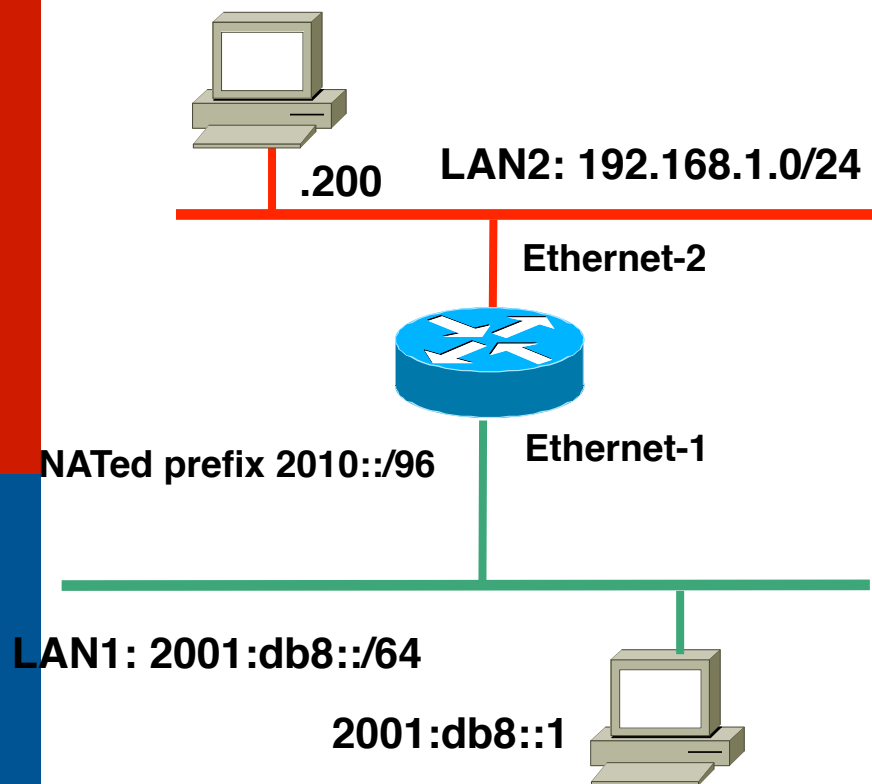
- `[no] ipv6 nat translation max-entries <n>`

- ❑ Debug commands

- `debug ipv6 nat`

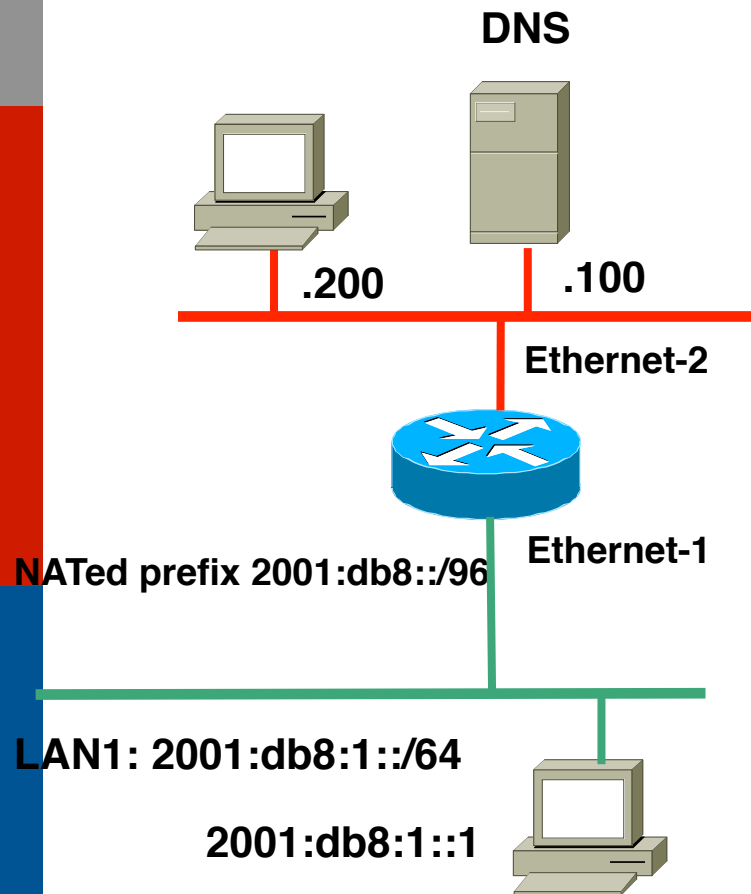
- `debug ipv6 nat detailed`

Cisco IOS NAT-PT configuration example



```
interface ethernet-1
  ipv6 address 2001:db8::10/64
  ipv6 nat
!
interface ethernet-2
  ip address 192.168.1.1 255.255.255.0
  ipv6 nat prefix 2010::/96
  ipv6 nat
!
ipv6 nat v6v4 source 2001:db8::1 192.168.2.1
ipv6 nat v4v6 source 192.168.1.200 2001:db8::60
!
```

Cisco IOS NAT-PT w/ DNS ALG

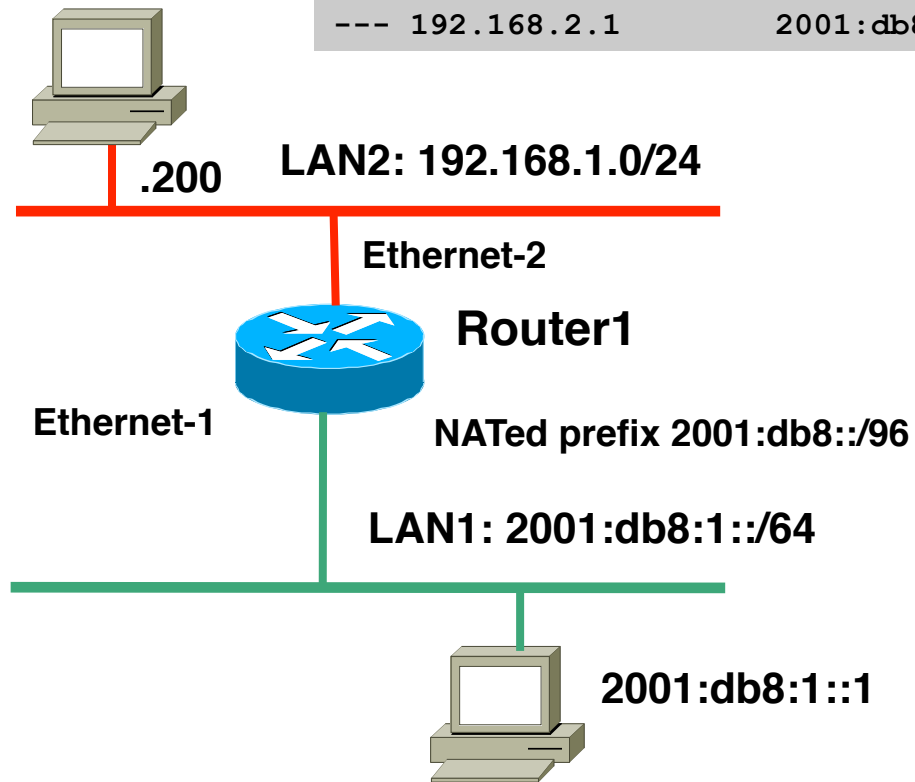


```
interface ethernet-1
  ipv6 address 2001:db8:1::10/64
  ipv6 nat
  !
interface ethernet-2
  ip address 192.168.1.1 255.255.255.0
  ipv6 nat
  !
ipv6 nat v4v6 source 192.168.1.100 2010::1
  !
ipv6 nat v6v4 source list v6-list map1 pool v4pool1
ipv6 nat v6v4 pool v4pool1 192.168.2.1 192.168.2.10
prefix-length 24
ipv6 nat service dns
ipv6 nat prefix 2001:db8::/96
  !
ipv6 access-list v6-list
  permit 2001:db8:1::/64 any
```

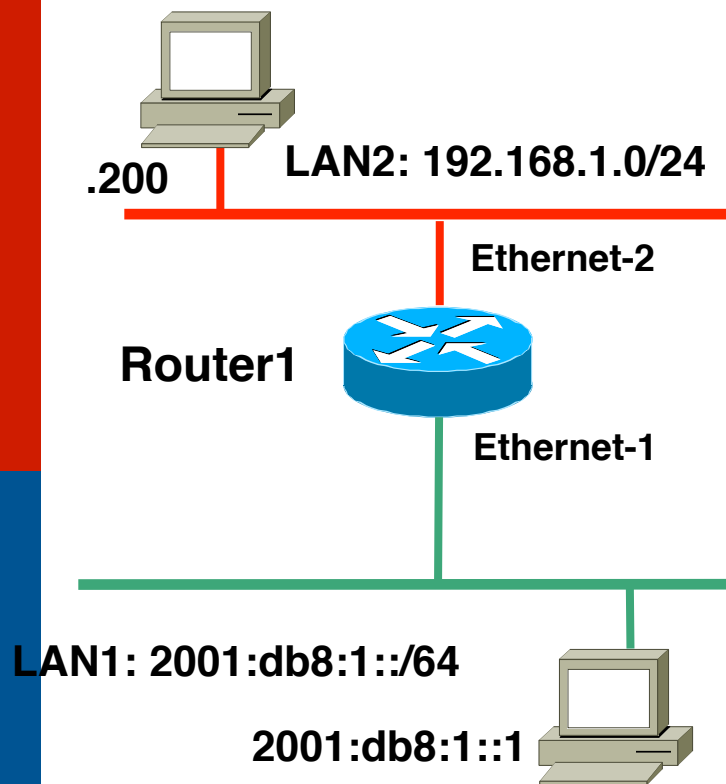
Cisco IOS NAT-PT display (1)

```
Router1 #show ipv6 nat translations
```

Pro	IPv4 source	IPv6 source	IPv6 destn	IPv4 destn
---	---	---	2001:db8:::60	192.168.1.200
---	192.168.2.1	2001:db8:1::1		---



Cisco IOS NAT-PT display (2)



```
Router1#show ipv6 nat statistics
```

```
Total active translations: 15 (2 static, 3 dynamic;  
10 extended)
```

```
NAT-PT interfaces:
```

```
Ethernet-1, Ethernet-2
```

```
Hits: 10 Misses: 0
```

```
Expired translations: 0
```

NAT-PT Summary

□ Points of note:

- ALG per application carrying IP address
- No End to End security
- No DNSsec
- No IPsec because different address realms

□ Conclusion

- Easy IPv6 / IPv4 co-existence mechanism
- Enable applications to cross the protocol barrier

IPv6 Servers and Services



Unix

Webserver

- ❑ Apache 2.x supports IPv6 by default
- ❑ Simply edit the **httpd.conf** file
 - HTTPD listens on all IPv4 interfaces on port 80 by default
 - For IPv6 add:
`Listen [2001:db8:10::1]:80`
 - ❑ So that the webserver will listen to requests coming on the interface configured with 2001:db8:10::1/64

Unix

Nameserver

- ❑ BIND 9 supports IPv6 by default
- ❑ To enable IPv6 nameservice, edit /etc/named.conf:

```
options {  
    listen-on-v6 { any; };  
};  
zone "workshop.net" {  
    type master;  
    file "workshop.net.zone";  
};  
zone "8.b.d.0.1.0.0.2.ip6.arpa" {  
    type master;  
    file "workshop.net.rev-zone";  
};
```

Tells bind to listen
on IPv6 ports

Forward zone contains
v4 and v6 information

Sets up reverse
zone for IPv6 hosts

Unix

Sendmail

- ❑ Sendmail 8 as part of a distribution is usually built with IPv6 enabled
 - But the configuration file needs to be modified
- ❑ If compiling from scratch, make sure NETINET6 is defined
- ❑ Then edit `/etc/mail/sendmail.mc` thus:
 - Remove the line which is for IPv4 only and enable the IPv6 line thus (to support both IPv4 and IPv6):
 - `DAEMON_OPTIONS(`Port=smtp, Addr::, Name=MTA-v6, Family=inet6')`
 - Remake `sendmail.cf`, then restart `sendmail`

Unix

FTP Server

- ❑ Vsftpd is covered here
 - Standard part of many Linux distributions now
- ❑ IPv6 is supported, but not enable by default
 - Need to run two vsftpd servers, one for IPv4, the other for IPv6
- ❑ IPv4 configuration file: /etc/vsftpd/vsftpd.conf

```
listen=YES
listen_address=<ipv4 addr>
```
- ❑ IPv6 configuration file: /etc/vsftpd/vsftpdv6.conf

```
listen=NO
listen_ipv6=YES
listen_address6=<ipv6 addr>
```

Unix Applications

❑ OpenSSH

- Uses IPv6 transport before IPv4 transport if IPv6 address available

❑ Firefox/Thunderbird

- Supports IPv6, but still hampered by broken IPv6 nameservers and IPv6 connectivity
- In `about:config` the value `network.dns.disableIPv6` is set to `true` by default
 - ❑ Change to `false` to enable IPv6

MacOS X

- ❑ IPv6 installed
- ❑ IPv6 enabled by default
 - Will use autoconfiguration by default
 - Enter **System Preferences** and then **Network** to enter static IPv6 addresses (depends on MacOS X version)
- ❑ Applications will use IPv6 transport if IPv6 address offered in name lookups

FreeBSD – client

- ❑ IPv6 installed, but disabled by default
- ❑ To enable using autoconfiguration:
 - Simply edit `/etc/rc.conf` to include these lines

```
ipv6_enable="YES"
ipv6_network_interfaces="em0"
```
 - Where
 - ❑ `em0` should be replaced with the name of the Ethernet interface on the device
- ❑ And then reboot the system

FreeBSD – server

- ❑ IPv6 installed, but disabled by default
- ❑ To enable using static configuration:
 - Edit /etc/rc.conf to include these lines

```
ipv6_enable="YES"
ipv6_network_interfaces="em0"
ipv6_ifconfig_em0="2001:db8::1 prefixlen 64"
ipv6_defaultrouter="fe80::30%em0"
```
 - Where
 - ❑ `em0` should be replaced with the name of the Ethernet interface on the device
 - ❑ `2001:db8::1` should be replaced with the IPv6 address
 - ❑ `fe80::30` should be replaced with the default gateway
- ❑ And then reboot the system

RedHat/Fedora/CentOS Linux – client

- ❑ IPv6 installed, but disabled by default
- ❑ To enable:
 - Edit `/etc/sysconfig/network` to include the line
`NETWORKING_IPV6=yes`
 - Edit `/etc/sysconfig/network-scripts/ifcfg-eth0` to include:
`IPV6INIT=yes`
 - And then `/sbin/service network restart` or reboot
- ❑ Other Linux distributions will use similar techniques

RedHat/Fedora/CentOS Linux – server

❑ To enable:

- Edit /etc/sysconfig/network to include:

```
NETWORKING_IPV6=yes  
IPV6_DEFAULTGW=FE80::30  
IPV6_DEFAULTDEV=eth0
```

- Edit /etc/sysconfig/network-scripts/ifcfg-eth0 to include:

```
IPV6ADDR=2001:db8::1/64  
IPV6INIT=yes  
IPV6_AUTOCONF=no
```

- Where

- ❑ **eth0** should be replaced with the name of the Ethernet interface on the device
- ❑ **2001:db8::1** should be replaced with the IPv6 address
- ❑ **fe80::30** should be replaced with the default gateway

- And then **/sbin/service network restart** or **reboot**

Windows XP & Vista

□ XP

- IPv6 installed, but disabled by default
- To enable, start command prompt and run
“**ipv6 install**”

□ Vista

- IPv6 installed, enabled by default
- Most apps (including IE) will use IPv6 transport if IPv6 address offered in name lookups

Other IOS Features



Redundancy, Radius, DHCP,...

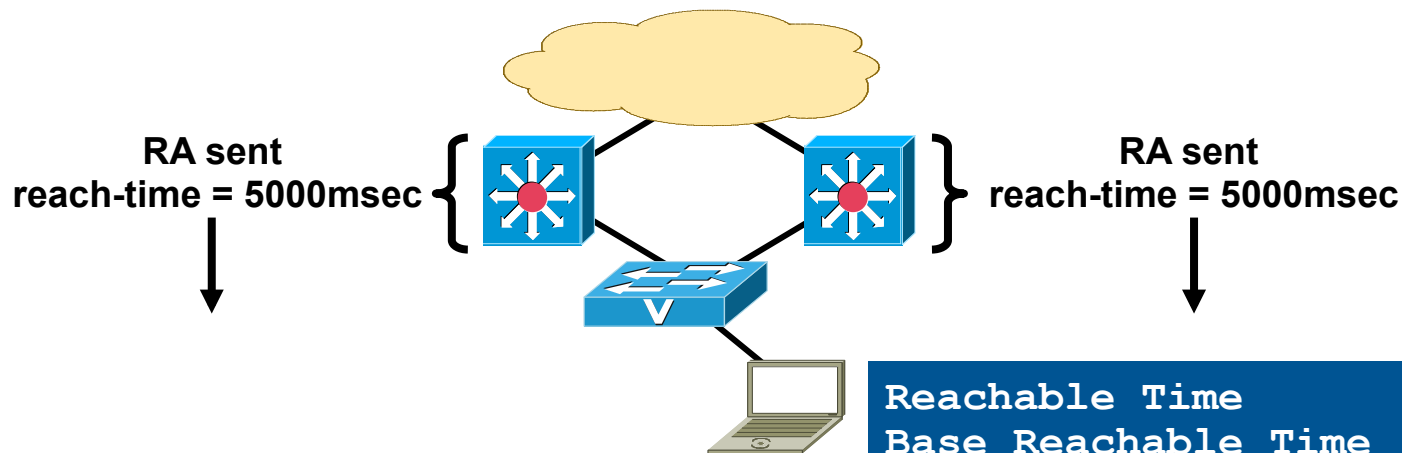
First-Hop Redundancy

- ❑ When HSRP, GLBP and VRRP for IPv6 are not available
- ❑ NUD can be used for rudimentary HA at the first-hop (today this only applies to the Campus/DC...HSRP is available on routers)

`(config-if)#ipv6 nd reachable-time 5000`

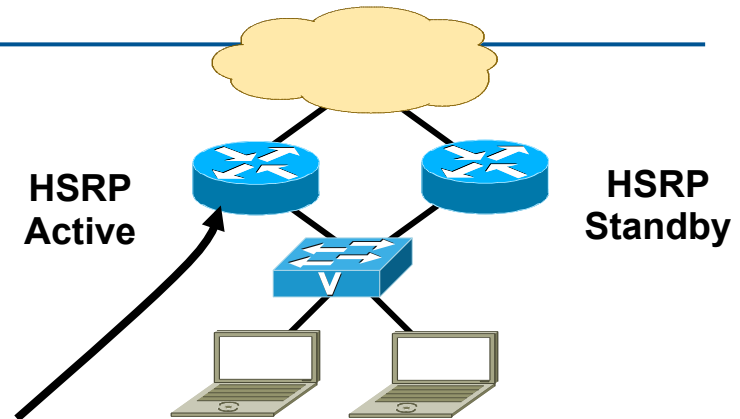
- ❑ Hosts use NUD "reachable time" to cycle to next known default gateway (30 seconds by default)

```
Default Gateway . . . . . : 10.121.10.1  
                          fe80::211:bcff:fec0:d000%4  
                          fe80::211:bcff:fec0:c800%4
```



HSRP for IPv6

- ❑ Many similarities with HSRP for IPv4
- ❑ Changes occur in Neighbor Advertisement, Router Advertisement, and ICMPv6 redirects
- ❑ No need to configure GW on hosts (RAs are sent from HSRP Active router)
- ❑ Virtual MAC derived from HSRP group number and virtual IPv6 Link-local address
 - 0005.73A0.0000 - 0005.73A0.0FFF (4096 addresses)
- ❑ HSRP IPv6 UDP Port Number 2029 (IANA Assigned)
- ❑ No HSRP IPv6 secondary address
- ❑ No HSRP IPv6 specific debug



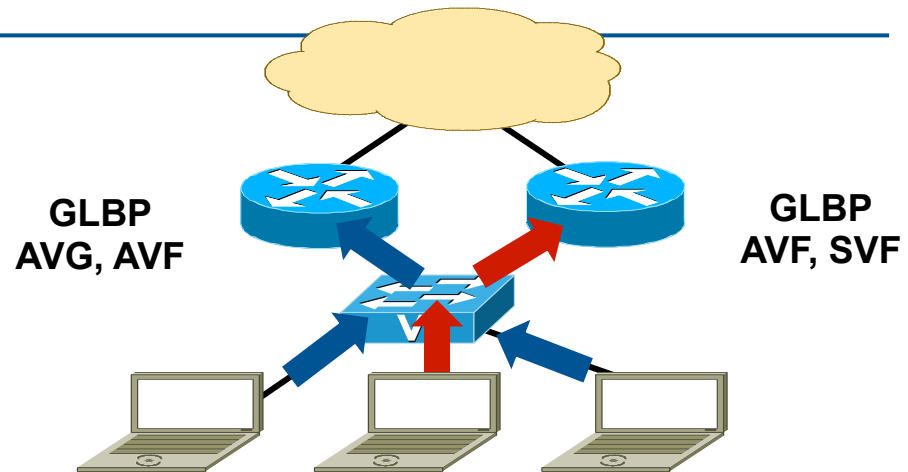
```
interface FastEthernet0/1
  ipv6 address 2001:DB8:66:67::2/64
  ipv6 cef
  standby version 2
  standby 1 ipv6 autoconfig
  standby 1 timers msec 250 msec 800
  standby 1 preempt
  standby 1 preempt delay minimum 180
  standby 1 authentication md5 key-string cisco
  standby 1 track FastEthernet0/0
```

Host with GW of Virtual IP

```
#route -A inet6 | grep ::/0 | grep eth2
::/0      fe80::207:85ff:fe3:2f60      UGDA  1024  3      0 eth2
::/0      fe80::205:9bff:febf:5ce0      UGDA  1024  0      0 eth2
::/0      fe80::5:73ff:fea0:1          UGDA  1024  0      0 eth2
```

GLBP for IPv6

- ❑ Many similarities with GLBP for IPv4 (CLI, Load-balancing)
- ❑ Modification to Neighbor Advertisement, Router Advertisement
- ❑ GW is announced via RAs
- ❑ Virtual MAC derived from GLBP group number and virtual IPv6 Link-local address



```
interface FastEthernet0/0
  ipv6 address 2001:DB8:1::1/64
  ipv6 cef
  glbp 1 ipv6 autoconfig
  glbp 1 timers msec 250 msec 750
  glbp 1 preempt delay minimum 180
  glbp 1 authentication md5 key-string cisco
```

AVG=Active Virtual Gateway
AVF=Active Virtual Forwarder
SVF=Standby Virtual Forwarder

IPv6 General Prefix

- ❑ Provides an easy/fast way to deploy prefix changes
- ❑ Example: 2001:db8:cafe::/48 = General Prefix
- ❑ Fill in interface specific fields after prefix
 - "office ::11:0:0:0:1" = 2001:db8:cafe:11::1/64

```
ipv6 unicast-routing
ipv6 cef

ipv6 general-prefix office
2001:DB8:CAFE::/48
!
interface GigabitEthernet3/2
  ipv6 address office ::2/127
  ipv6 cef
!
interface GigabitEthernet1/2
  ipv6 address office ::E/127
  ipv6 cef
```

```
interface Vlan11
  ipv6 address office ::11:0:0:0:1/64
  ipv6 cef
!
interface Vlan12
  ipv6 address office ::12:0:0:0:1/64
  ipv6 cef
```

```
6k-agg-1#sh ipv6 int vlan 11 | i Global|2001
```

```
Global unicast address(es):
```

```
2001:DB8:CAFE:11::1, subnet is 2001:DB8:CAFE:11::/64
```

AAA/RADIUS

- ❑ RADIUS attributes and IPv6 (RFC3162)
- ❑ RADIUS Server support requires an upgrade (supporting RFC3162)
 - Few RADIUS solutions support RFC3162 functionality today
- ❑ IPv6 AAA/RADIUS Configuration www.cisco.com/warp/public/cc/pd/iosw/prodlit/ipv6a_wp.htm

RADIUS Configuration with permanently assigned /64:

```
Auth-Type = Local, Password = "foo"  
User-Service-Type = Framed-User,  
Framed-Protocol = PPP,  
cisco-avpair = "ipv6:prefix=2001:DB8:1:1::/64"
```

Interface Identifier attribute (Framed-Interface-Id) can be used:

```
Interface-Id = "0:0:0:1",
```

DHCPv6 Overview (1)

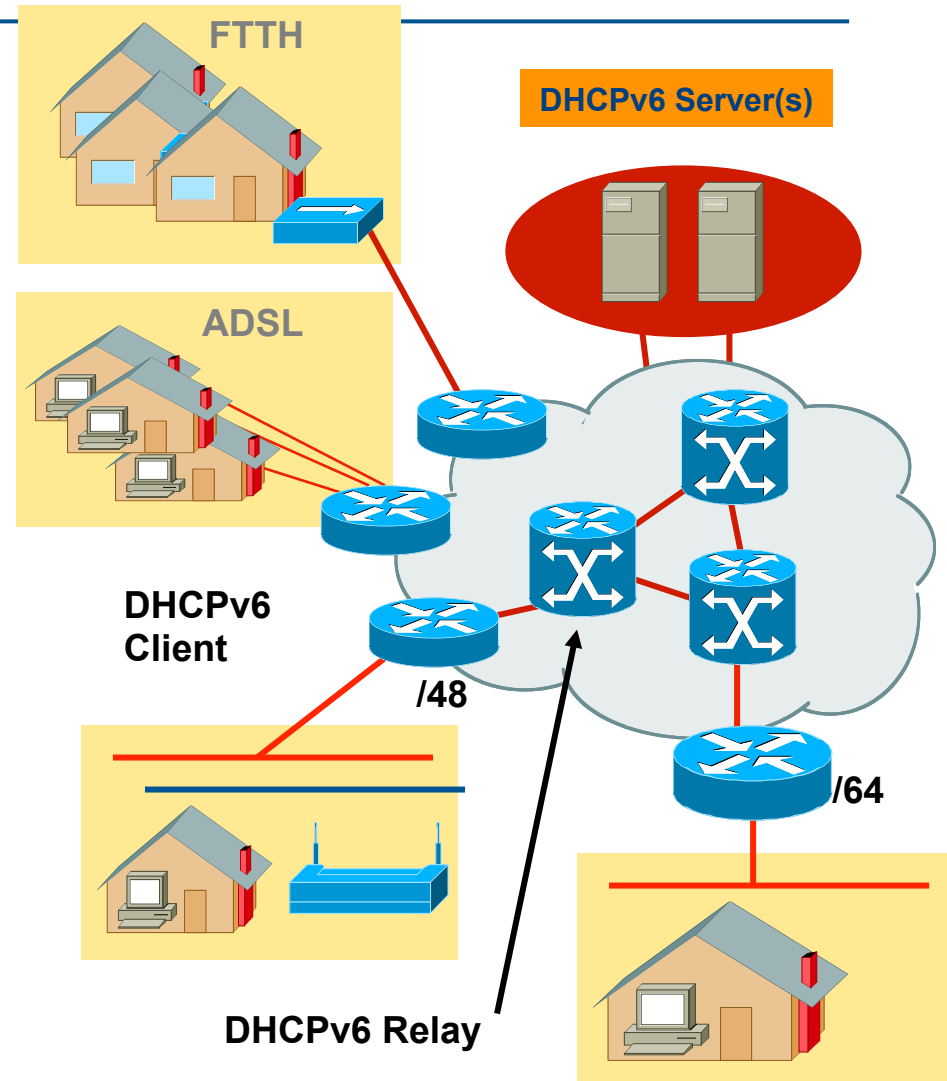
- ❑ Operational model based on DHCPv4, but details differ:
 - Client uses link-local address for message exchanges
 - Server can assign multiple addresses per client through Identity Associations
 - Clients and servers identified by DUID
 - Address assignment & Prefix delegation
 - Message exchanges similar, but will require new protocol engine
 - Server-initiated configuration, authentication part of the base specification
 - Extensible option mechanism & Relay-agents

DHCPv6 Overview (2)

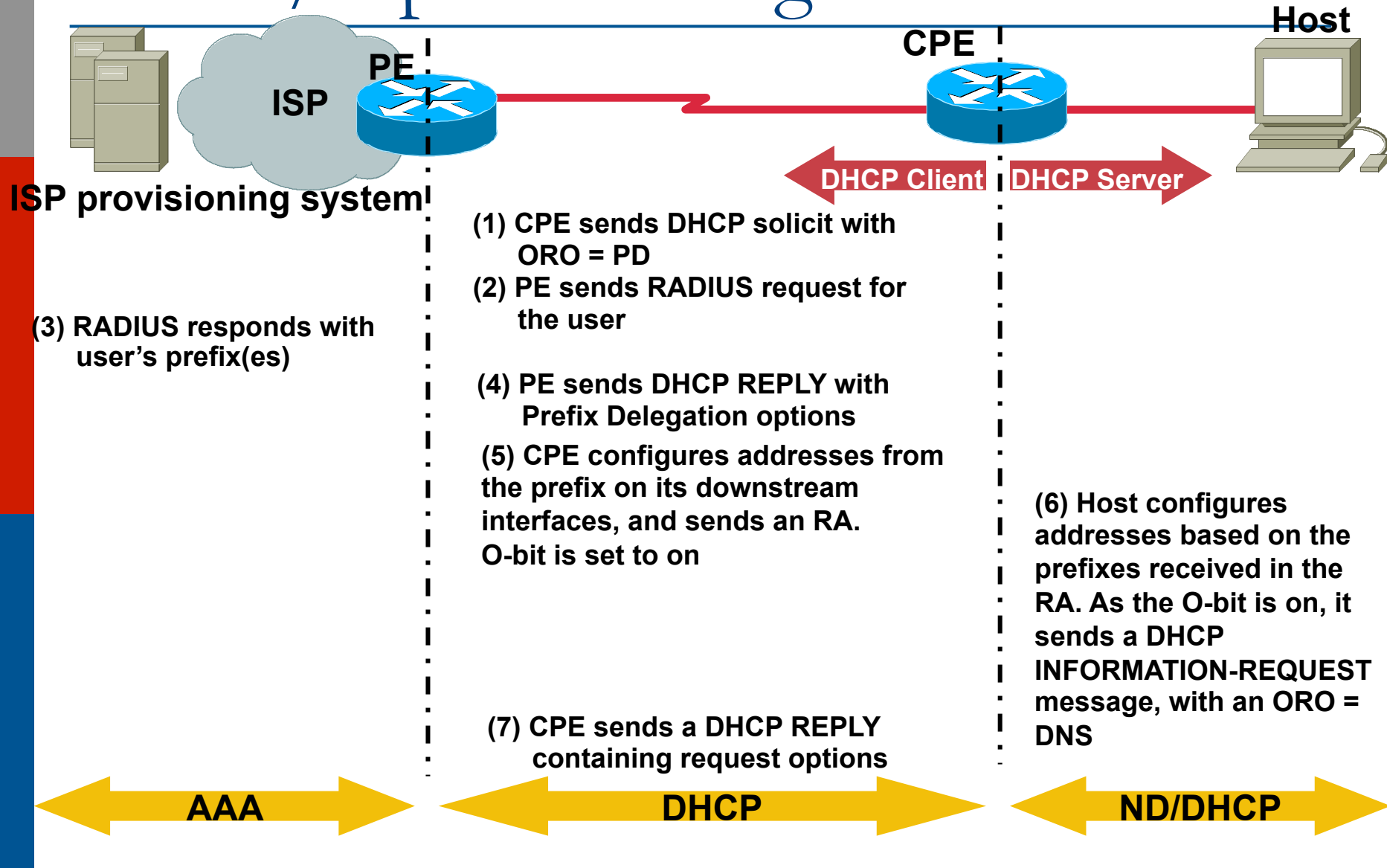
- Allows both stateful and stateless configuration
- RFC 3315 (DHCPv6) has additional options:
 - DNS configuration—RFC 3646
 - Prefix delegation—RFC 3633
 - NTP servers
 - Stateless DHCP for IPv6—RFC 3736

DHCPv6 PD: RFC 3633

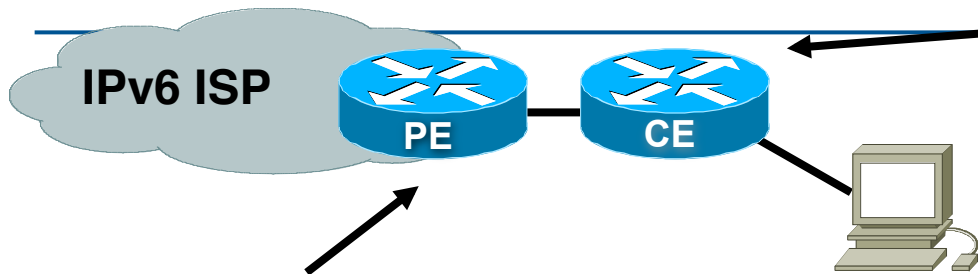
- ❑ Media independence
 - e.g., ADSL, FTTH
 - Only knows identity of requesting router
- ❑ Leases for prefixes
- ❑ Flexible deployments
 - Client/Relay/Server model
- ❑ Requesting router includes request for prefixes in DHCP configuration request
- ❑ Delegating router assigns prefixes in response along with other DHCP configuration information



Prefix/Options Assignment



DHCPv6 Prefix Delegation



```
vpdn enable
!
vpdn-group pppoe
 accept-dialin
 protocol pppoe
 virtual-template 1
!
ipv6 dhcp pool FOO
 prefix-delegation 2001:7:7::/48 0003000100055FAF2C08
 prefix-delegation 2001:8:8::/48 0003000100055FAC1808
 dns-server 2001:4::1
 domain-name cisco.com
!
interface Virtual-Template1
 ipv6 enable
 no ipv6 nd suppress-ra
 ipv6 dhcp server FOO
 ppp authentication chap
!
interface FastEthernet1/0
 pppoe enable
```

```
vpdn enable
!
vpdn-group 1
 request-dialin
 protocol pppoe
!
interface FastEthernet0/1
 ipv6 address DH-
 PREFIX 0:0:0:1::/64 eui-64
!
interface FastEthernet0/0
 pppoe enable
 pppoe-client dial-pool-number 1
!
interface Dialer1
 encapsulation ppp
 dialer pool 1
 dialer-group 1
 ipv6 address autoconfig
 ipv6 dhcp client pd DH-PREFIX
 ppp authentication chap callin
 ppp chap hostname dhcp
 ppp chap password 7 0300530816
!
ipv6 route ::/0 Dialer1
```

http://www.cisco.com/en/US/tech/tk872/technologies_white_paper09186a00801e199d.shtml

Technologies to aid IPv6 Transition and Integration



ISP Workshops