



Hands-on Workshop on Network Technologies



Hands-on session 1: Introduction and Basic Configuration Lab 3 - IPv6 Lab Series



Jose Gomez¹, Jorge Crichigno²
¹Fort Lewis College (FLC)
²University of South Carolina (USC)

<https://research.cec.sc.edu/cyberinfra/>

Tuesday, Jul 15, 2025
Online

IPv6 Lab Series

- Lab 1 Introduction to Mininet
- Lab 2 Introduction to FRR
- Lab 3 IPv6 Address Configuration
- Lab 4 Enabling Stateless Address Autoconfiguration (SLAAC) in IPv6 Routers
- Lab 5 Configuring Devices using SLAAC and Stateless DHCPv6 Server
- Lab 6 Configuring Devices using Stateful DHCPv6
- Lab 7 Using IPv6 Static Routing
- Lab 8 Configuring Single Area OSPFv3 for IPv6
- Lab 9 Using BGP in an IPv6 network
- Lab 10 Configuring DNS and Web Servers in an IPv6 network
- Lab 11 Transitioning from IPv4 to IPv6 – tunnels
- Lab 12 Configuring Stateless NAT64
- Lab 13 Enabling IPv4 and IPv6 Coexistence with DN64
- Lab 14 Configuring IPSec Tunnel on IPv6
- Lab 15 Monitoring IPv6 networks using Zeek

Other Lab Libraries

Cybersecurity

- Virtual Labs on Cybersecurity Tools and Applications
- Virtual Labs on Zeek Intrusion Detection and Prevention Systems

Other Lab Libraries

SDN and P4 Programmable Data Plane Switches

- Cybersecurity Applications on P4 Programmable Data Planes
- P4 Programmable Data Planes: Applications, Stateful Elements, and Custom Packet Processing
- P4 Programmable Data Plane Switches based on BMv2
- P4 Programmable Data Plane Switches based on Intel's Tofino Chip
- Introduction to Software Defined Networking (SDN)
- Introduction to P4-DPDK

Other Lab Libraries

Routing and Switching

- Open Shortest Path First (OSPF)
- Introduction to Border Gateway Protocol (BGP)
- MPLS and Advanced BGP Topics
- Open vSwitch (OvS)

Other Lab Libraries

Network Monitoring and Management

- Network Management Tools (Netflow, IPFix, sFlow)
- Introduction to perfSONAR
- PerfSONAR 5.0
- P4-perfSONAR Lab Series

Other Lab Libraries

Network Fundamentals

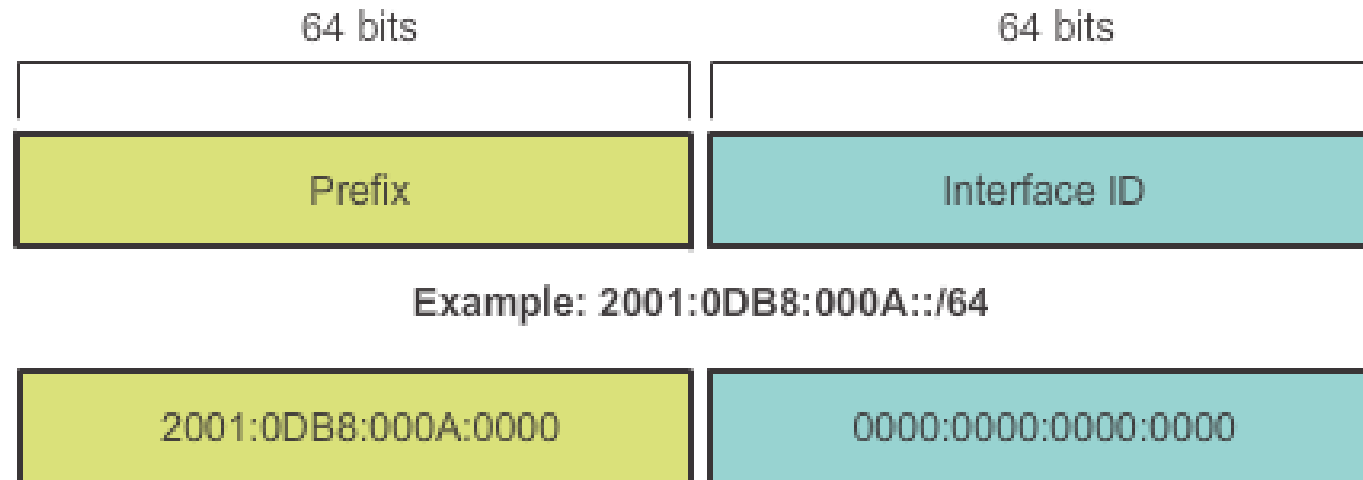
- Network Tools and Protocols (NTP)
- Introduction to IPv6

Objectives of this Session

- Understand the types of IPv6 addresses.
- Differentiate between IPv6 Link Local Address (LLA) and Global Unicast Address (GUA).
- Configure IPv6 LLA and GUA.

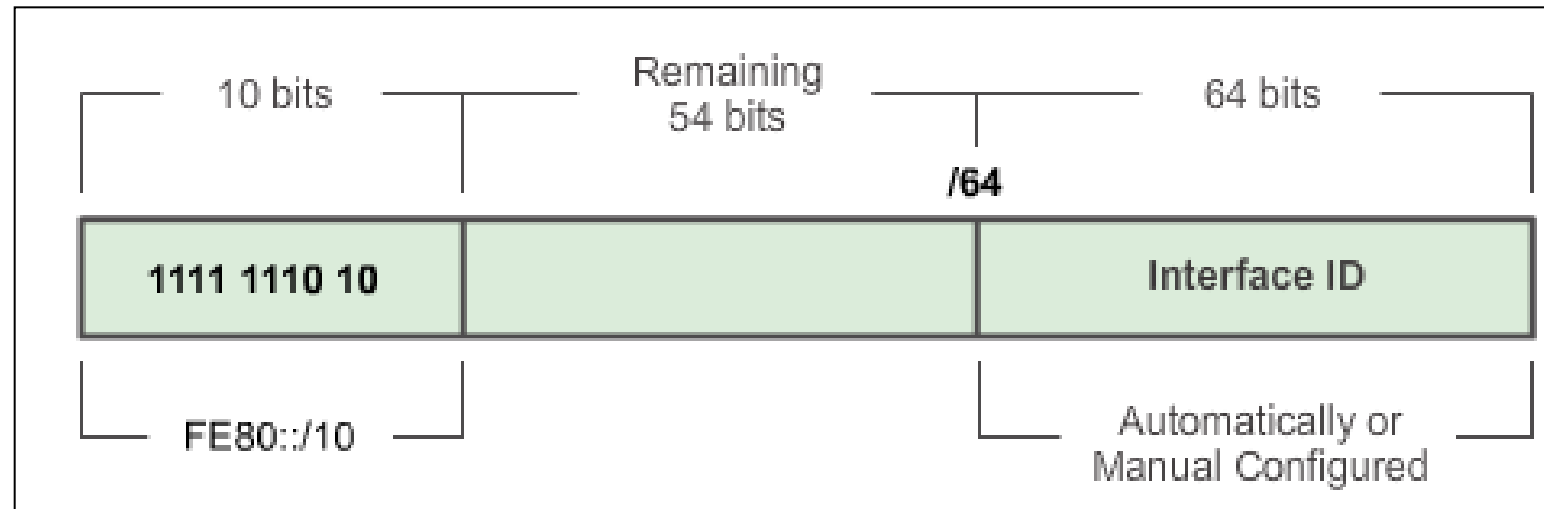
IPv6 Unicast Addresses

- Global Unicast
 - Similar to a public IPv4 address
 - Globally unique
- Link-local
 - Used to communicate with other devices on the same local link
 - Confined to a single link; not routable beyond the link



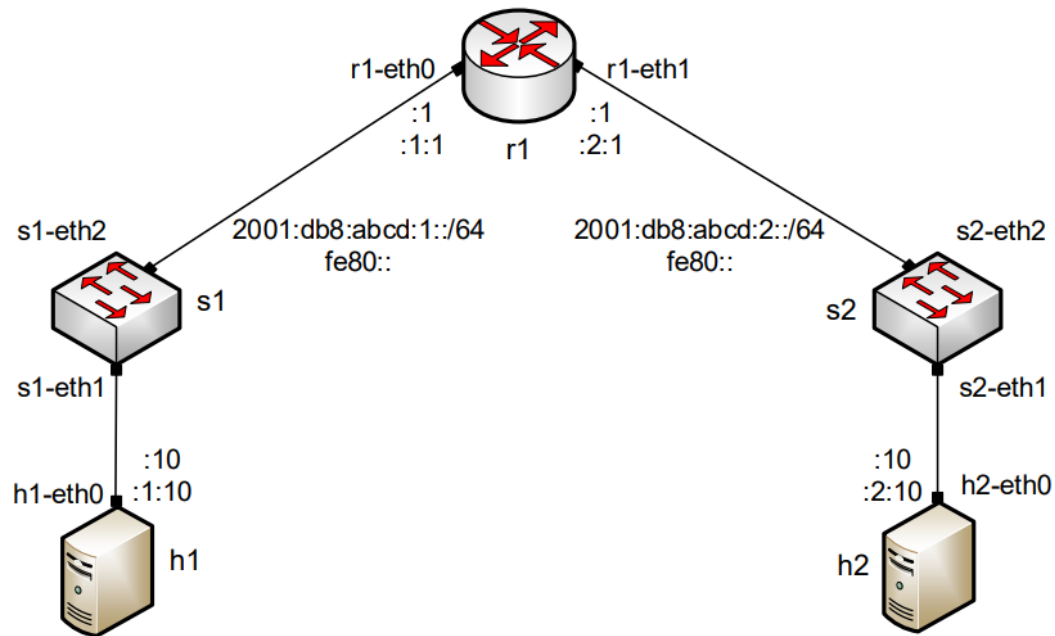
IPv6 Unicast Link Local Address

- Every IPv6-enabled network interface must have a link-local address
- It enables a device to communicate with other IPv6-enabled devices on the same link and only on that link (subnet)
- FE80::/10 range, first 10 bits are **1111 1110 10**xx xxxx



Network Topology

- Lab 3



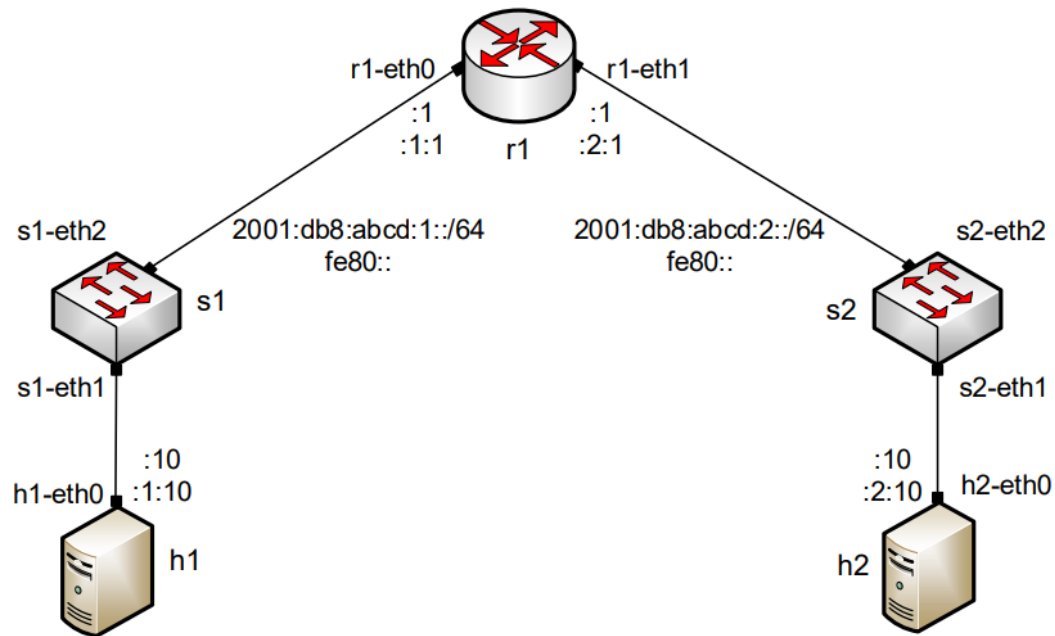
Network topology

Device	Interface	IPv6 Address	Subnet	Default gateway
Router r1	r1-eth0	2001:db8:abcd:1::1 fe80::1:1	/64 /64	N/A
	r1-eth1	2001:db8:abcd:2::1 fe80::2:1	/64 /64	N/A
Host h1	h1-eth0	2001:db8:abcd:1::10 fe80::1:10	/64 /64	2001:db8:abcd:1::1
Host h2	h2-eth0	2001:db8:abcd:2::10 fe80::2:10	/64 /64	2001:db8:abcd:2::1

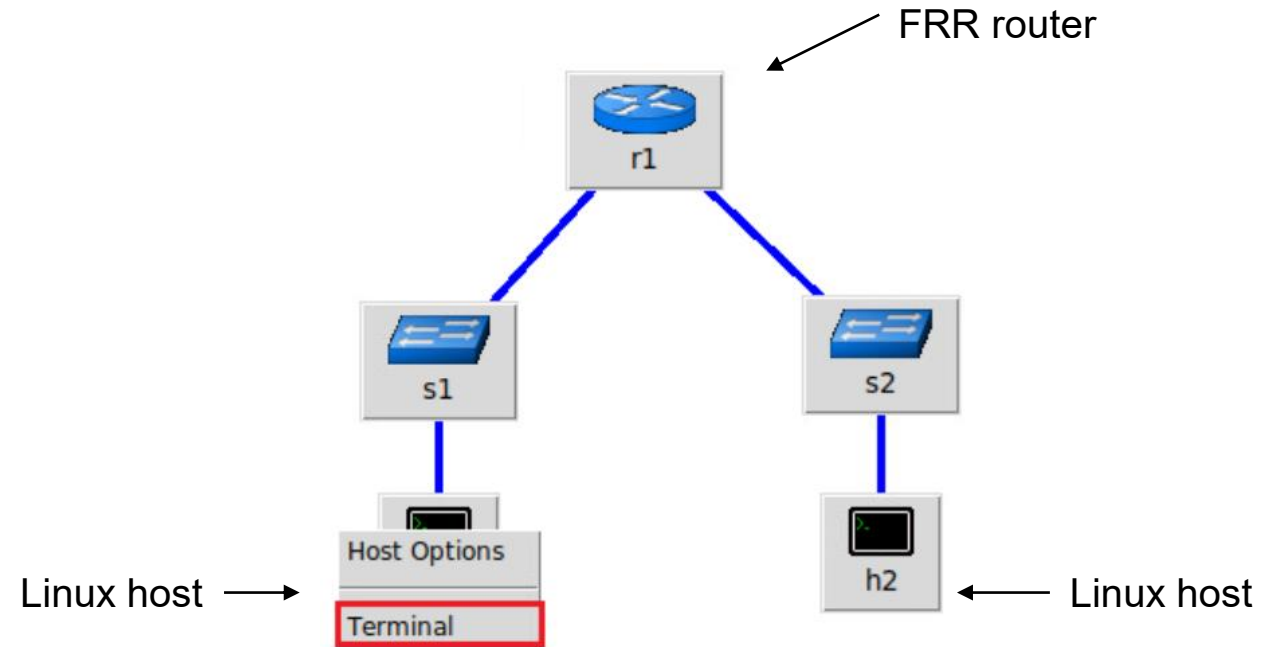
Address information

Network Topology

- Lab 3



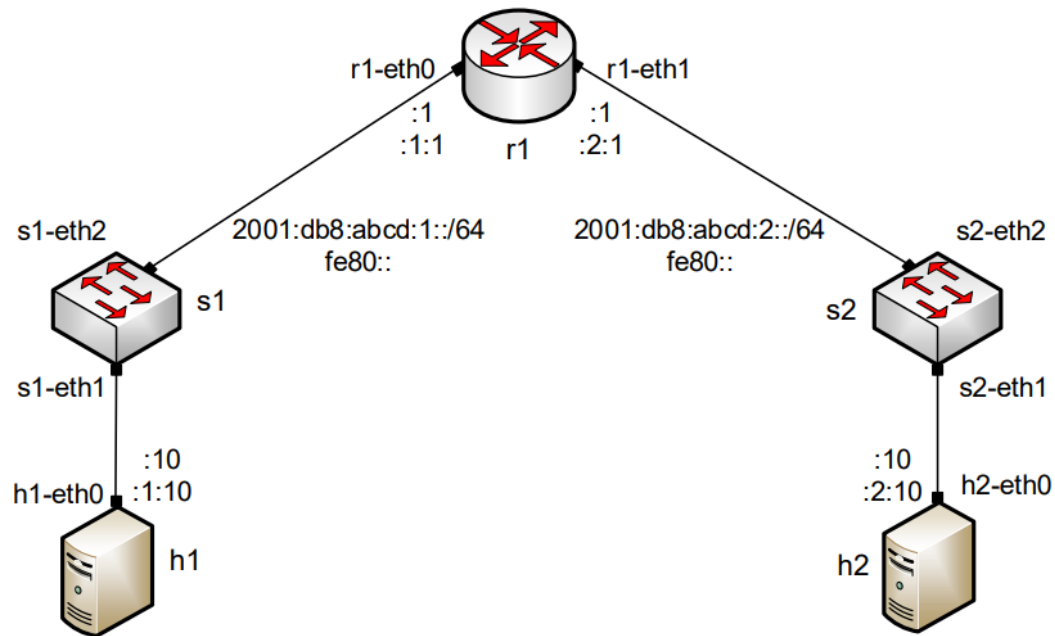
Network topology



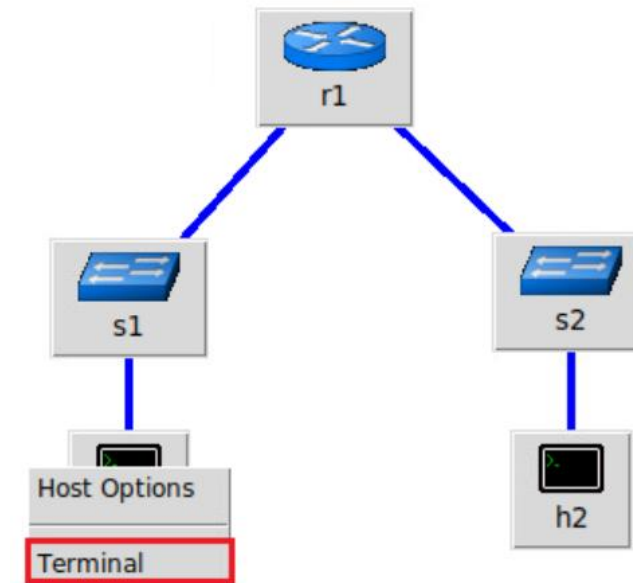
Mininet implementation

Network Topology

- Lab 3



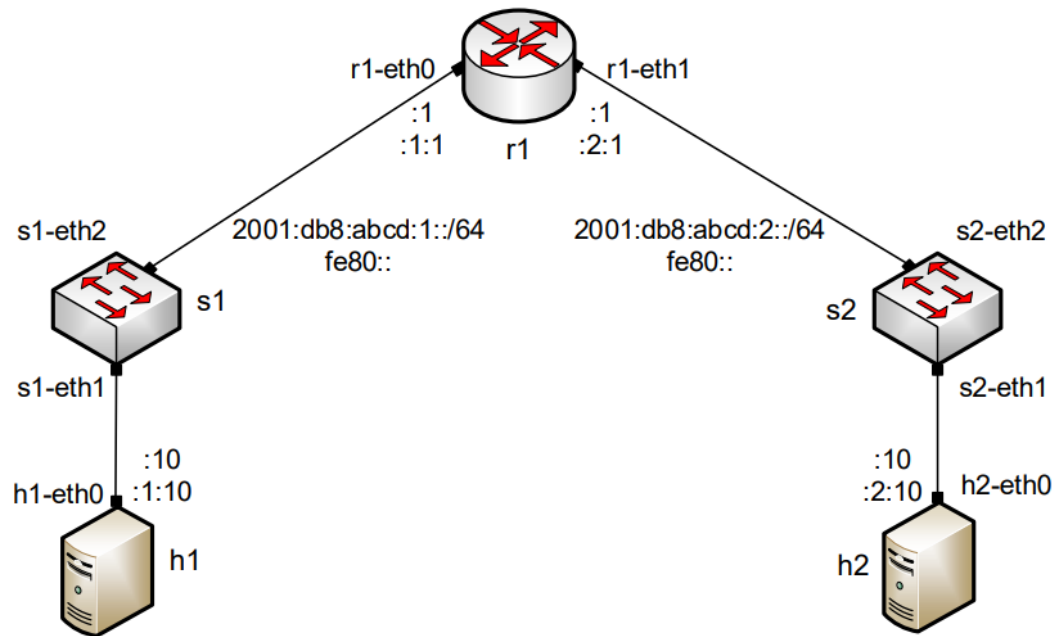
Network topology



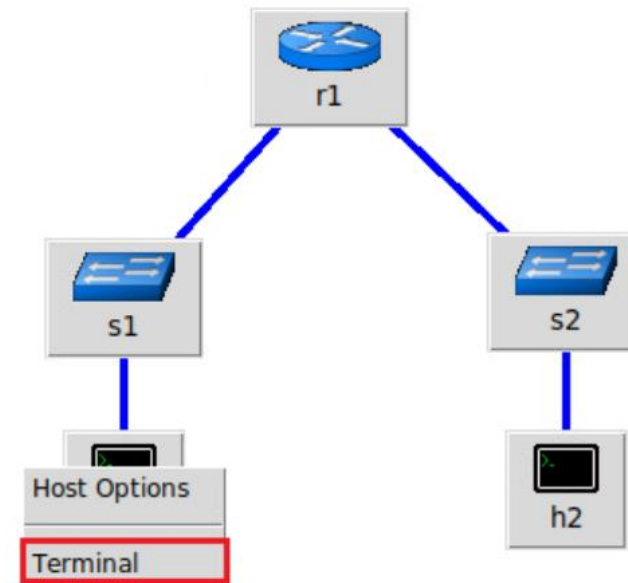
```
"Host: h1"
root@frr-pc:~# ip -6 addr add fe80::1:10/64 dev h1-eth0
root@frr-pc:~#
```

Network Topology

- Lab 3



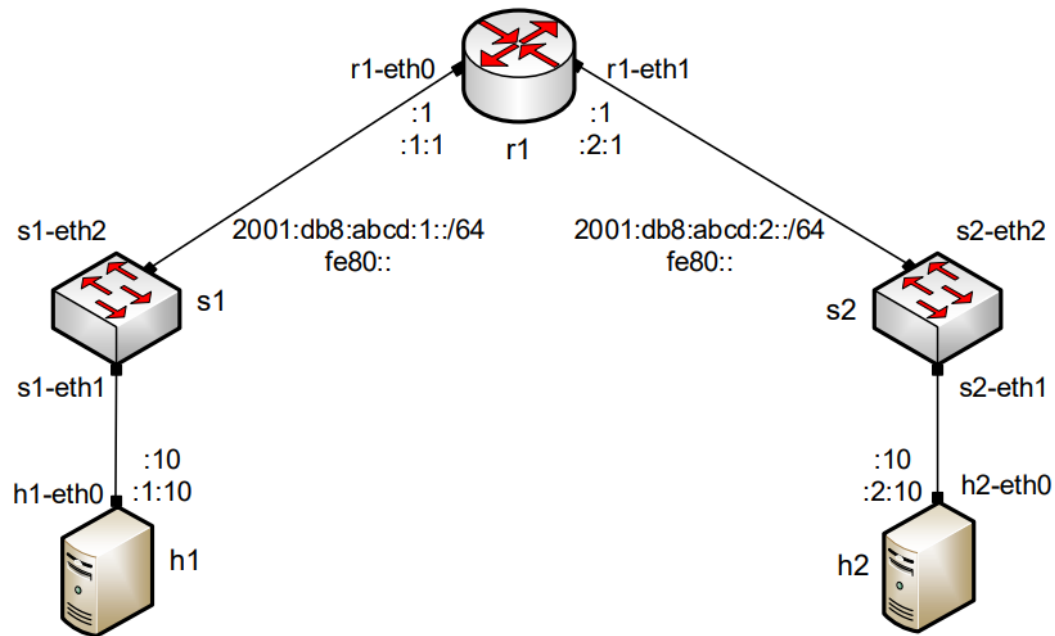
Network topology



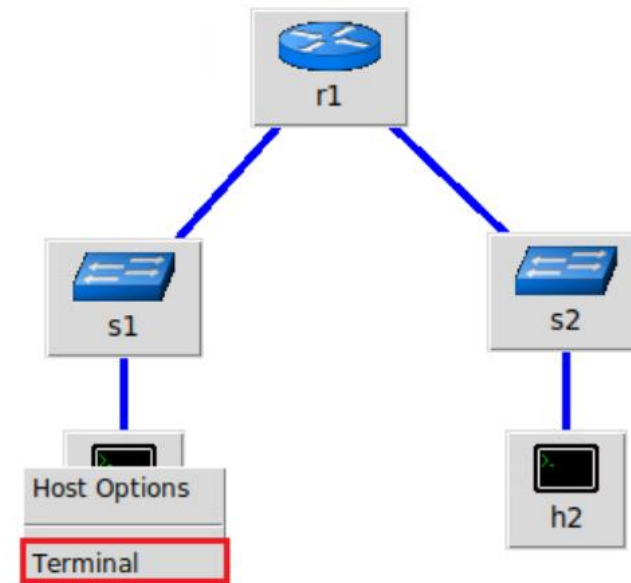
```
"Host: h1"
root@frr-pc:~# ip -6 addr add 2001:db8:abcd:1::10/64 dev h1-eth0
root@frr-pc:~#
```

Network Topology

- Lab 3



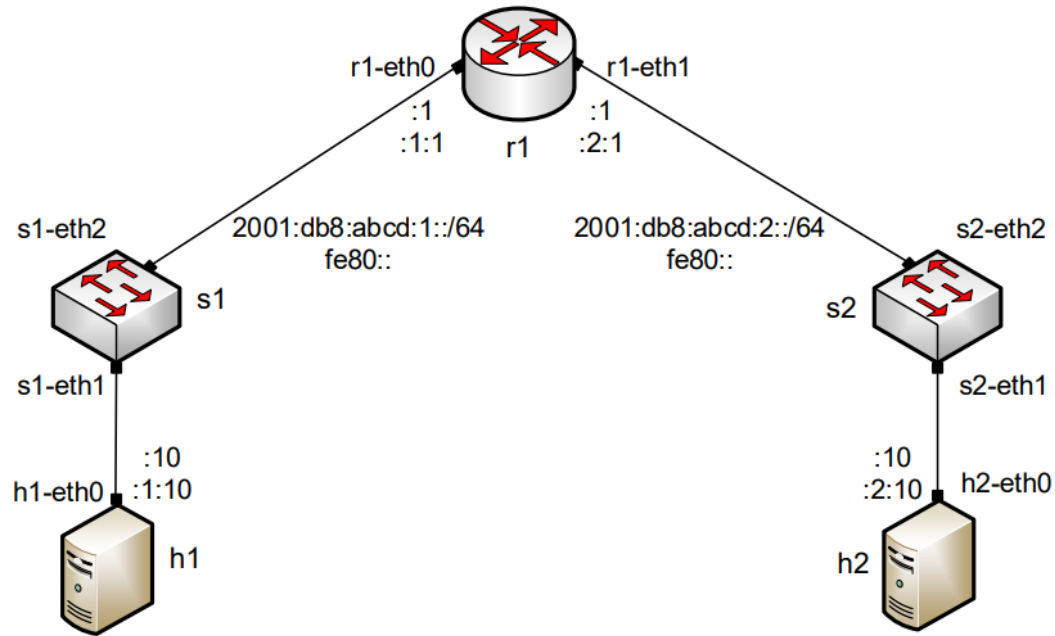
Network topology



```
"Host: h1"
root@frr-pc:~# route add -A inet6 default gw 2001:db8:abcd:1::1
root@frr-pc:~#
```

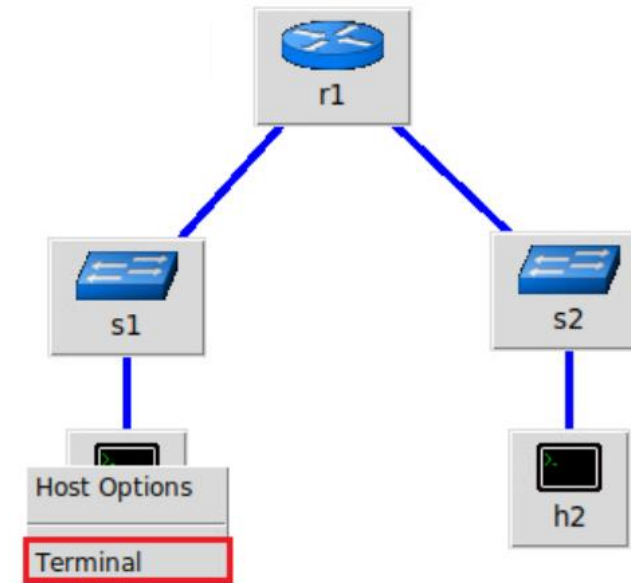
Network Topology

- Lab 3



Network topology

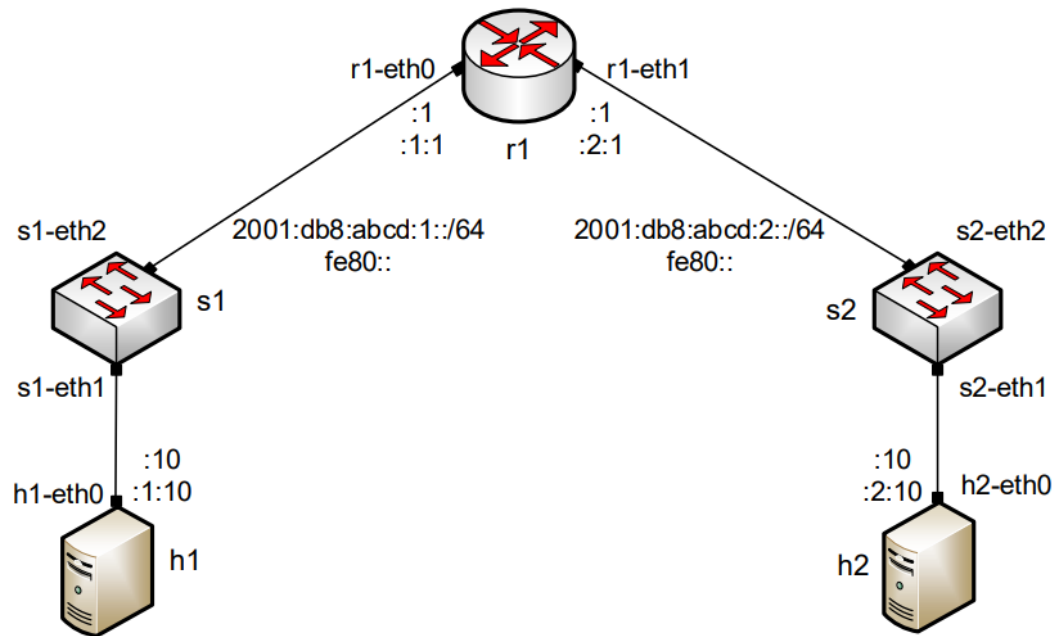
```
"Host: r1"
frr-pc(config-if)# ipv6 address fe80::1:1/64
frr-pc(config-if)#
```



Mininet implementation

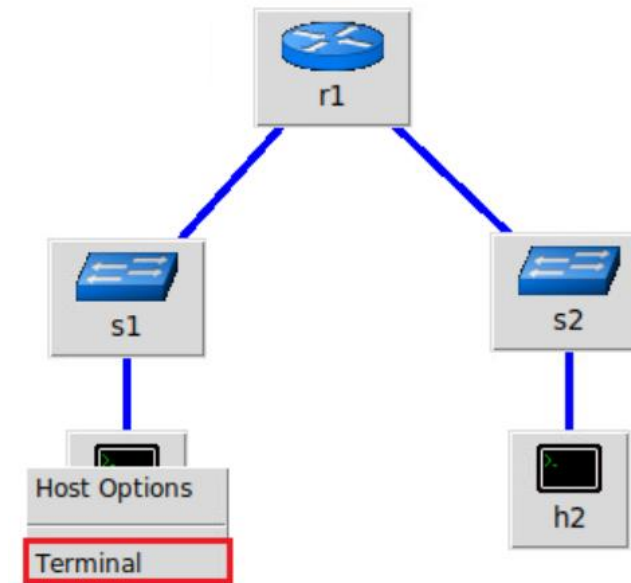
Network Topology

- Lab 3



Network topology

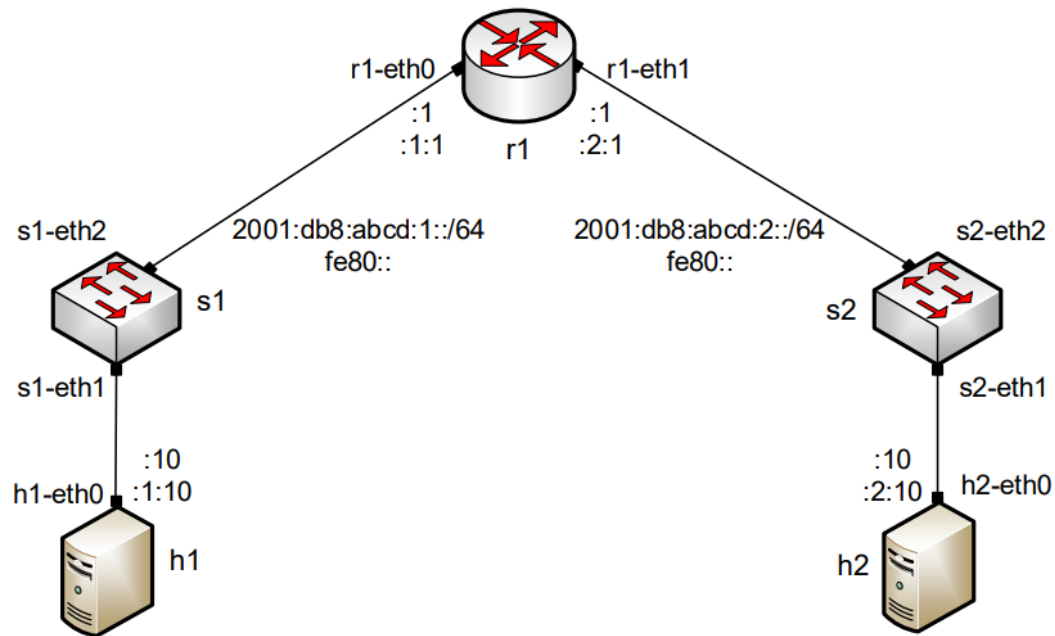
```
"Host: r1"
frr-pc(config-if)# ipv6 address 2001:db8:abcd:1::1/64
frr-pc(config-if)#
```



Mininet implementation

Network Topology

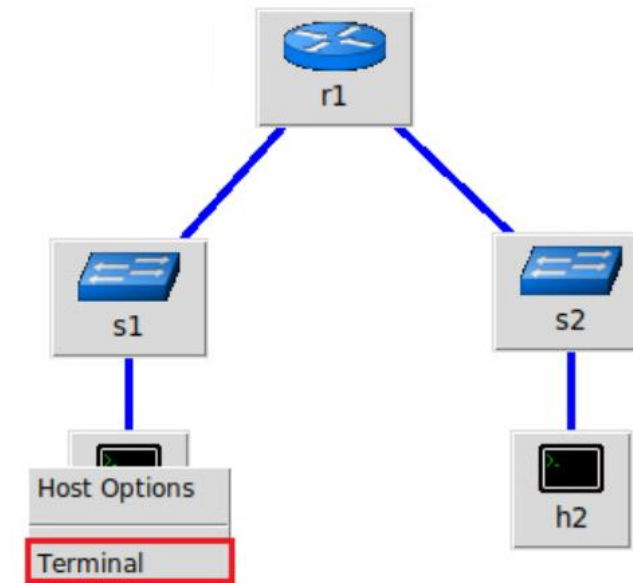
- Lab 3



Network topology

```
"Host: r1"
frr-pc(config)# do show ipv6 route
Codes: K - kernel route, C - connected, S - static, R - RIPng,
       O - OSPFv3, I - IS-IS, B - BGP, N - NHRP, T - Table,
       v - VNC, V - VNC-Direct, A - Babel, D - SHARP, F - PBR,
       f - OpenFabric,
       > - selected route, * - FIB route, q - queued route, r - rejected route

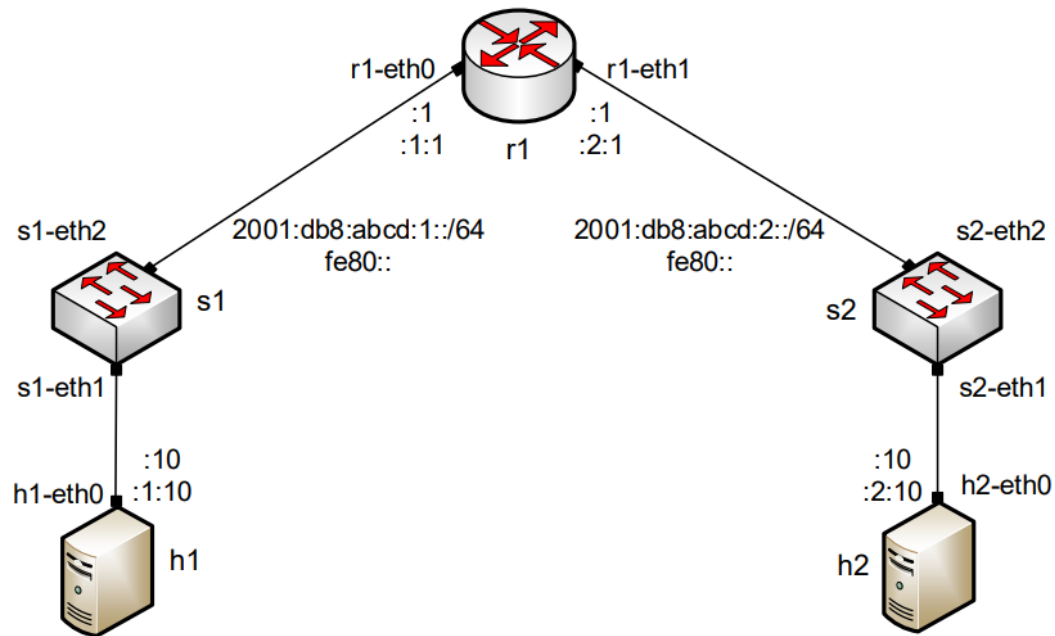
C>* 2001:db8:abcd:1::/64 is directly connected, r1-eth0, 00:02:18
C>* 2001:db8:abcd:2::/64 is directly connected, r1-eth1, 00:01:22
C>* fe80::/64 is directly connected, r1-eth1, 00:13:25
C>* fe80::/64 is directly connected, r1-eth0, 00:14:20
frr-pc(config)#
```



Mininet implementation

Network Topology

- Lab 3



Network topology

```
Host: h1
root@frr-pc:~# ping 2001:db8:abcd:2::10 -c 4
PING 2001:db8:abcd:2::10(2001:db8:abcd:2::10) 56 data bytes
64 bytes from 2001:db8:abcd:2::10: icmp_seq=1 ttl=63 time=0.880 ms
64 bytes from 2001:db8:abcd:2::10: icmp_seq=2 ttl=63 time=0.118 ms
64 bytes from 2001:db8:abcd:2::10: icmp_seq=3 ttl=63 time=0.116 ms
64 bytes from 2001:db8:abcd:2::10: icmp_seq=4 ttl=63 time=0.108 ms

--- 2001:db8:abcd:2::10 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 47ms
rtt min/avg/max/mdev = 0.108/0.305/0.880/0.332 ms
root@frr-pc:~#
```

Testing connectivity from host h1 to host h2

Accessing the Platform

- Please use the following link to access the platform: <https://netlab.cec.sc.edu/>
- Login using the following credentials:
- **Username:** email used for registration
- **Temporary Password:** nsf-2025



netlab.cec.sc.edu

Username

Password

Login



Welcome

This is the first time you have logged into this account.

You will now be asked to provide some account settings. These can be changed later.

Change Password

New Password

Retype New Password

Submit

Help

Cyberinfrastructure
Lab @ UofSC

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Please enter a valid e-mail address.

You can leave this blank if you do not want to receive e-mail from the system.

✉ Change E-mail Address

E-mail Address



🕒 Date and Time Settings

Time Zone

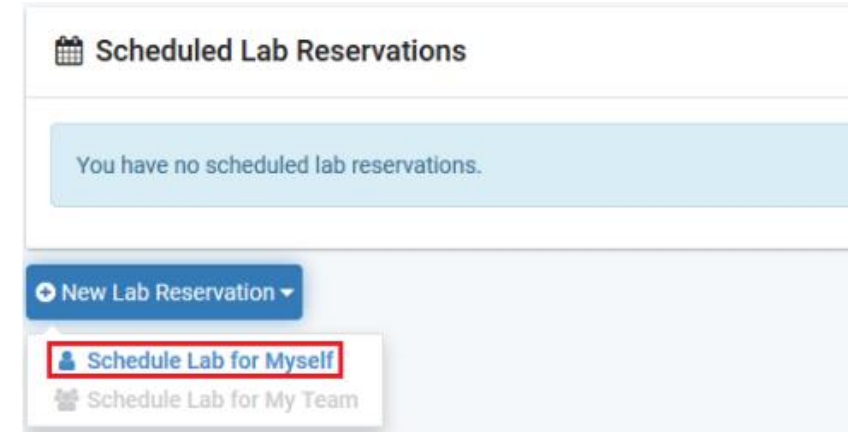
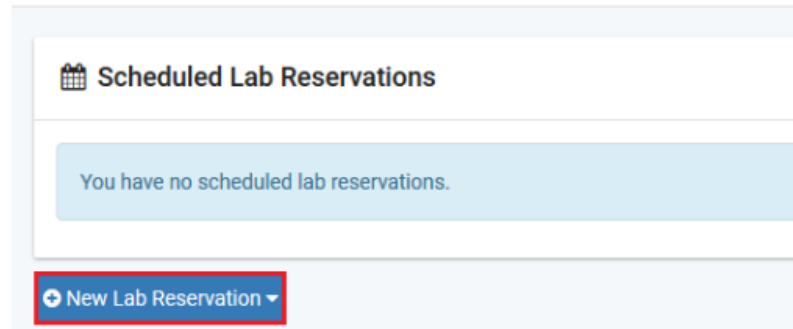
Date Display Format

Time Display Format

First Day of Week

Accessing the Platform

- Click on New Lab Reservation
- Click on Schedule Lab for Myself



Accessing the Platform

- Select the course
- For this session, we will use “Introduction to IPv6”

[MyNETLAB](#) > [Schedule \(Self\)](#) > [Select Class \(2024 NYSErNet Workshop on IPv6\)](#) > [Select Content](#)

Multiple course topics are available in this class. Please select one.


Intoduction to perfSONAR 5
This lab series focuses on perfSONAR 5 using Mininet











Introduction to IPv6
This lab series introduces IPv6 concepts

[← Previous](#) [× Cancel](#)

Accessing the Platform

- Select the Lab
- For this session, we will run:
 - Lab 3: IPv6 Address Configuration

 This lab series introduces IPv6 concepts Search

Lab Name	Action
Lab 1: Introduction to Mininet	
Lab 2: Introduction to FRR	
Lab 3: IPv6 Address Configuration	
Lab 4: Enabling Stateless Address Autoconfiguration (SLAAC) in IPv6 Routers	
Lab 5: Configuring SLAAC and Stateless DHCPv6 Server	
Lab 6: Configuring Stateful Dynamic Host Configuration Protocol version 6 (DHCPv6)	
Lab 7: IPv6 Static Routing Configuration	
Lab 8: Configuring Single Area OSPFv3	
Lab 9: Interdomain Routing (BGP) with IPv6	
Lab 10: DNS and Web Server IPv6 Configuration	

Show 50 entries Showing 1 to 10 of 10 items < 1 >

Accessing the Platform

- Select the next available POD and allocate time

Pod Scheduler

◀ ⌂ February - 2024 ▶

Sun Mon Tue Wed Thu Fri Sat

28 29 30 31 1 2 3

4 5 6 7 8 9 10

11 12 13 14 15 16 17

18 19 20 21 22 23 24

25 26 27 28 29 1 2

Selected Day

February

7

2024

Current Time



15:00

Eastern Time (US & Canada)

	IPv6_H1_25001 IPv6	IPv6_H1_25002 IPv6	IPv6_H1_25003 IPv6	IPv6_H1_25004 IPv6
14:00				
15:00				
16:00				
17:00				
18:00				
19:00				
20:00				
21:00				

Add Reservation

Pod IPv6_H1_25002

Reservation Type Instructor Private Reservation

Reserve For Jose Gomez

Lab Exercise Lab 3: IPv6 Address Configuration

Time Zone Eastern Time (US & Canada)

Start Time 2024-02-07 15:05

End Time 2024-02-07 16:00

Length of Reservation 44 mins.

Accessing the Platform

We will use the NETLAB virtual platform:

- **URL:** <https://netlab.cec.sc.edu/>
- **Username:** email used for registration
- **Temporary Password:** nsf-2025

Network Topology

- Lab 3

