IPv4 routing within AS6 is implemented by using RIP. No routers announce 0.0.0.0/0 or IPv6 subnets. AS4, AS6, and AS46 announce the subnets in gray. AS10, AS20, AS30, and AS40 are transit ASes, and as such they do not announce any owned subnets. All peering LANs are announced. AS46 is a customer of AS30 and AS40, and as such it must forbid transit traffic between AS30 and AS40. AS46 prefers passing via AS30 to reach AS6. Enable IPv6 forwarding on all IPv6 routers. IPv6 routing is implemented by static routes.

An IPv6-in-IPv4 tunnel is established between interface eth0 of as6r2 and interface eth1 of as46r1 (the “tube” in the figure).

**Goals:**
- Every IPv4 address must be reachable from any IPv4-enabled network nodes. Same for IPv6.
- Packet routing, especially among AS46, AS4, and AS6, must be consistent with BGP policies. AS46 must forbid transit traffic.

**Setting up an IPv6 address**
- `ifconfig interface up`
- `ifconfig interface add ipv6-address/64`

**Enabling IPv6 forwarding**
- `echo 1 > /proc/sys/net/ipv6/conf/all/forwarding`

**Adding a static IPv6 route**
- `route -A inet6 add ipv6-prefix/64 [GW ipv6-address] [dev interface]`

**Creating an IPv6-in-IPv4 tunnel**
- `ip tunnel add tunnelName mode sit remote remoteIPv4 local localIPv4 ttl 10`
- `ifconfig tunnelName up`
- `ifconfig tunnelName add localIPv4/32 [dev interface]`
- `route -A inet6 add default dev tunnelName`

**IPv6 traceroute**
- `traceroute6 -N 1 ipv6-address`
Using Netkit, implement the network depicted in the figure and described below (you can use the following items as a checklist).

- IPv4 routing within AS40 is implemented by using RIP.
- No routers announce 0.0.0.0/0 or IPv6 subnets.
- AS40, AS60, and AS460 announce the subnets in gray.
- AS1, AS2, AS3, and AS4 are transit ASes, and as such they do not announce any owned subnets.
- All peering LANs are announced.
- AS40 is a customer of AS1 and AS4, and as such it must forbid transit traffic between AS1 and AS4.
- To reach AS40, AS4 prefers passing via AS3 and AS3 prefers passing via AS2.
- Enable IPv6 forwarding on all IPv6 routers.
- IPv6 routing is implemented by static routes.
- An IPv6-in-IPv4 tunnel is established between interface eth1 of as60r1 and interface eth1 of as40r1 (the “tube” in the figure).

**Goals:**
- Every IPv4 address must be reachable from any IPv4-enabled network nodes. Same for IPv6.
- Packet routing, especially among AS460, AS60, and AS40, must be consistent with BGP policies. AS40 must forbid transit traffic.

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**IPv6 only**

**IPv4/v6**

**IPv4 only**
Goals:

- Every IPv4 address must be reachable from any IPv4-enabled network nodes. Same for IPv6.
- Packet routing, especially among AS4060, AS4000 and AS6000, must be consistent with BGP policies. AS4000 must forbid transit traffic.

IPv4 routing in AS4060 is implemented by using RIP.

- No routers announce 0.0.0.0/0 or IPv6 subnets.
- AS4060, AS4000, and AS6000 announce the subnets in gray.
- AS1, AS2, AS3, and AS4 are transit ASes, and AS4 transit ASes, and as such they do not announce any owned subnets.
- All peering LANs are announced.
- AS4000 is a customer of AS2 and AS3, and as such it must forbid transit traffic between AS2 and AS3.
- AS1 prefers passing via AS4 to reach AS4000.

IPv6:

- Enable IPv6 forwarding on all IPv6 routers.
- IPv6 routing is implemented by static routes.
- An IPv6-in-IPv4 tunnel is established between interface eth1 of as4060r2 and interface eth1 of as6000r1 (the “tube” in the figure).

Using Netkit, implement the network depicted in the figure and described below (you can use the following items as a checklist).

<table>
<thead>
<tr>
<th>Setting Up an IPv6 Address</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>ifconfig interface up</code></td>
</tr>
<tr>
<td><code>ifconfig interface add ipv6adrd/netmask</code></td>
</tr>
</tbody>
</table>

Enabling IPv6 Forwarding

```
route -A inet6 add ipv6net[/netmask] [gw ipv6adrd] [dev interface]
```

Creating an IPv6-In-IPv4 Tunnel

```
ip tunnel add <tunnelname> mode sit remote remoteIP4 local localIP4 ttl 10
```

IPv6 Traceroute

```
traceroute6 -N 1 ipv6adrd
```
Using Netkit, implement the network depicted in the figure and described below (you can use the following items as a checklist).

- IPv4 routing within AS600 is implemented by using RIP.
  - No routers announce 0.0.0.0 or IPv6 subnets.
  - AS406, AS400, and AS600 announce the subnets in gray.
  - AS1, AS2, AS3, and AS4 are transit ASes, and as such they do not announce any owned subnets.
  - All peering LANs are announced.
  - AS400 is a customer of AS1 and AS4, and as such it must forbid transit traffic between AS1 and AS4.
  - AS2 prefers passing via AS3 to reach AS400.
  - Enable IPv6 forwarding on all IPv6 routers.
  - IPv6 routing is implemented by static routes.
  - An IPv6-in-IPv4 tunnel is established between interface eth0 of as600r2 and interface eth0 of as406r1 (the “tube” in the figure).

**Goals:**
- Every IPv4 address must be reachable from any IPv4-enabled network nodes. Same for IPv6.
- Packet routing, especially among AS406, AS400, and AS600, must be consistent with BGP policies. AS400 must forbid transit traffic.

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**SETTING UP AN IPv6 ADDRESS**

```sh
echo 1 >/proc/sys/net/ipv6/conf/all/forwarding
```  

**ENABLING IPv6 FORWARDING**

```sh
route -A inet6 add IPv6Net/[Netmask] [gw IPv6Addr] [dev INTERFACE]
```  

**ADDING A STATIC IPv6 ROUTE**

```sh
ip route add IPv6Net/128 dev dev INTERFACE
```  

**CREATING AN IPv6-IN-IPv4 TUNNEL**

```sh
ip netns add tunnelName
ip addr add /128 dev tunnelName
ip link set dev tunnelName up
ip link set dev tunnelName master tun0
```  

**IPv6 TRACEROUTE**

```sh
tcpdump -i tun0
```