



Hands-on Workshop on Network Technologies



Hands-on session 1: Essentials of BGP, EBGP, IBGP Lab 3 - BGP Lab Series



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

Tuesday, Jul 28, 2026
Online

Lab Series: Border Gateway Protocol

- Lab experiments

Lab 1: Introduction to Mininet

Lab 2: Introduction to Free Range Routing (FRR)

Lab 3: Introduction to BGP

Lab 4: Configure and verify EBGp

Lab 5: BGP Authentication

Lab 6: Configure BGP with Default Route

Lab 7: Using AS_PATH BGP Attribute

Lab 8: Configuring IBGP and EBGp Sessions, Local Preference, and MED

Lab 8.1: Configuring OSPF, IBGP and EBGp Sessions, Local Preference, and MED

Lab 9: IBGP, Next Hop and Full Mesh Topology

Lab 10: BGP Route Reflection

Lab 11: Configuring BGP Local Preference, and AS_PATH Prepending

Lab 11.1: Configuring BGP Local Preference, and AS_PATH Prepending

Lab 12: Hot Potato Routing and BGP LOCAL_PREF Attribute

Lab 13: Configuring Local Preferences on a Per Route Basis

Organization of the labs

Each lab starts with a section *Overview*

- Objectives
- Lab topology
- Lab settings: passwords, device names
- Roadmap: organization of the lab

Section 1

- Background information of the topic being covered (e.g., fundamentals of BGP)
- Section 1 is optional (i.e., the reader can skip this section and move to lab directions)

Section 2... n

- Step-by-step directions

Introduction to BGP

Lab activities are described in Lab 3, BGP Lab Series

Hands-on Labs on BGP

- Webpage with PowerPoint presentations:

https://research.cec.sc.edu/cyberinfra/NT_2026

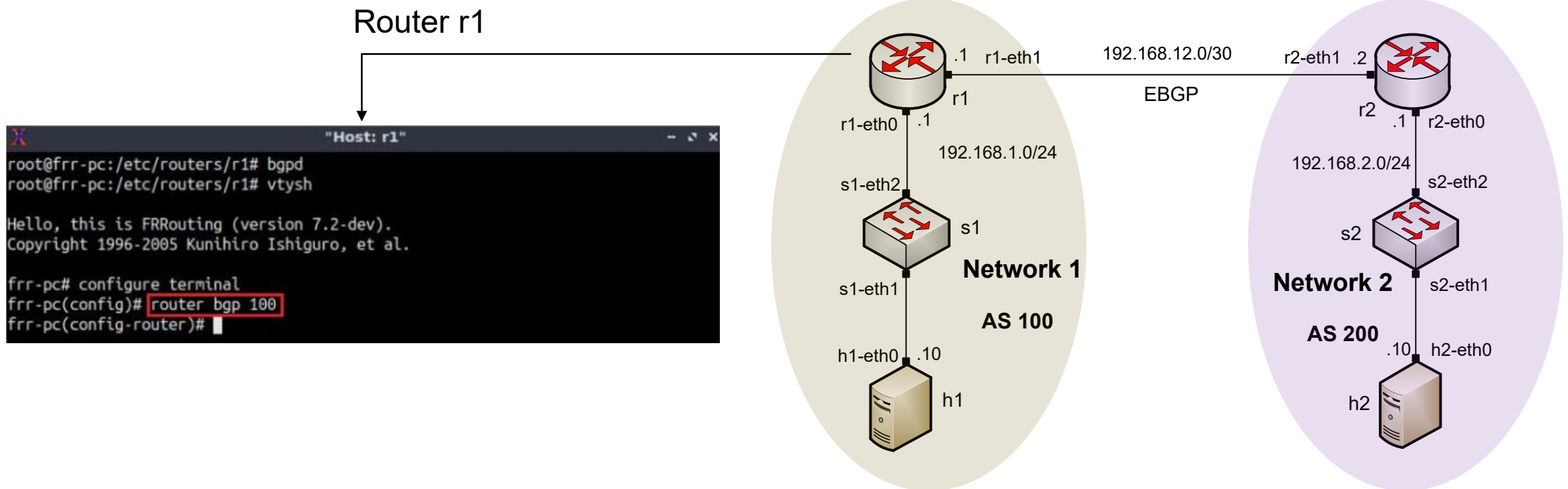
Hands-on session 1 (1:40PM-2:10PM): to access labs for Session 1 (Essentials of BGP, EBGp, IBGP).

The virtual platform (Netlab) is reachable through the following link:

<https://netlab.cec.sc.edu>

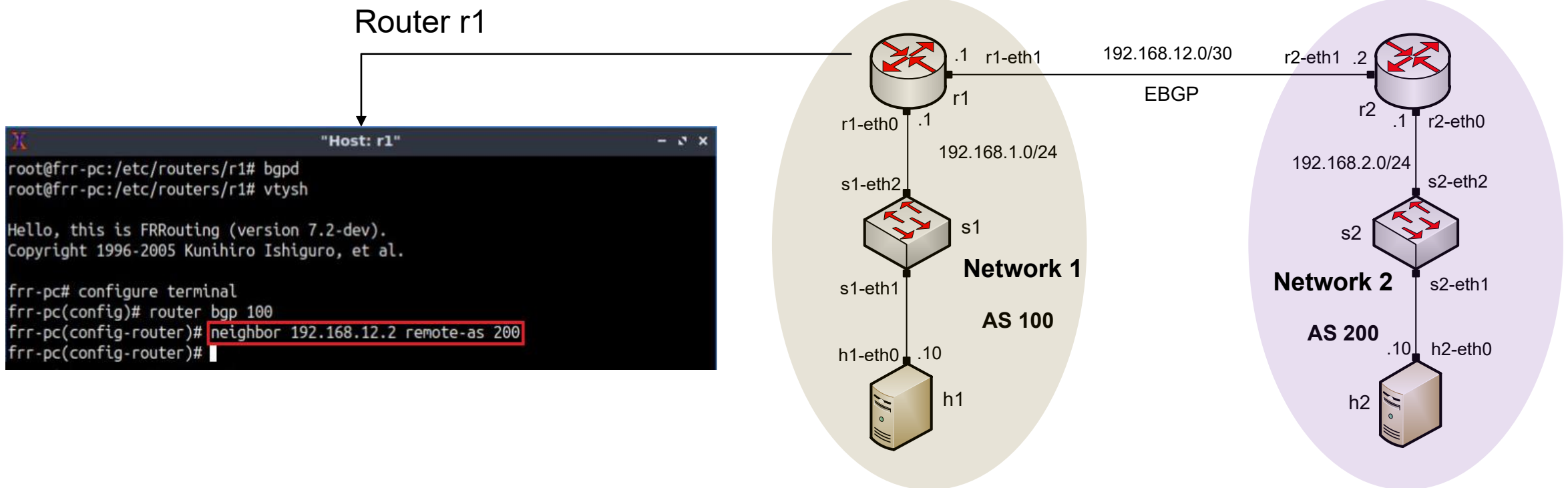
Lab Topology

- Enable the BGP process



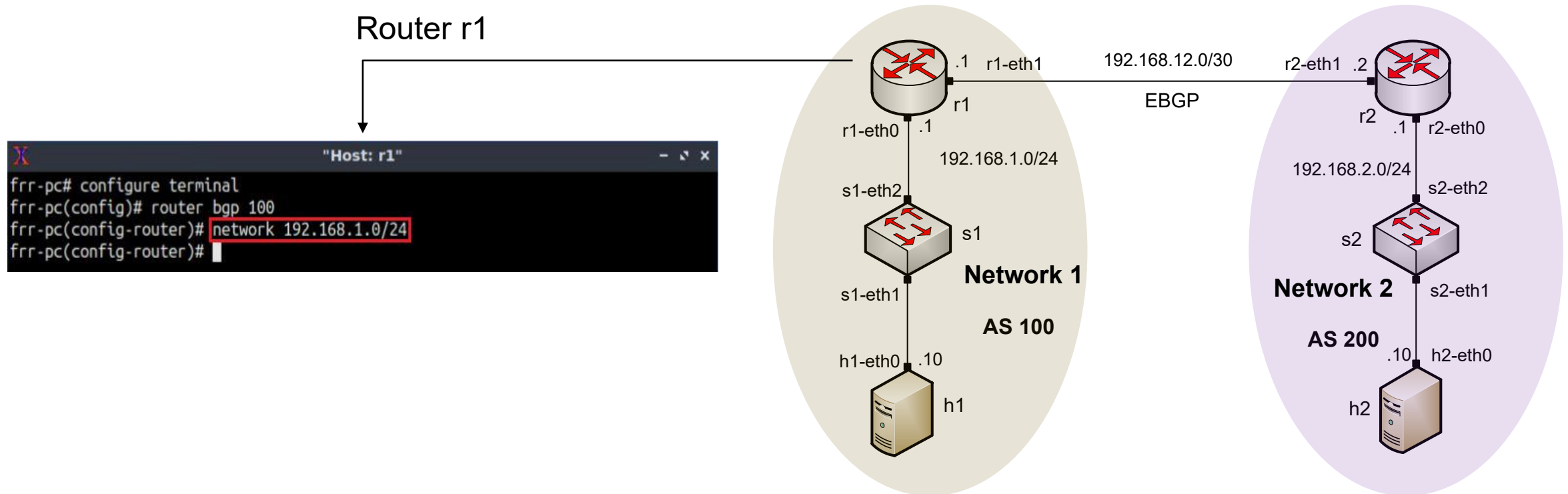
Lab Topology

- Establish BGP neighborhood



Lab Topology

- Advertise a network in BGP

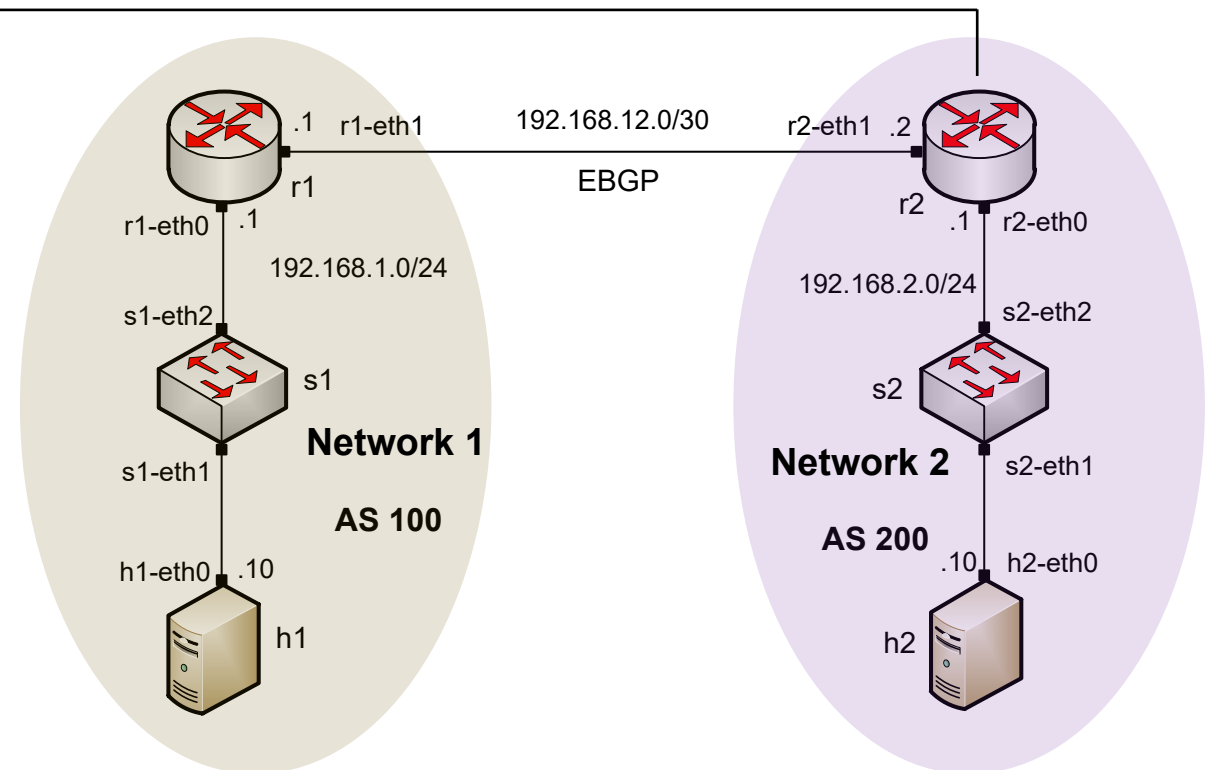


Lab Topology

- Routing table: lists the routes learned from different routing protocols

Router r2

```
Host: r2
frr-pc# show ip route
Codes: K - kernel route, C - connected, S - static, R - RIP,
       O - OSPF, I - IS-IS, B - BGP, E - EIGRP, 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
B>* 192.168.1.0/24 [20/0] via 192.168.12.1, r2-eth1, 00:00:52
C>* 192.168.2.0/24 is directly connected, r2-eth0, 00:18:36
C>* 192.168.12.0/30 is directly connected, r2-eth1, 00:18:02
frr-pc#
```



Lab Topology

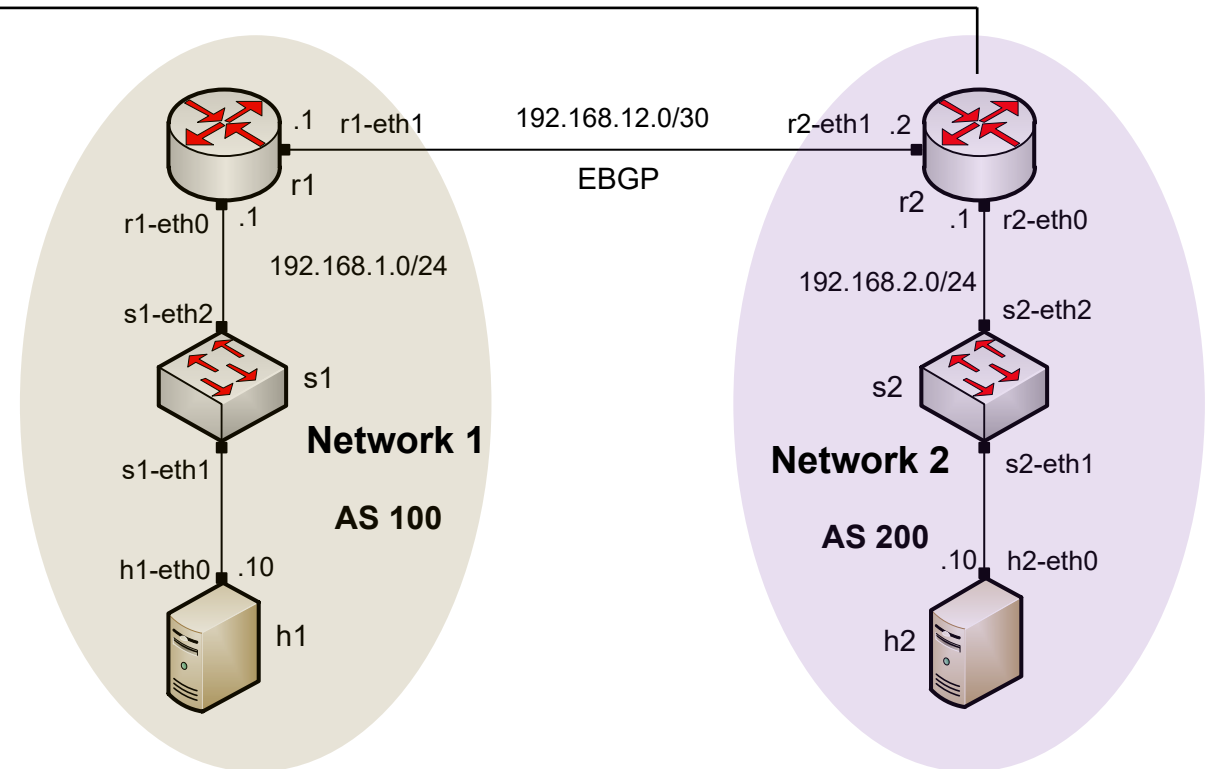
- BGP table: lists the routes learned from BGP routing protocol

Router r2

```
Host: r2
frr-pc# show ip bgp
BGP table version is 2, local router ID is 192.168.12.2, vrf id 0
Default local pref 100, local AS 200
Status codes: s suppressed, d damped, h history, * valid, > best, = multipath,
               i internal, r RIB-failure, S Stale, R Removed
Nexthop codes: @NNN nexthop's vrf id, < announce-nh-self
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network        Next Hop           Metric LocPrf Weight Path
*> 192.168.1.0/24  192.168.12.1             0         0 100 i
*> 192.168.2.0/24  0.0.0.0                 0        32768 i

Displayed 2 routes and 2 total paths
frr-pc#
```



Accessing the Platform

- Please use the following link to access the platform:
 - <https://netlab.cec.sc.edu/>
- Login using your credentials
- **Username:** <email address used for the registration>
- **Temporary Password:** nsf-2026



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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 - <https://netlab.cec.sc.edu/>
- Login using your credentials
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- **Temporary Password:** nsf-2026

The diagram illustrates the user interface flow for accessing the platform. It starts with a 'Change E-mail Address' form, which includes a light blue informational box at the top stating: 'Please enter a valid e-mail address. You can leave this blank if you do not want to receive e-mail from the system.' Below this, the form title is 'Change E-mail Address' with an envelope icon. The 'E-mail Address' field contains the text 'testuser@example.edu'. At the bottom, there are two buttons: 'Submit' (highlighted with a red box) and 'Help'. An orange arrow points from this form to the 'Date and Time Settings' form. The second form is titled 'Date and Time Settings' with a clock icon. It contains four settings, each with a dropdown menu: 'Time Zone' is set to '(GMT-05:00) Eastern Time (US & Canada)', 'Date Display Format' is set to 'YYYY-MM-DD (2016-09-15)', 'Time Display Format' is set to '24 Hour (15:37)', and 'First Day of Week' is set to 'Sunday'. At the bottom of this form, there are also 'Submit' (highlighted with a red box) and 'Help' buttons.

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 testuser@example.edu

Submit Help

🕒 Date and Time Settings

Time Zone (GMT-05:00) Eastern Time (US & Canada)

Date Display Format YYYY-MM-DD (2016-09-15)

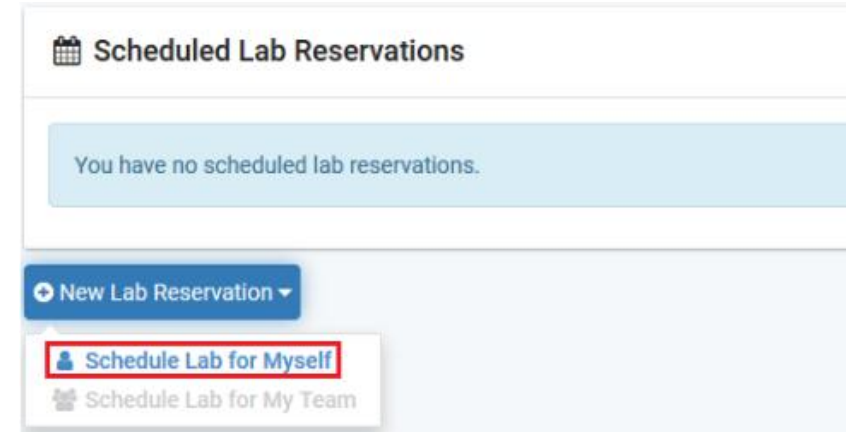
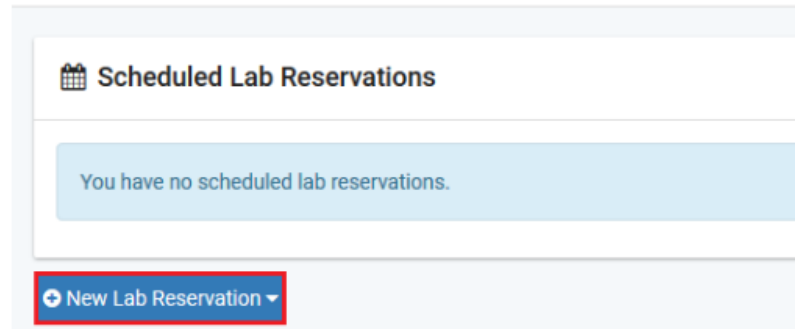
Time Display Format 24 Hour (15:37)

First Day of Week Sunday

Submit Help

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 “BGP Lab Series”

Introduction to BGP

BGP Lab Series

Accessing the Platform

- Select the Lab
- For this session, we will run:
 - Lab 3: Introduction to BGP

BGP Lab Series

Lab Name

Lab 1: Introduction to Mininet

Lab 2: Introduction to Free Range Routing (FRR)

Lab 3: Introduction to BGP

Lab 4: Configure and verify EBGP

Exercise 1: BGP Configuration

Lab 5: BGP Authentication

Lab 6: Configure BGP with Default Route

Lab 7: Using AS_PATH BGP Attribute

Accessing the Platform

- Select the next available POD and allocate time

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December 2024 ▶

Sun

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Selected Day

December

8

2024

Current Time



17:23

Eastern Time (US & Canada)

	BGP_H1_2830 BGP Border Gateway Protocol	BGP_H2_2831 BGP Border Gateway Protocol	BGP_H3_2832 BGP Border Gateway Protocol	BGP_H1_2833 BGP Border Gateway Protocol
16:00				
17:00				
18:00				
19:00				



 Add Reservation

Pod

BGP_H2_2831

Reservation Type

Instructor Private Reservation

Reserve For

Jose Gomez

Lab Exercise

Lab 3: Introduction to BGP

Time Zone

Eastern Time (US & Canada)

Start Time

2024-12-08 17:24

End Time

2024-12-08 18:00



Length of Reservation

25 mins.

✓ Submit

⬅ Previous

✕ Cancel

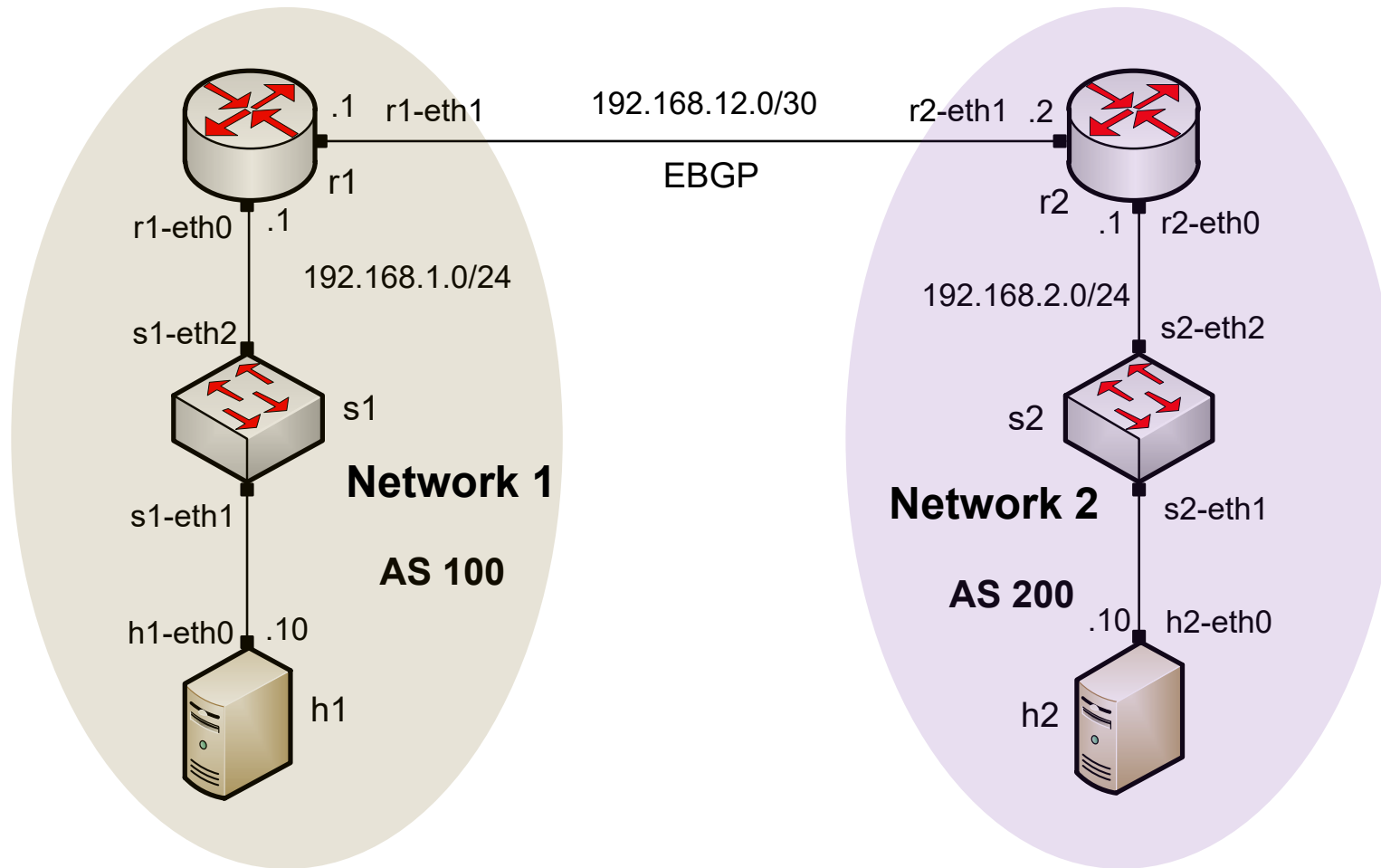
Accessing the Platform

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- **Username:** <email address used for the registration>
- **Temporary Password:** nsf-2026

Additional Slides

Lab Topology



Free Range Routing (FRR) Architecture (Lab 2)

