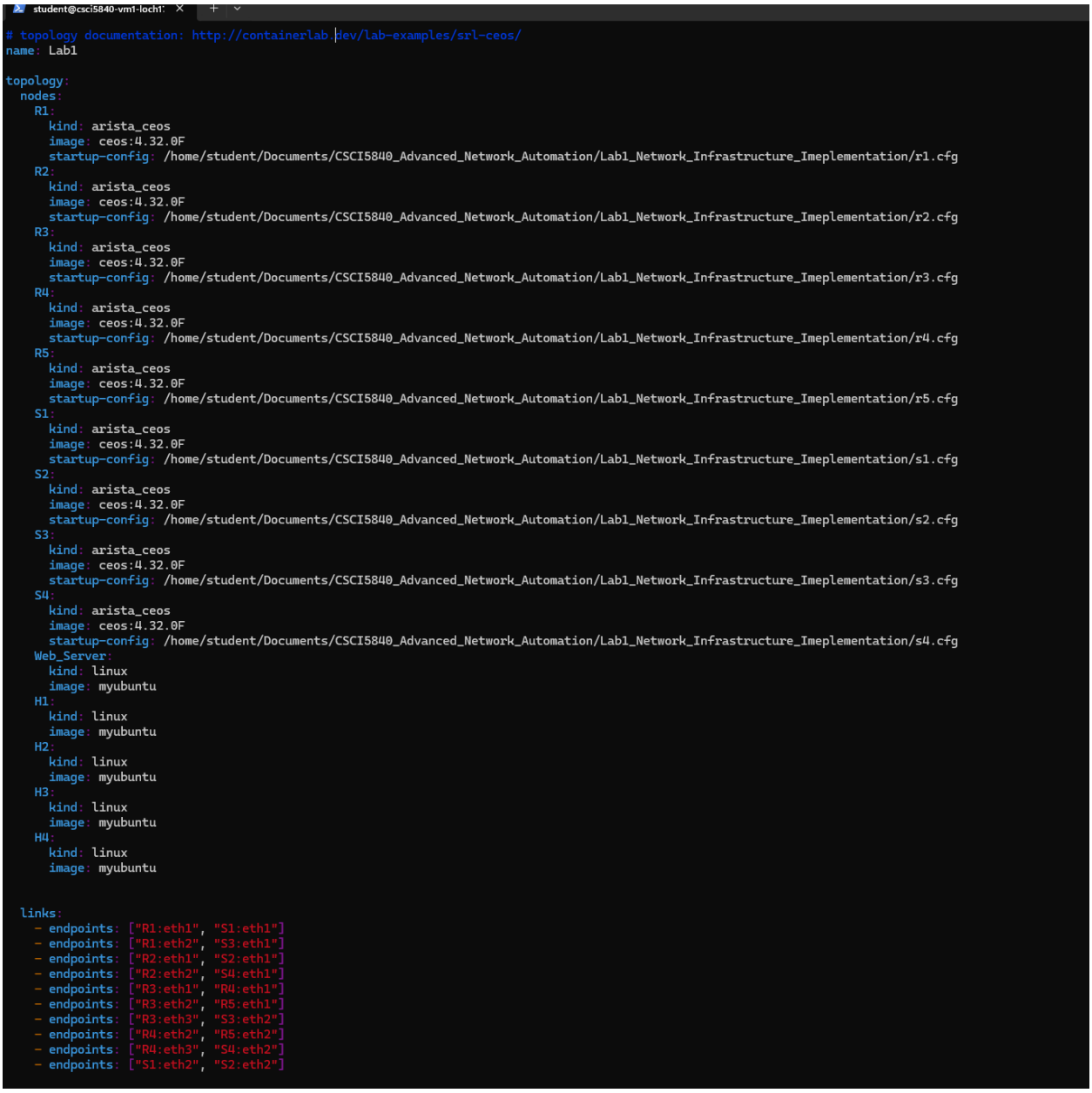
This is a guide to the Lab 1 implementation:

First, install all necessary files for Container lab:

```
curl -sL https://containerlab.dev/setup | sudo -E bash -s "all"
```

Then create a “clab” file with format: clab.(NAME).yml

Here’s a snippet of what this file looks like:



```
# topology documentation: http://containerlab.dev/lab-examples/srl-ceos/
name: Lab1

topology:
  nodes:
    R1:
      kind: arista_ceos
      image: ceos:4.32.0F
      startup-config: /home/student/Documents/CSCI5840_Advanced_Network_Automation/Lab1_Network_Infrastructure_Imeplementation/r1.cfg
    R2:
      kind: arista_ceos
      image: ceos:4.32.0F
      startup-config: /home/student/Documents/CSCI5840_Advanced_Network_Automation/Lab1_Network_Infrastructure_Imeplementation/r2.cfg
    R3:
      kind: arista_ceos
      image: ceos:4.32.0F
      startup-config: /home/student/Documents/CSCI5840_Advanced_Network_Automation/Lab1_Network_Infrastructure_Imeplementation/r3.cfg
    R4:
      kind: arista_ceos
      image: ceos:4.32.0F
      startup-config: /home/student/Documents/CSCI5840_Advanced_Network_Automation/Lab1_Network_Infrastructure_Imeplementation/r4.cfg
    R5:
      kind: arista_ceos
      image: ceos:4.32.0F
      startup-config: /home/student/Documents/CSCI5840_Advanced_Network_Automation/Lab1_Network_Infrastructure_Imeplementation/r5.cfg
    S1:
      kind: arista_ceos
      image: ceos:4.32.0F
      startup-config: /home/student/Documents/CSCI5840_Advanced_Network_Automation/Lab1_Network_Infrastructure_Imeplementation/s1.cfg
    S2:
      kind: arista_ceos
      image: ceos:4.32.0F
      startup-config: /home/student/Documents/CSCI5840_Advanced_Network_Automation/Lab1_Network_Infrastructure_Imeplementation/s2.cfg
    S3:
      kind: arista_ceos
      image: ceos:4.32.0F
      startup-config: /home/student/Documents/CSCI5840_Advanced_Network_Automation/Lab1_Network_Infrastructure_Imeplementation/s3.cfg
    S4:
      kind: arista_ceos
      image: ceos:4.32.0F
      startup-config: /home/student/Documents/CSCI5840_Advanced_Network_Automation/Lab1_Network_Infrastructure_Imeplementation/s4.cfg
    Web_Server:
      kind: linux
      image: myubuntu
    H1:
      kind: linux
      image: myubuntu
    H2:
      kind: linux
      image: myubuntu
    H3:
      kind: linux
      image: myubuntu
    H4:
      kind: linux
      image: myubuntu


  links:
    - endpoints: ["R1:eth1", "S1:eth1"]
    - endpoints: ["R1:eth2", "S3:eth1"]
    - endpoints: ["R2:eth1", "S2:eth1"]
    - endpoints: ["R2:eth2", "S4:eth1"]
    - endpoints: ["R3:eth1", "R4:eth1"]
    - endpoints: ["R3:eth2", "R5:eth1"]
    - endpoints: ["R3:eth3", "S3:eth2"]
    - endpoints: ["R4:eth2", "R5:eth2"]
    - endpoints: ["R4:eth3", "S4:eth2"]
    - endpoints: ["S1:eth2", "S2:eth2"]
```

To get the images, we have to import them using docker, in my case we are using Arista cEOS for the routers and switches, and Ubuntu for the server and hosts.

Arista cEOS download:

```
Sudo docker import cEOS64-lab-4.32.0F.tar.xz ceos:4.32.0F
```

Ubuntu download:

Here I created a Dockerfile to create the docker image as I want:

```
FROM ubuntu:20.04
RUN apt-get update && \
        apt-get install -y iputils-ping net-tools isc-dhcp-client
```

Then run the command to import into docker:

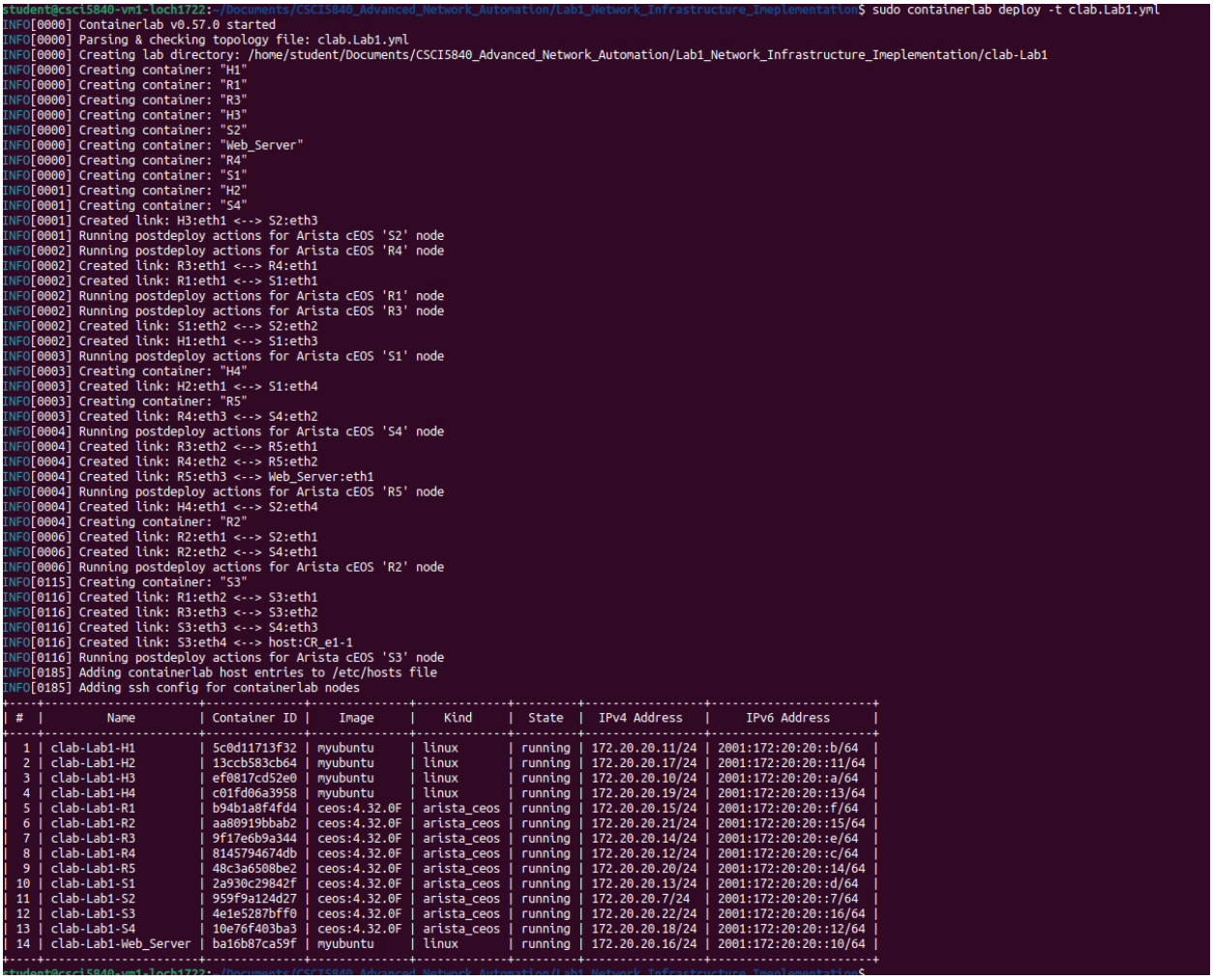
```
Sudo docker build -t myUbuntu
```

Now we have the images ready to run as seen from the .yml file before.

Next run the containerlab with this command:

```
sudo containerlab destroy -t clab.TEST.yml
```

It will output this line of text when it is successfully ran:



Now to ssh to the Arista devices for example, R1, type this command:

Ssh admin@172.20.20.15

Username: admin Password: admin

To ssh to the Ubuntu instances, type this in with the respective container ID

Docker exec -it <container ID> bash

Now comes the configuration. Simply log into to the devices as shown above and add these configurations:

Web_Server configuration:

Route add default gw <gateway IP> eth1

Host configuration:

Route add default gw <gateway IP> eth1

Dhclient eth1

Dhclient -6 eth1

Router and Switch configurations:

```
R1:
interface Ethernet1
   no switchport
!
interface Ethernet1.10
   encapsulation dot1q vlan 10
   ip address 21.0.0.2/24
!
interface Ethernet1.20
   encapsulation dot1q vlan 20
   ip address 22.0.0.2/24
!
interface Ethernet1.30
   encapsulation dot1q vlan 30
   ipv6 address 2300::2/64
!
interface Ethernet2
   no switchport
!
interface Ethernet2.40
   encapsulation dot1q vlan 40
   ip address 10.40.0.20/29
!
interface Ethernet2.100
   encapsulation dot1q vlan 100
   ip address 10.100.0.6/24
!
interface Loopback0
   ip address 10.40.1.1/32
!
interface Management0
   ip address 172.20.20.15/24
   ipv6 address 2001:172:20:20::f/64
```

```
!
interface Vlan100
!
ip routing
!
router ospf 40
   router-id 10.40.1.1
   network 10.40.0.16/29 area 0.0.0.0
   network 21.0.0.0/24 area 0.0.0.0
   network 22.0.0.0/24 area 0.0.0.0
   max-lsa 12000
!
router rip
   network 21.0.0.0/24
   network 22.0.0.0/24
   no shutdown
!
R2:
dhcp server
   subnet 21.0.0.0/24
      range 21.0.0.4 21.0.0.254
      name VLAN10
      default-gateway 21.0.0.1
   !
   subnet 22.0.0.0/24
      range 22.0.0.4 22.0.0.254
      name VLAN20
      default-gateway 22.0.0.1
   !
   subnet 2100::/64
      range 2100::4 2100::ffff:ffff:fffe
      name VLAN10
   !
   subnet 2200::/64
      range 2200::4 2200::ffff:ffff:fffe
      name VLAN 20
   !
   subnet 2300::/64
      range 2300::4 2300::ffff:ffff:fffe
      name VLAN30
!
vlan 10
   name vlan10
!
vlan 20
```

```
   name vlan20
!
vlan 30
   name vlan30
!
interface Ethernet1
   no switchport
!
interface Ethernet1.10
   encapsulation dot1q vlan 10
   ip address 21.0.0.1/24
   dhcp server ipv4
   dhcp server ipv6
   ipv6 address 2100::1/64
!
interface Ethernet1.20
   encapsulation dot1q vlan 20
   ip address 22.0.0.1/24
   dhcp server ipv4
   dhcp server ipv6
   ipv6 address 2200::1/64
!
interface Ethernet1.30
   encapsulation dot1q vlan 30
   dhcp server ipv6
   ipv6 address 2300::1/64
!
interface Ethernet2
   no switchport
!
interface Ethernet2.40
   encapsulation dot1q vlan 40
   ip address 10.40.0.19/29
!
interface Ethernet2.100
   encapsulation dot1q vlan 100
   ip address 10.100.0.7/24
!
interface Loopback0
   ip address 10.40.2.1/32
!
interface Vlan10
   dhcp server ipv4
   dhcp server ipv6
!
```

```
interface Vlan20
   dhcp server ipv4
   dhcp server ipv6
!
interface Vlan30
   dhcp server ipv4
   dhcp server ipv6
!
ip routing
!
router ospf 40
   router-id 10.40.2.1
   network 10.40.0.16/29 area 0.0.0.0
   network 21.0.0.0/24 area 0.0.0.0
   network 22.0.0.0/24 area 0.0.0.0
   max-lsa 12000
!
router rip
   network 21.0.0.0/24
   network 22.0.0.0/24
   shutdown
!
R3:
interface Ethernet1
   no switchport
   ip address 10.40.0.9/30
!
interface Ethernet2
   no switchport
   ip address 10.40.0.1/30
!
interface Ethernet3
   no switchport
!
interface Ethernet3.40
   encapsulation dot1q vlan 40
   ip address 10.40.0.18/29
!
interface Ethernet3.100
   encapsulation dot1q vlan 100
   ip address 10.100.0.8/24
!
interface Loopback0
   ip address 10.40.3.1/32
!
```

```
interface Management0
   ip address 172.20.20.14/24
   ipv6 address 2001:172:20:20::e/64
!
ip routing
!
router bgp 65001
   router-id 10.40.3.1
   neighbor 10.40.0.2 remote-as 65005
   neighbor 10.40.0.10 remote-as 65001
   network 10.40.0.16/29
   network 10.40.3.1/32
   redistribute ospf
!
router ospf 40
   router-id 10.40.3.1
   redistribute bgp
   network 10.40.0.16/29 area 0.0.0.0
   max-lsa 12000
!
R4:
interface Ethernet1
   no switchport
   ip address 10.40.0.10/30
!
interface Ethernet2
   no switchport
   ip address 10.40.0.6/30
!
interface Ethernet3
   no switchport
!
interface Ethernet3.40
   encapsulation dot1q vlan 40
   ip address 10.40.0.17/29
!
interface Ethernet3.100
   encapsulation dot1q vlan 100
   ip address 10.100.0.9/24
!
interface Loopback0
   ip address 10.40.4.1/32
!
interface Management0
   ip address 172.20.20.12/24
```

```
   ipv6 address 2001:172:20:20::c/64
!
ip routing
!
router bgp 65001
   router-id 10.40.4.1
   neighbor 10.40.0.5 remote-as 65005
   neighbor 10.40.0.9 remote-as 65001
   network 10.40.0.16/29
   network 10.40.4.1/32
   redistribute ospf
!
router ospf 40
   router-id 10.40.4.1
   redistribute bgp
   network 10.40.0.16/29 area 0.0.0.0
   max-lsa 12000
!
R5:
interface Ethernet1
   no switchport
   ip address 10.40.0.2/30
!
interface Ethernet2
   no switchport
   ip address 10.40.0.5/30
!
interface Ethernet3
   no switchport
   ip address 1.1.1.1/30
!
interface Loopback0
   ip address 10.40.5.1/32
!
interface Management0
   ip address 172.20.20.20/24
   ipv6 address 2001:172:20:20::14/64
!
ip routing
!
router bgp 65005
   router-id 10.40.5.1
   maximum-paths 2
   neighbor 10.40.0.1 remote-as 65001
   neighbor 10.40.0.6 remote-as 65001
```

```
   network 1.1.1.0/30
   network 10.40.0.16/29
   network 10.40.5.1/32
!
S1:
vlan 10
   name HOST_10
!
vlan 20
   name HOST_20
!
vlan 30
   name HOST_30
!
vlan 200
   name MGMT
!
vlan 240
   name PROD
!
interface Ethernet1
   switchport mode trunk
!
interface Ethernet2
   switchport mode trunk
!
interface Ethernet3
   switchport access vlan 10
!
interface Ethernet4
   switchport access vlan 20
!
no ip routing
!
S2:
vlan 10
   name HOST_10
!
vlan 20
   name HOST_20
!
vlan 30
   name HOST_30
!
vlan 200
```

```
   name MGMT
!
vlan 240
   name PROD
!
interface Ethernet1
   switchport mode trunk
!
interface Ethernet2
   switchport mode trunk
!
interface Ethernet3
   switchport access vlan 10
!
interface Ethernet4
   switchport access vlan 30
!
interface Vlan40
!
S3:
vlan 40,100
   name PROD
!
interface Ethernet1
   switchport mode trunk
!
interface Ethernet2
   switchport mode trunk
!
interface Ethernet3
   switchport mode trunk
!
interface Ethernet4
   switchport access vlan 100
!
interface Management0
   ip address 172.20.20.22/24
   ipv6 address 2001:172:20:20::16/64
!
interface Vlan100
   ip address 10.100.0.3/24
!
no ip routing
!
S4:
```

```
vlan 40
   name PROD
!
vlan 100
   name MGMT
!
interface Ethernet1
   switchport mode trunk
!
interface Ethernet2
   switchport mode trunk
!
interface Ethernet3
   switchport mode trunk
!
interface Management0
   ip address 172.20.20.18/24
   ipv6 address 2001:172:20:20::12/64
!
interface Vlan100
   ip address 10.100.0.4/24
!
no ip routing
!
```

Once these configurations are installed, feel free to log into the hosts and text connectivity!