

IPv6 Integration and Coexistence Strategies

Objectives

- **Upon completion of this module, you will be able to perform the following tasks:**
 - List the strategies enabling integration and co-existence of IPv4 and IPv6**
 - Describe the dual stack approach**
 - Describe and configure tunnels**
 - Describe and configure 6to4**
 - Describe the tunnel broker approach**
 - List the IPv6-only to IPv4-only solutions**

Agenda

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- **Dual stack**
- **Overlay tunnels:**
 - **Configured tunnel**
 - **6to4**
 - **6over4**
 - **Tunnel broker**
- **IPv6-only to IPv4-only**

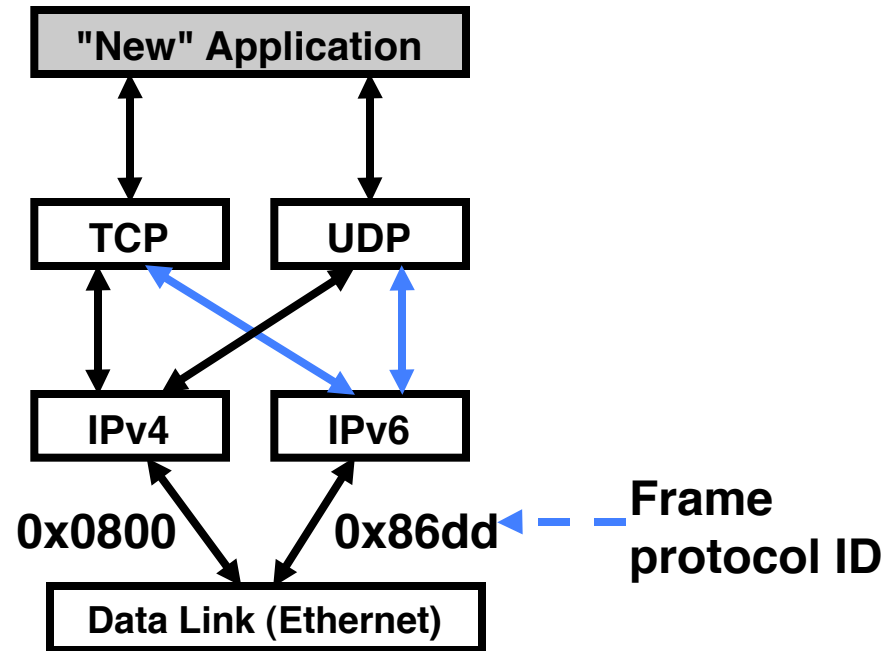
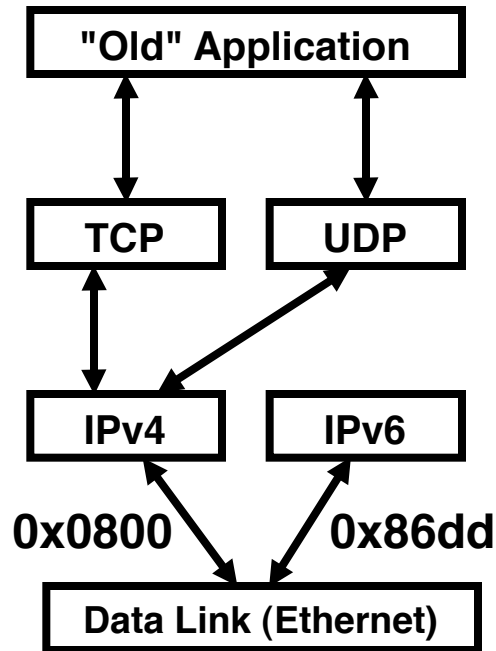
Strategies

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- **For end-systems, there is:**
Dual stack
- **For network Integration, there is:**
Overlay tunnels
IPv6-only to IPv4-only

Deploying Dual Stack

Dual Stack



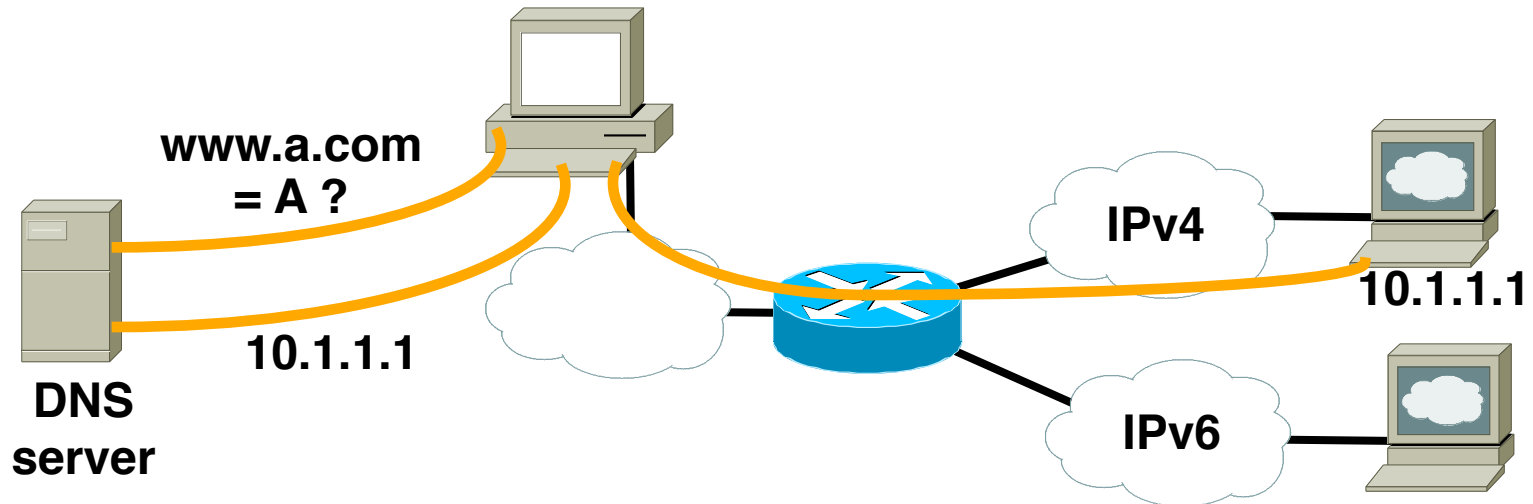
- Dual stack node means:

Both IPv4 and IPv6 stacks enabled

Applications can talk to both

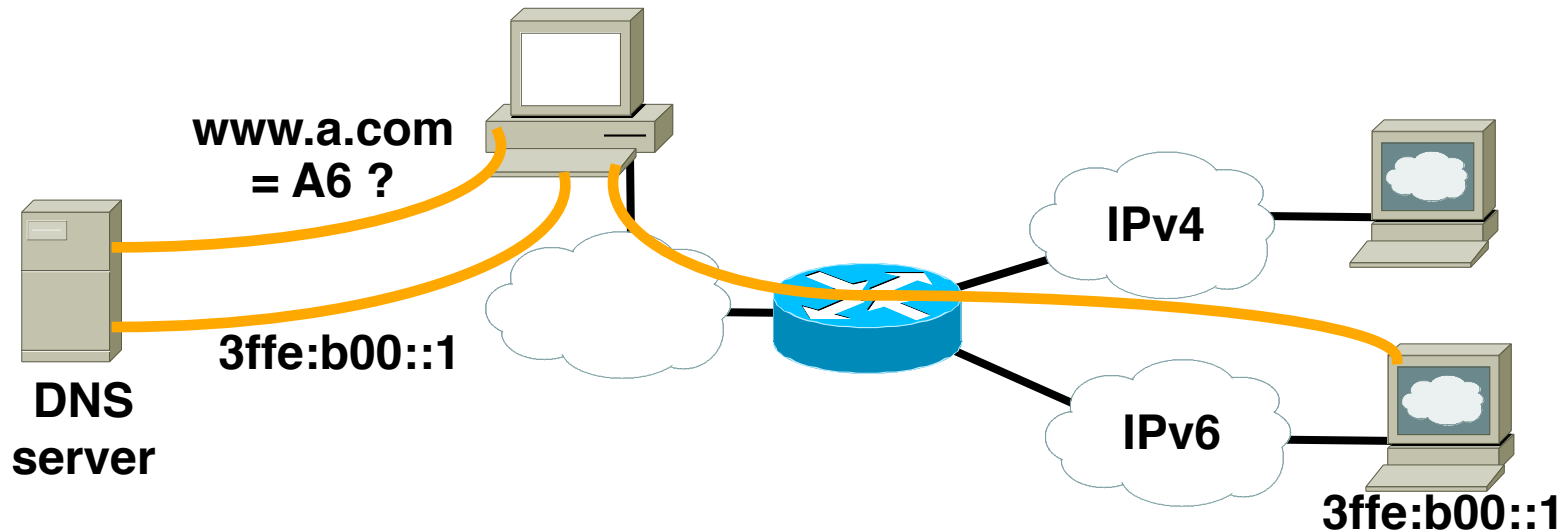
Choice of the IP version is based on name lookup and application preference

Dual Stack (cont.)



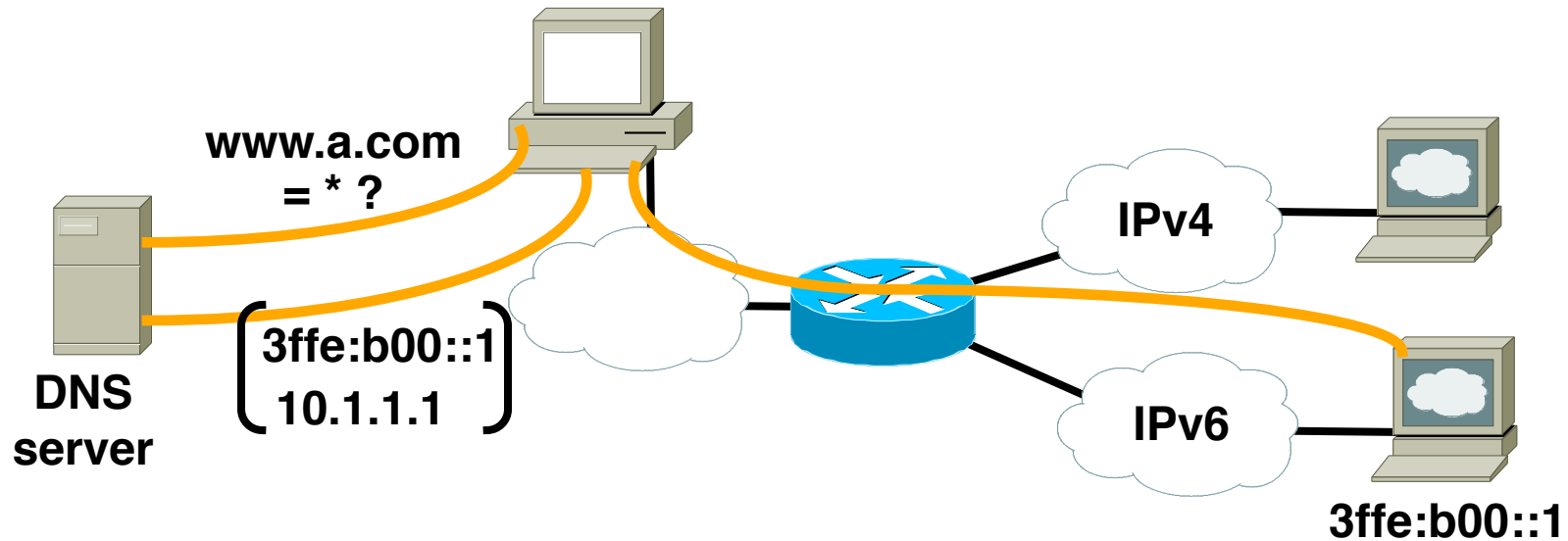
- Without IPv6, an application that:
 - Is not aware of IPv6
 - Or is forcing the use of IPv4
 - Asks the DNS for IPv4 address
 - And connects to the IPv4 address

Dual Stack (cont.)



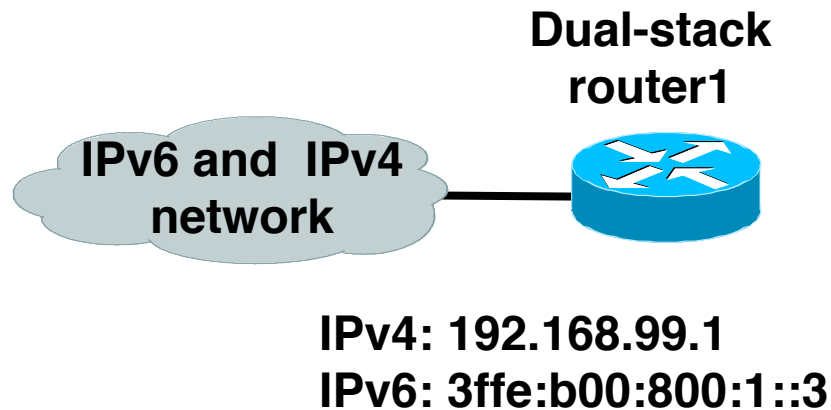
- In an IPv6-only case, an application that:
 - Is only IPv6-enabled or IPv6 is the only stack
 - Or is forcing the use of IPv6
 - Asks the DNS for IPv6 address
 - Connects to the IPv6 address

Dual Stack (cont.)



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

Dual Stack

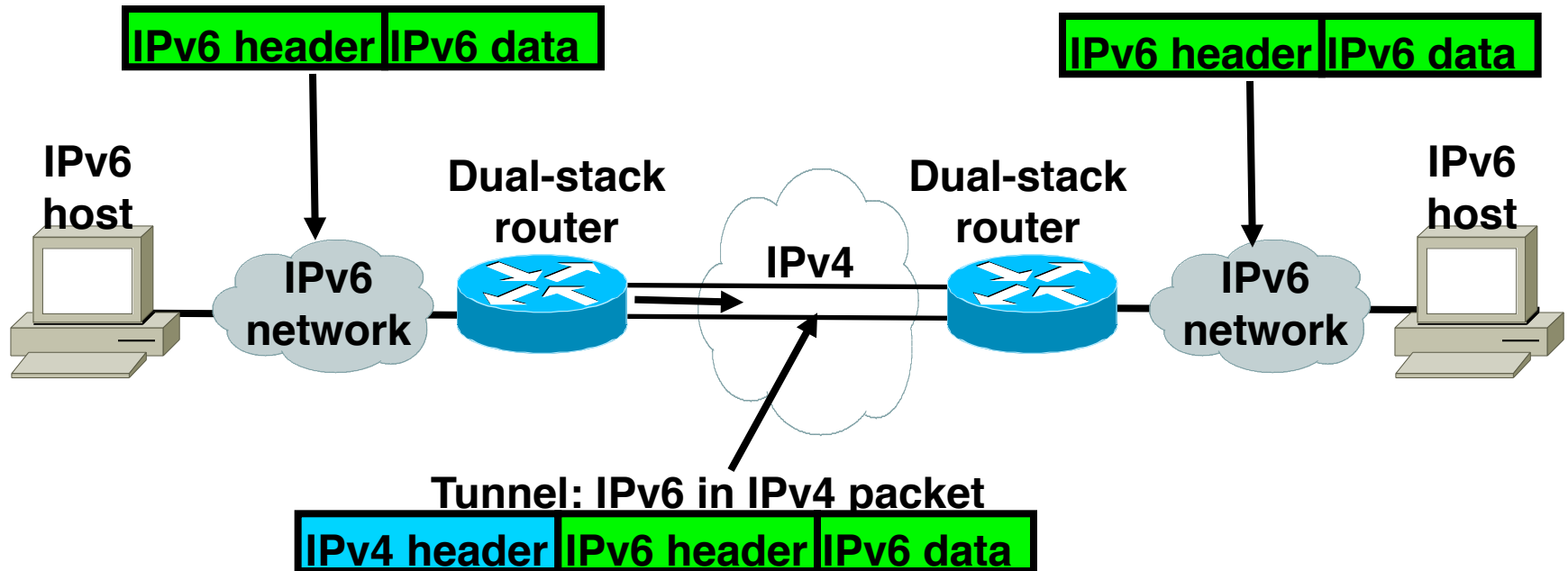


```
router1#  
ipv6 unicast-routing  
  
interface Ethernet0  
ip address 192.168.99.1 255.255.255.0  
ipv6 address 3ffe:b00:c18:1::3/127
```

- **IPv4 and IPv6 are configured on an interface**
- **This interface is dual-stacked**

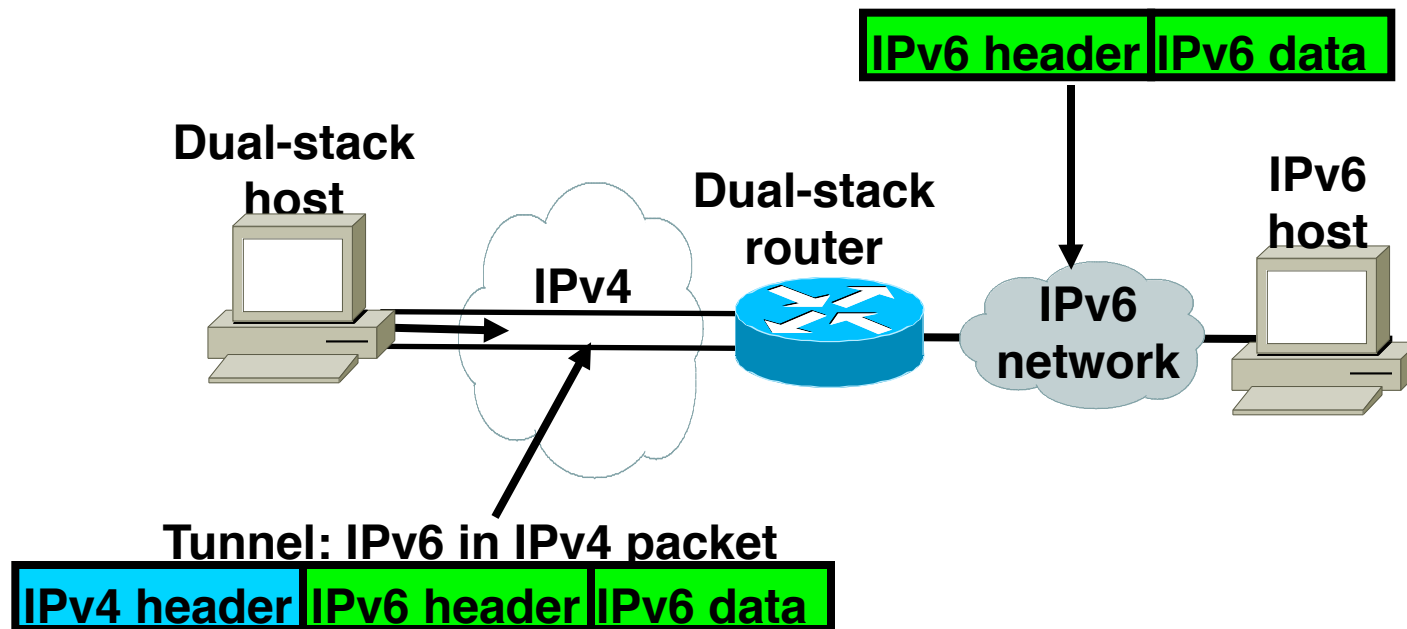
Deploying Overlay Tunnels

Overlay Tunnels



- Tunneling is encapsulating the IPv6 packet in the IPv4 packet.

Overlay Tunnels (cont.)



- Tunneling can be used by routers and hosts.

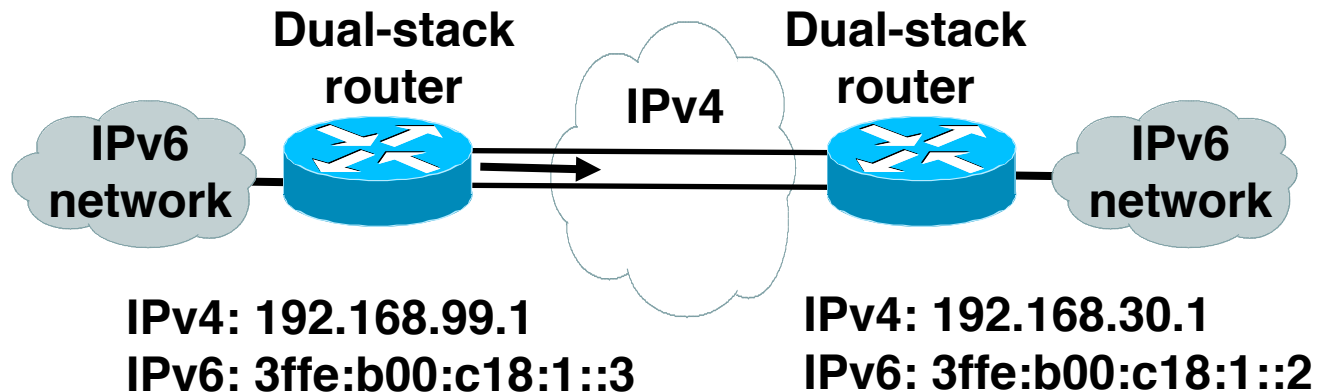
Tunnel Establishment

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- **Many techniques are available to establish a tunnel:**
 - Manually configured**
 - Semi-automated**
 - Tunnel broker**
 - Automatic**
 - Compatible IPv4**
 - 6to4**
 - 6over4**

Configured Tunnel

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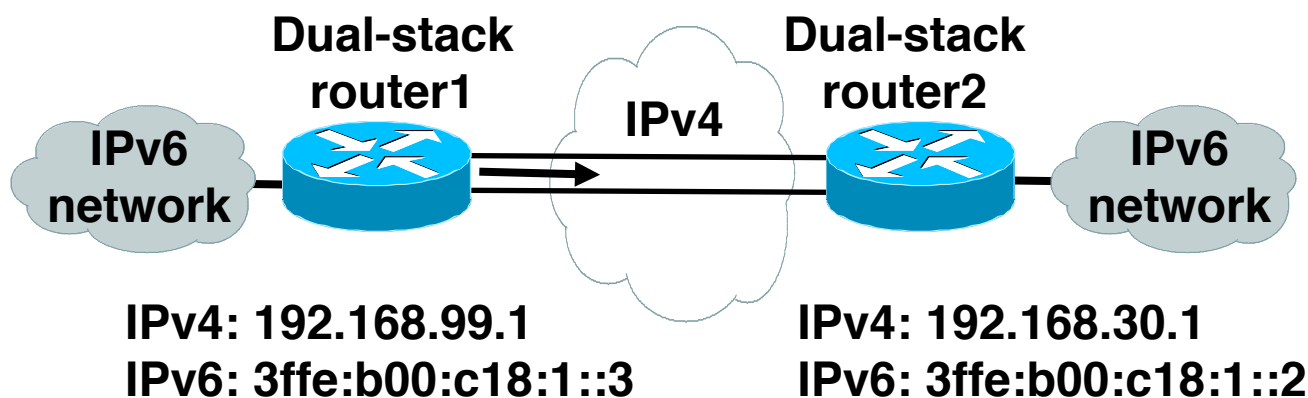
- **Configured tunnels require:**

Dual stack end points

Both IPv4 and IPv6 addresses configured at each end

IOS Tunnel Configuration

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router1#

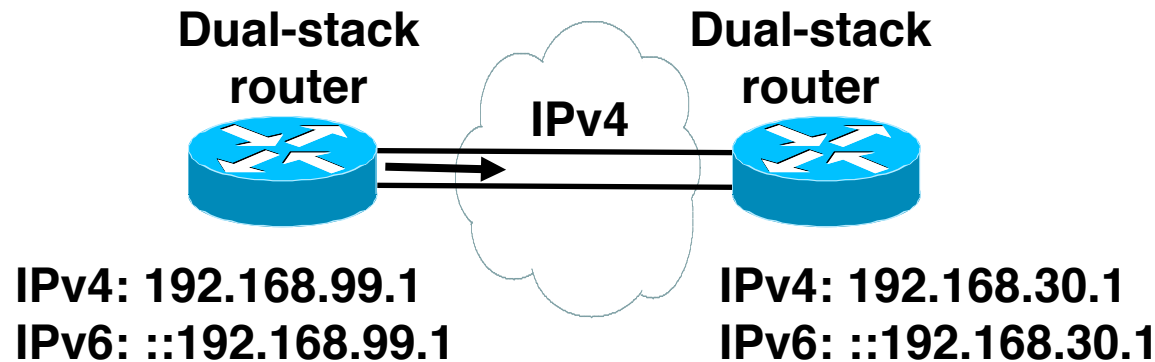
```
interface Tunnel0
ipv6 address 3ffe:b00:c18:1::3/127
tunnel source 192.168.99.1
tunnel destination 192.168.30.1
tunnel mode ipv6ip
```

router2#

```
interface Tunnel0
ipv6 address 3ffe:b00:c18:1::2/127
tunnel source 192.168.30.1
tunnel destination 192.168.99.1
tunnel mode ipv6ip
```


IPv4 Compatible

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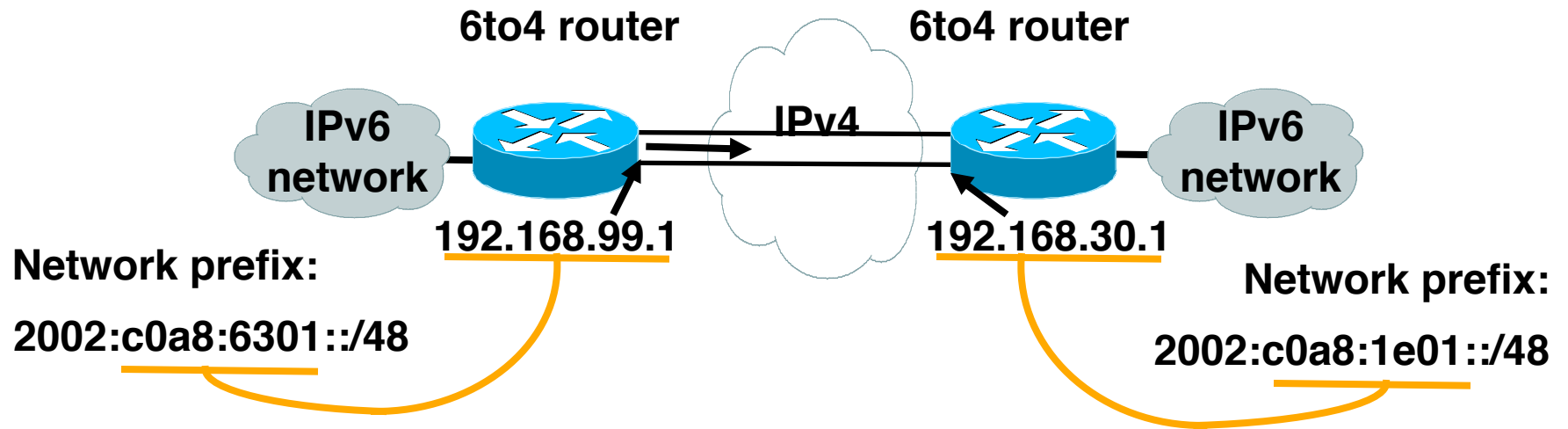


- **IPv4-compatible addresses are easy way to auto-tunnel, but it:**

Does not scale

Is deprecated

6to4

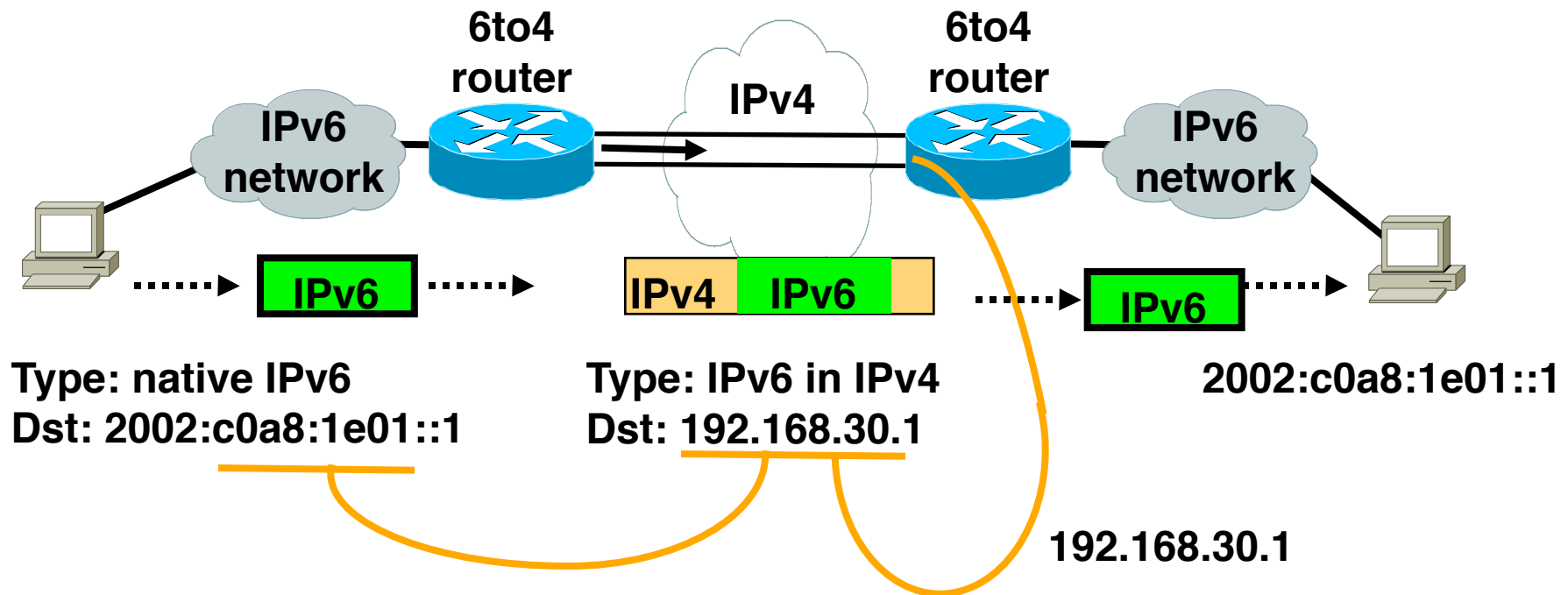


- **6to4:**

Is an automatic tunnel method

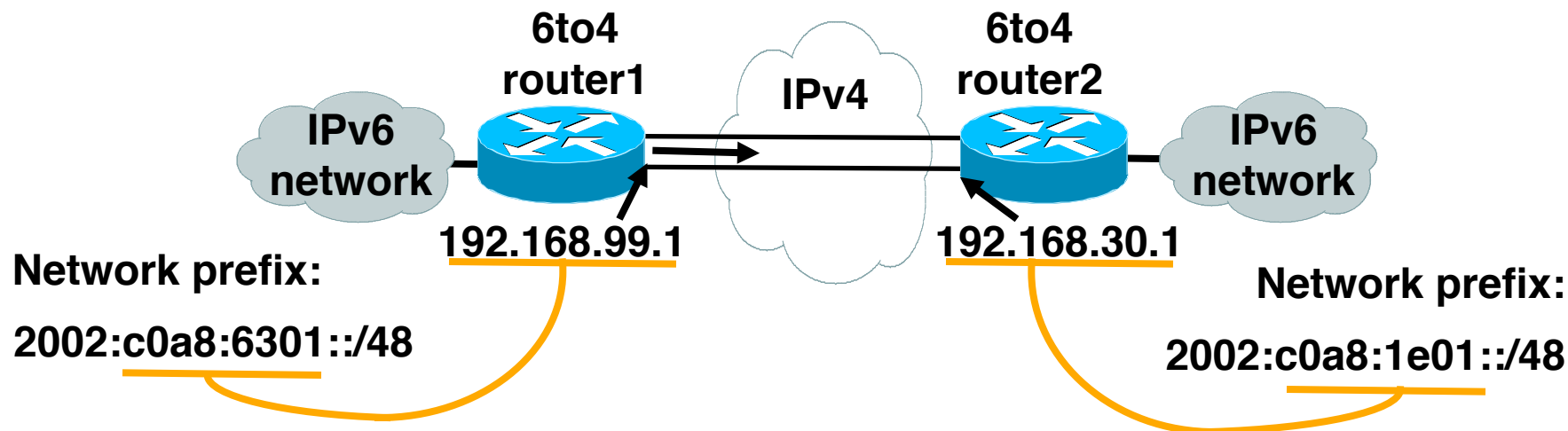
Gives a prefix to the attached IPv6 network

6to4 (cont.)



IOS 6to4 Configuration

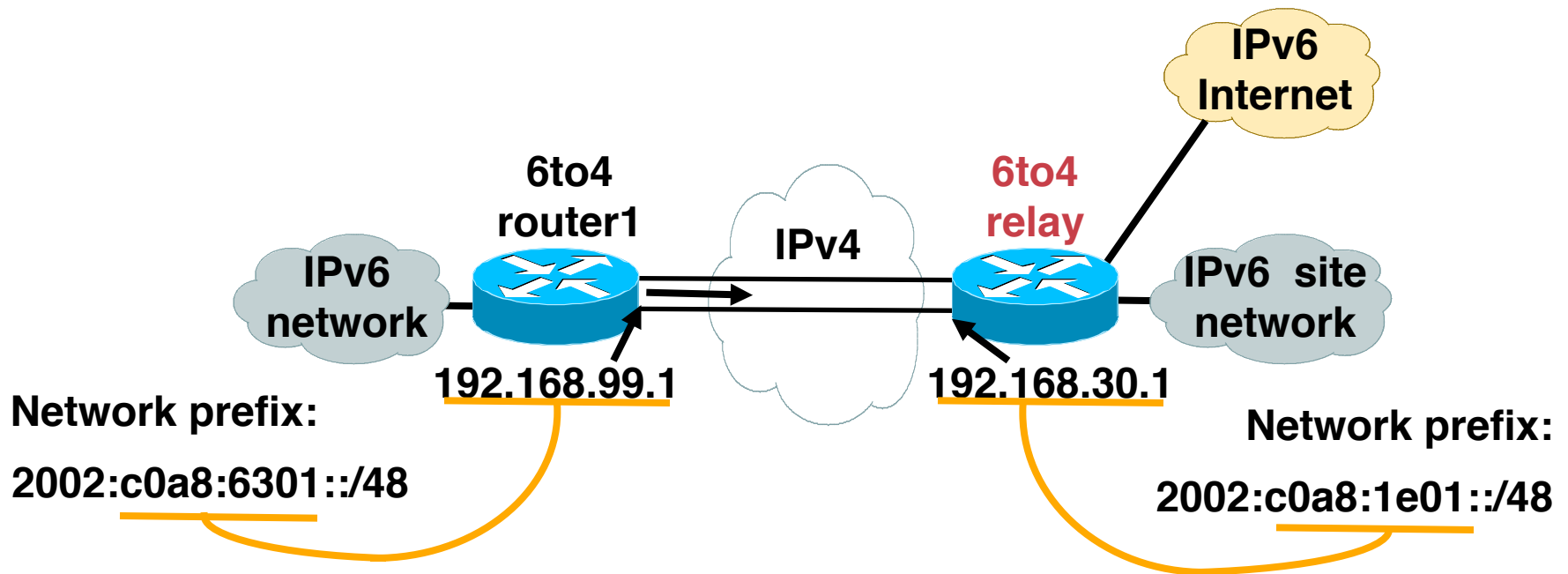
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```
router1#  
interface Ethernet0  
ip address 192.168.99.1 255.255.255.0  
ipv6 address 2002:c0a8:6301:1::/64 eui-64  
!  
interface Tunnel0  
no ip address  
ipv6 unnumbered Ethernet0  
tunnel source Ethernet0  
tunnel mode ipv6ip 6to4  
  
ipv6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

```
router2#  
interface Ethernet0  
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 Ethernet0  
tunnel mode ipv6ip 6to4  
  
ipv6 route 2002::/16 Tunnel0
```

6to4 Relay

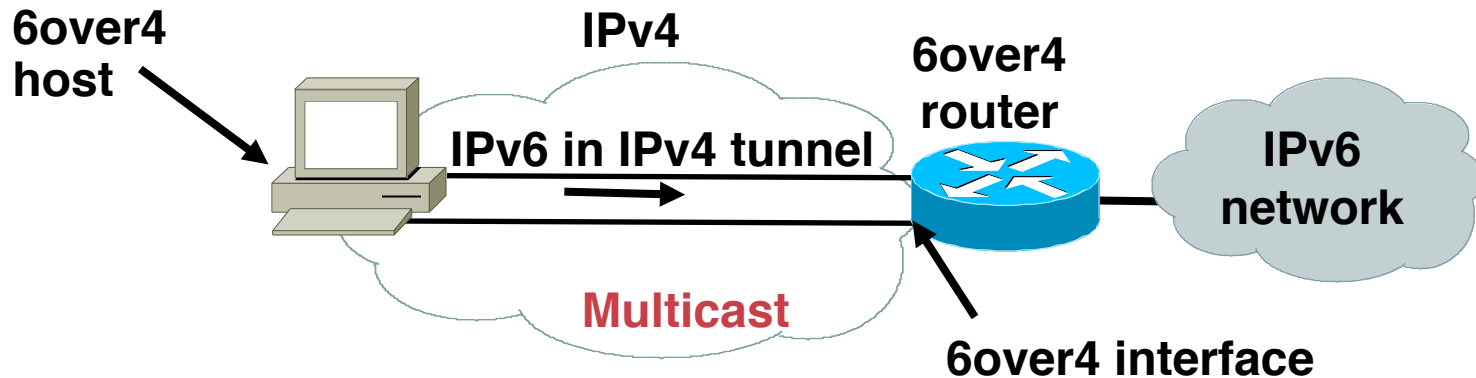


- **6to4 relay:**

Is a gateway to the rest of the IPv6 Internet

Default router

6over4



- **6over4:**

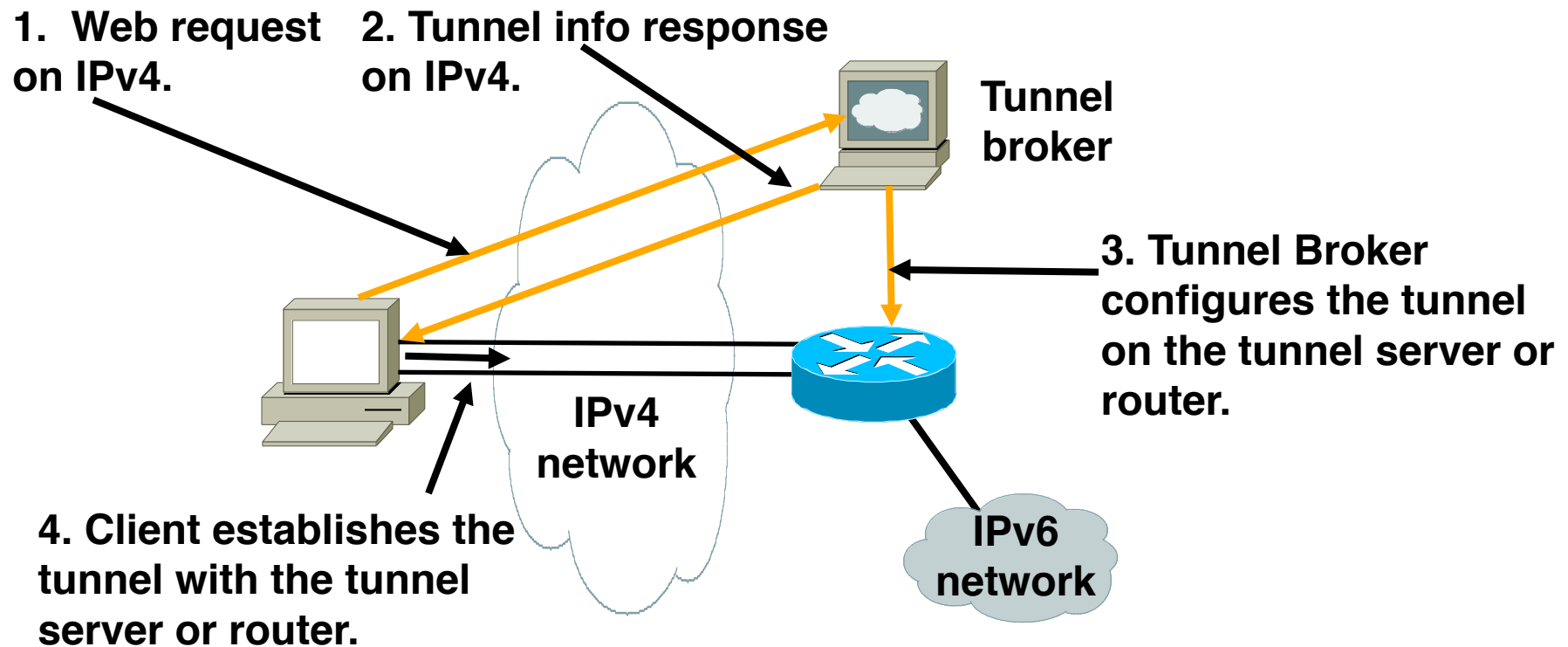
Is an automatic tunnel method

Maps IPv6 multicast addresses into IPv4 multicast addresses

IPv4 becomes a "virtual Ethernet" for IPv6

Needs an IPv4 Multicast-enabled network

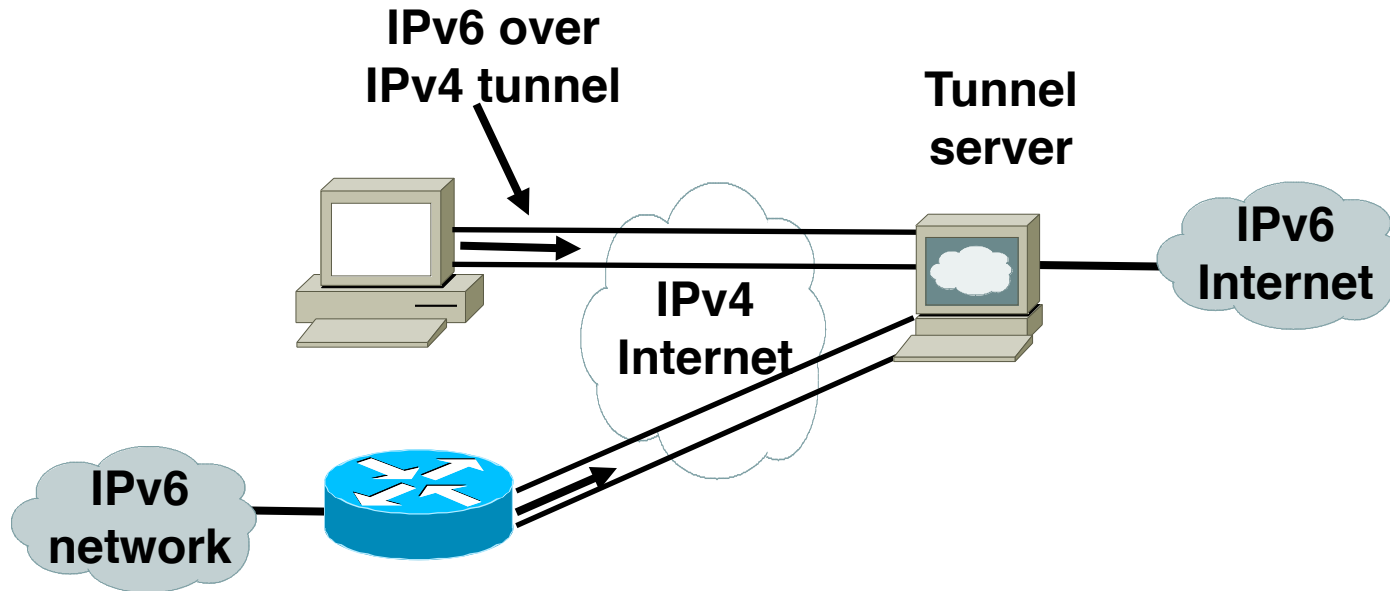
Tunnel Broker



- **Tunnel broker:**

Tunnel information is sent via http-ipv4

Tunnel Server



- Tunnel server is:
Simpler model
Server is both for Web requests and for tunnel end-point

IPv6-only to IPv4-only

IPv6-only to IPv4-only

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- **Connecting non-connected domains with:
Application-Level Gateway**

Dual stack

Host uses its current stack to connect to ALG

Can be a proxy (SOCKS)

API tricks

Bump-in-the-stack, Bump-in-the-API

Translation

Transport Layer

Network Layer

Additional Resources

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RFC 2893, Transition Mechanisms for IPv6 Hosts and Routers

RFC 2529, Transmission of IPv6 over IPv4 Domains without Explicit Tunnels (6over4)

draft-ietf-ngtrans-6to4-07.txt, Connection of IPv6 Domains via IPv4 Clouds (6to4)

RFC 2766, Network Address Translation—Protocol Translation (NAT-PT)

draft-ietf-ngtrans-introduction-to-ipv6-transition-04.txt, On overview of the introduction of IPv6 in the Internet

draft-ietf-ngtrans-broker-03.txt, IPv6 Tunnel Broker