Advanced Networking Topics:
BGP, BGP Hijacking, MPLS, MPLS-based VPNs, Segment Routing, and others

Lab 9: Introduction to Segment Routing over IPv6 (SRv6)

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Segment Routing

- This lab presents Segment Routing over IPv6 (SRv6)
- We will enable and configure the routers to perform SRv6 using the Linux kernel implementation
- SRv6 is available in the mainstream Linux kernel since version 4.10

Enabling SRv6 on Linux

- SRv6 is enabled through the sysctl tool
- Sysctl allows modifying values for the kernel parameters
- All interfaces must set *seg6_enabled, forwarding* keys

```
root@frr-pc:/etc/routers/r2# sysctl -w net.ipv6.conf.r2-eth0.seg6_enabled=1
net.ipv6.conf.r2-eth0.seg6_enabled = 1
root@frr-pc:/etc/routers/r2# sysctl -w net.ipv6.conf.r2-eth0.forwarding=1
net.ipv6.conf.r2-eth0.forwarding = 1
root@frr-pc:/etc/routers/r2# sysctl -w net.ipv6.conf.r2-eth1.seg6_enabled=1
net.ipv6.conf.r2-eth1.seg6_enabled = 1
root@frr-pc:/etc/routers/r2# sysctl -w net.ipv6.conf.r2-eth1.forwarding=1
net.ipv6.conf.r2-eth1.forwarding = 1
root@frr-pc:/etc/routers/r2# sysctl -w net.ipv6.conf.all.forwarding=1
net.ipv6.conf.all.forwarding = 1
root@frr-pc:/etc/routers/r2# sysctl -w net.ipv6.conf.all.seg6_enabled=1
net.ipv6.conf.all.seg6_enabled = 1
root@frr-pc:/etc/routers/r2#
```

Configuring routes

- The iproute2 tool is used to add the segment routing headers (SRH) onto packets

```
ip -6 route add <prefix> encap seg6 mode <encapmode> segs <segments> [hmac <keyid>] dev <device>
```

- *prefix*: IPv6 prefix of the route.

- *encapmode*: *encap* to encapsulate matching packets into an outer IPv6 header containing the SRH, and inline to insert the SRH right after the IPv6 header of the original packet.

- *segments*: comma-separated list of segments. Example: fc00::1,fc42::5.

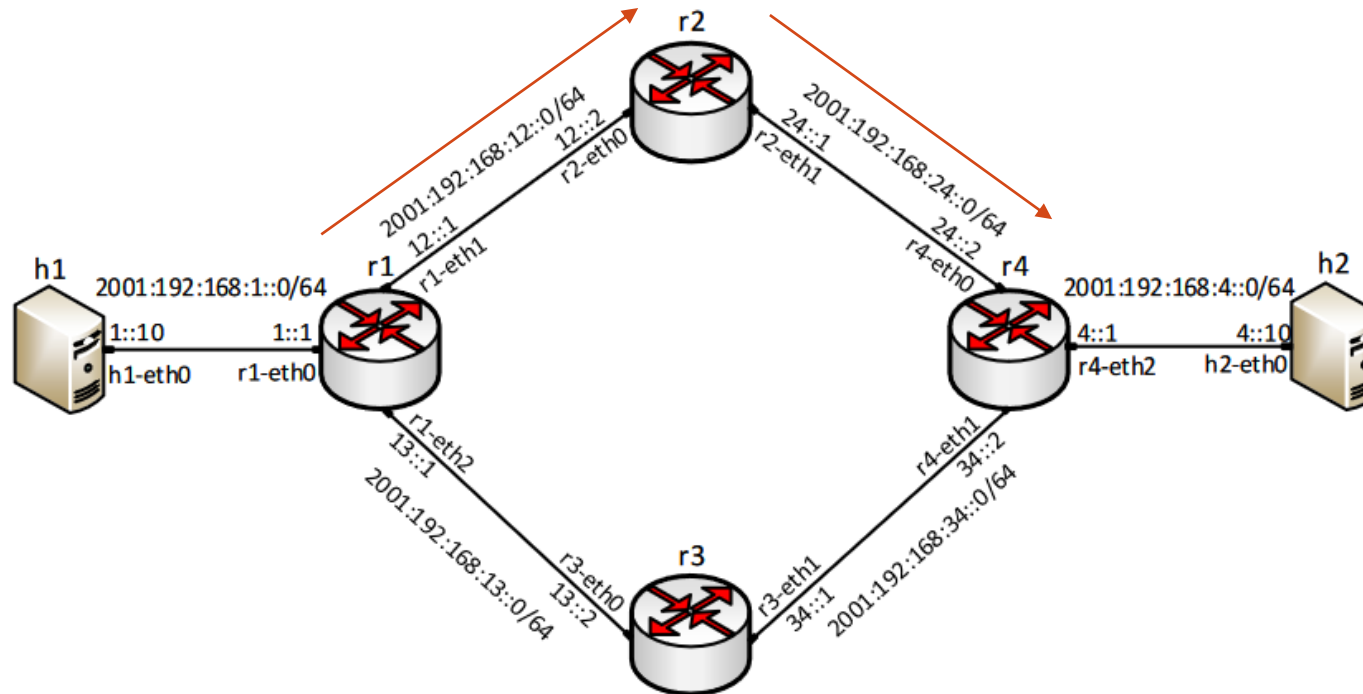- *keyid*: HMAC key ID (optional)

- *device*: any non-loopback device.

Lab Goal and Topology

- Configure SRv6 on the Linux kernel
- Change the configuration to route packets to another route
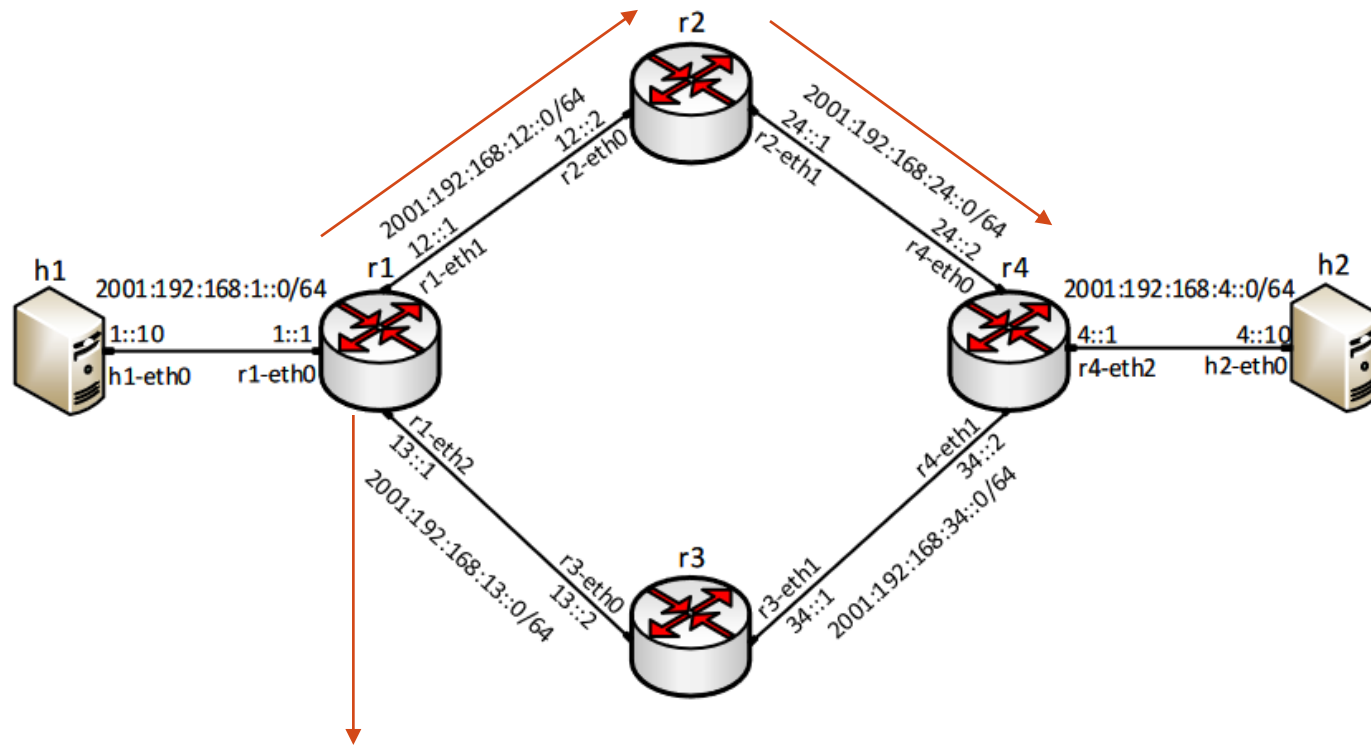- Lab topology:
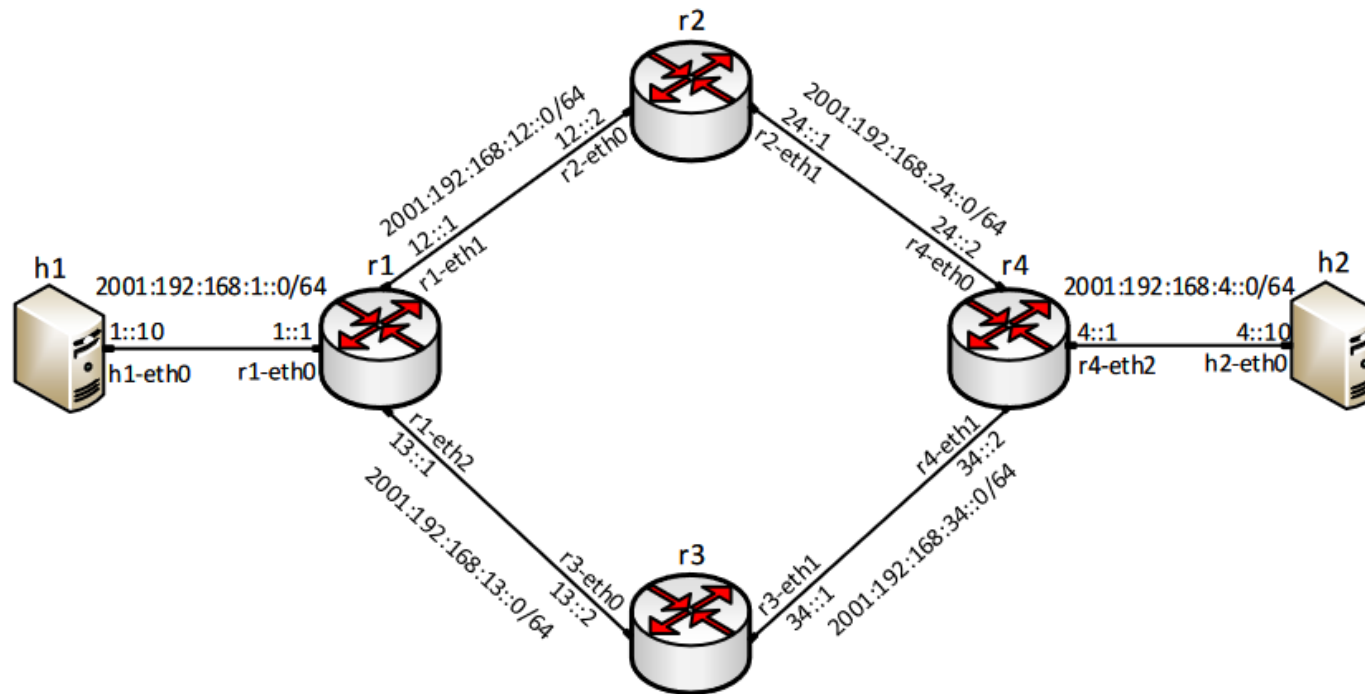
Lab Goal and Topology

- There are two paths for host h1 to reach host h2
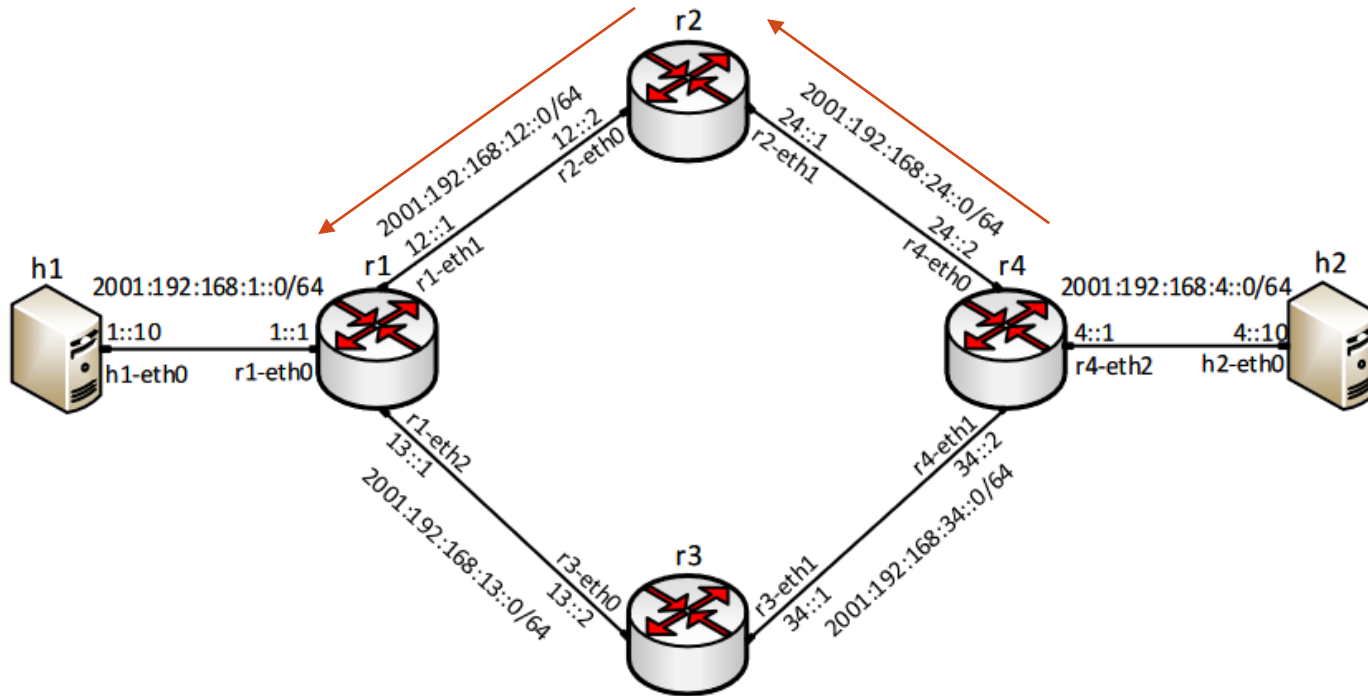- The first path is determined by r1-r2-r4

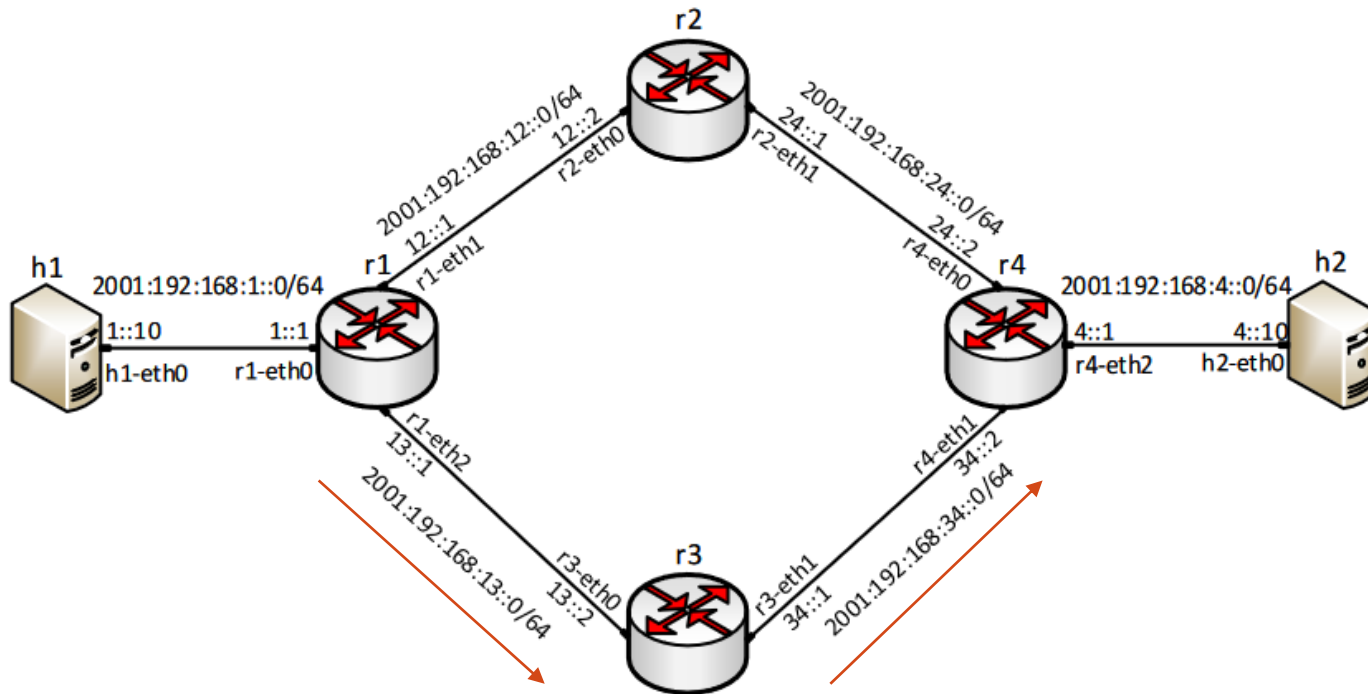# Lab Goal and Topology

- The first path r1-r2-r4

Lab Goal and Topology

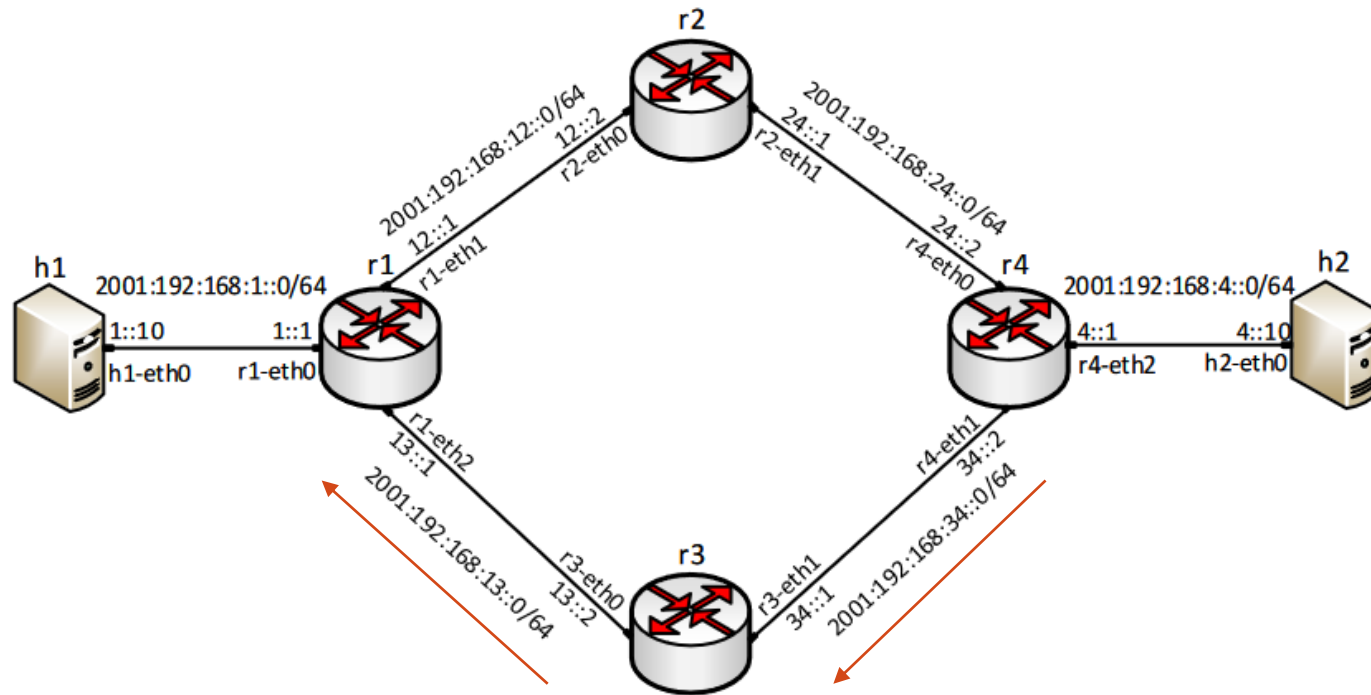- The first path (reverse) r4-r2-r1

Lab Goal and Topology
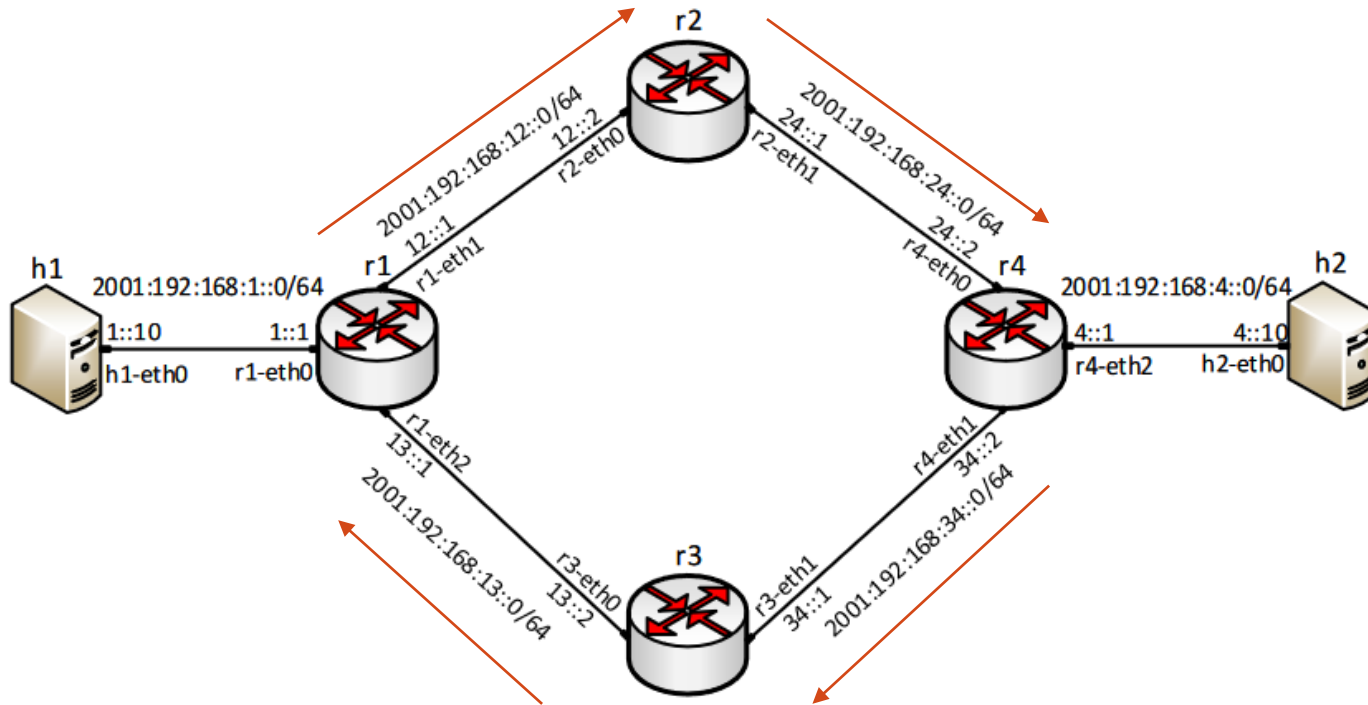
- The second path r1-r3-r4

Lab Goal and Topology

- The second path (reverse) r4-r3-r1

Lab Goal and Topology

- Asymmetric path r1-r2-r4, r4-r3-r1

Lab Goal and Topology

- Assume r1 and r4 are SRv6-capable
- Assume r2 and r3 are not SRv6-capable

Not SRv6-capable

SRv6-capable

SRv6-capable

Not SRv6-capable