LAPORAN AKHIR FINAL PROJECT

MAGANG & STUDI INDEPENDEN BERSERTIFIKAT

Desain dan Implementasi jaringan skala kecil (Small Network) yang menerapkan Network Programmability

Di Balitbang SDM Kementerian Kominfo

Diajukan untuk memenuhi persyaratan kelulusan

Program MSIB MBKM

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Kelas D TSA Network Programmability

S1 PENDIDIKAN TEKNIK INFORMATIKA

UNIVERSITAS NEGERI MALANG

2022

PENDAHULUAN

A. Latar Belakang

Manajemen konfigurasi perangkat jaringan menjadi hal yang sangat krusial di masa serba digital seperti saat ini. Dengan pesatnya perkembangan teknologi informasi, maintain perangkat jaringan perlu diperhatikan. Karena sebagian besar konfigurasi perangkat jaringan masih dilakukan secara manual. Terlebih lagi konfigurasi perangkat jaringan melibatkan banyak perangkat dan proses yang dinamis. Dengan demikian perlu adanya network automation untuk untuk mengelola, mengonfigurasi, dan maintain perangkat jaringan secara otomatis.

Berdasarkan latar belakang tersebut, maka dibuatlah Desain dan Implementasi jaringan skala kecil (Small Network) yang menerapkan Network Programmability sebagai fitur network automation yang memungkinkan kita untuk maintain, manajemen, dan monitoring konfigurasi perangkat jaringan.

METODE PELAKSANAAN

A. Deskripsi Final Project

Desain dan Implementasi jaringan skala kecil (Small Network) yang menerapkan Network Programmability. Pada sebuah gedung terdapat 2 lantai dimana lantai 1 terdapat 2 ruang, dimana pada ruang 1 terdapat 3 PC dan pada ruang 2 terdapat 2 PC. Lantai 2 terdapat 1 PC, 1 Server, dan 1 Network Controller. Masing-masing ruang dihubungkan oleh switch dan masing-masing lantai dihubungkan oleh router. Lantai 1 dan 2, dihubungkan 1 router core. Desain jaringan menerapkan skema pengalamatan Variable Length Subnet Mask (VLSM) dan menerapkan Virtual Local Area Network (VLAN) serta menggunakan routing protocol.

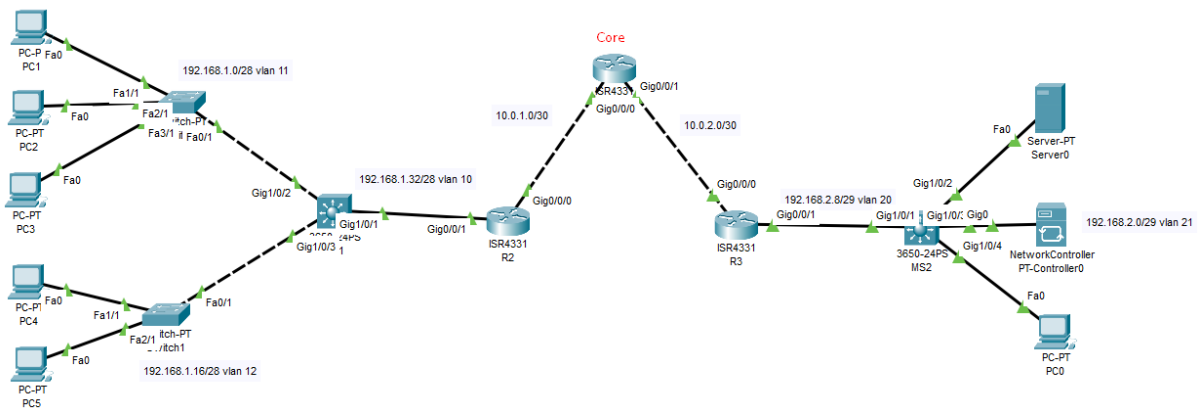
B. Tahap Requirement

Network Simulation Tools yang digunakan Cisco Packet Tracer dengan fitur:

- Desain memuat minimal 3 (tiga) unit Cisco 4331 routers, 2 (dua) unit Cisco 3650 Switches, 6 (enam) unit PC client, 1 (satu) Server dan wajib menggunakan 1 (satu) Network Controller.
- Desain jaringan menerapkan skema pengalamatan Variable Length Subnet Mask (VLSM) dan menerapkan Virtual Local Area Network (VLAN) serta menggunakan routing protocol.
- Konfigurasi dasar pengamanan perangkat jaringan meliputi menerapkan password privilege, console dan remote access hanya melalui Secure Shell (SSH).
- Kode program yang dibuat mengimplementasikan fitur REST-API dari Network Controller.

Kode program Python yang dibuat wajib menerapkan Software Version Control sehingga disimpan pada Git Local Repository dan diintegrasikan dengan GitHub.

Topologi Jaringan.



Addressing Table

Device	Interface	IP Address
R1	G0/0/0	10.0.1.1/30
	G0/0/1	10.0.2.1/30
R2	G0/0/0	10.0.1.2/30
	G0/0/1.10	192.168.33.1/28
	G0/0/1.11	192.168.1.1/28
	G0/0/1.12	192.168.1.17/28
R3	G0/0/0	10.0.2.2/30
	G0/0/1.20	192.168.2.9/29
	G0/0/1.21	192.168.2.1/29
MS1	VLAN 10	192.168.1.34/28
MS2	VLAN 20	192.168.2.10/29
PC0	NIC	DHCP Client VLAN 21
PC1	NIC	DHCP Client VLAN 11
PC2	NIC	DHCP Client VLAN 11
PC3	NIC	DHCP Client VLAN 11
PC4	NIC	DHCP Client VLAN 12
PC5	NIC	DHCP Client VLAN 12
Server0	NIC	192.168.2.3/29
PT-Controller0	NIC	192.168.2.4/29

C. Tahap Implementasi

Berikut merupakan konfigurasi yang diterapkan pada setiap perangkat jaringan.

Note: All; domain : admin.com, enable secret password : adminenpass, console password : adminconpass, ssh : admin, admin1pass

a) R1

R1

Physical Config CLI Attributes

IOS Command Line Interface

```
R1#sh running-config
Building configuration...

Current configuration : 1351 bytes
!
version 15.4
no service timestamps log datetime msec
no service timestamps debug datetime msec
service password-encryption
security passwords min-length 10
!
hostname R1
!
!
!
enable secret 5 $1$mERr$WWNkcIXfYuLGqs6oFAPyN1
!
!
!
!
!
!
ip cef
no ipv6 cef
!
!
!
username admin secret 5 $1$mERr$ILrAmVhMGbrCFnj8QqS3T.
!
!
!
!
!
!
```

Ctrl+F6 to exit CLI focus

Copy Paste

Top

R1

Physical Config CLI Attributes

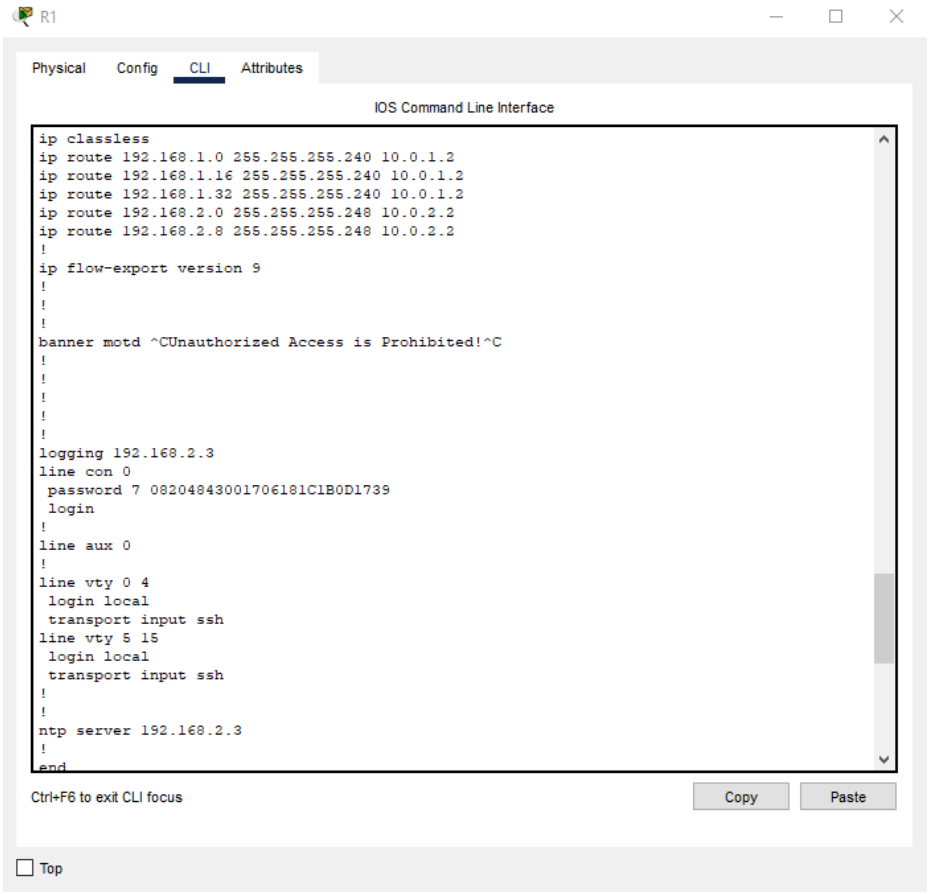
IOS Command Line Interface

```
no ip domain-lookup
ip domain-name admin.com
ip name-server 192.168.2.3
!
!
spanning-tree mode pvst
!
!
!
!
!
!
interface GigabitEthernet0/0/0
 description connect to R2
 ip address 10.0.1.1 255.255.255.252
 duplex auto
 speed auto
!
interface GigabitEthernet0/0/1
 ip address 10.0.2.1 255.255.255.252
 duplex auto
 speed auto
!
interface GigabitEthernet0/0/2
 no ip address
 duplex auto
 speed auto
 shutdown
!
interface Vlan1
 no ip address
 shutdown
!
ip classless
ip route 192.168.1.0 255.255.255.240 10.0.1.2
```

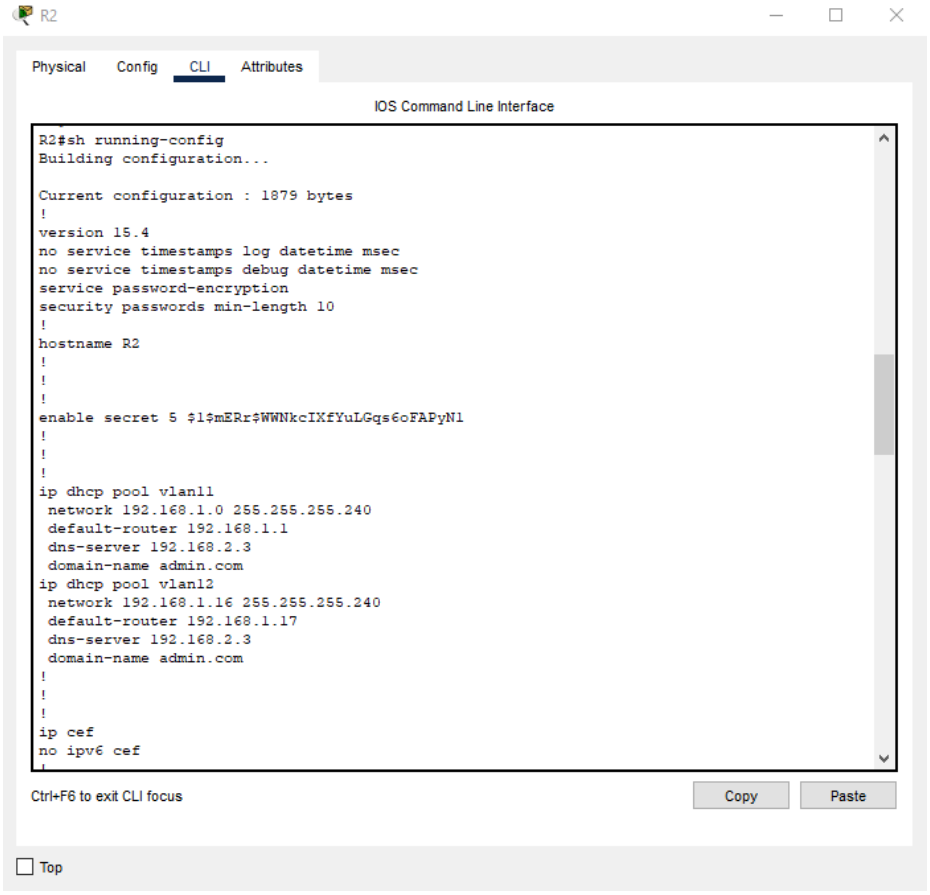
Ctrl+F6 to exit CLI focus

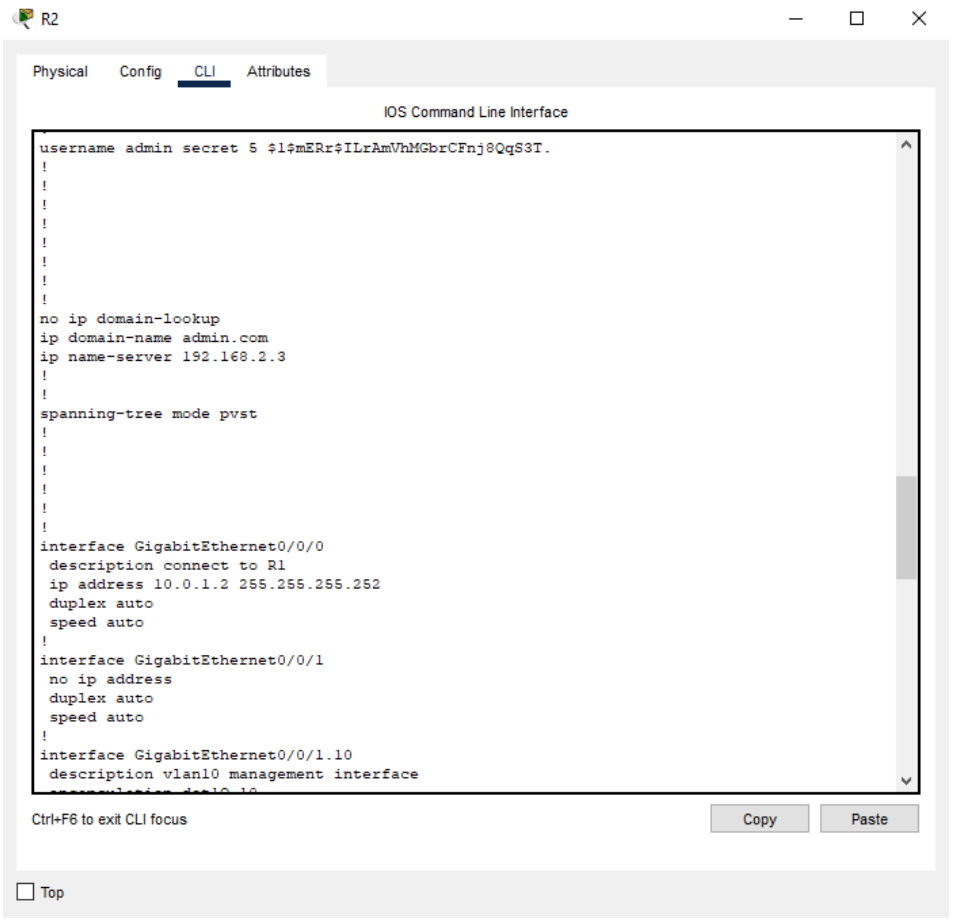
Copy Paste

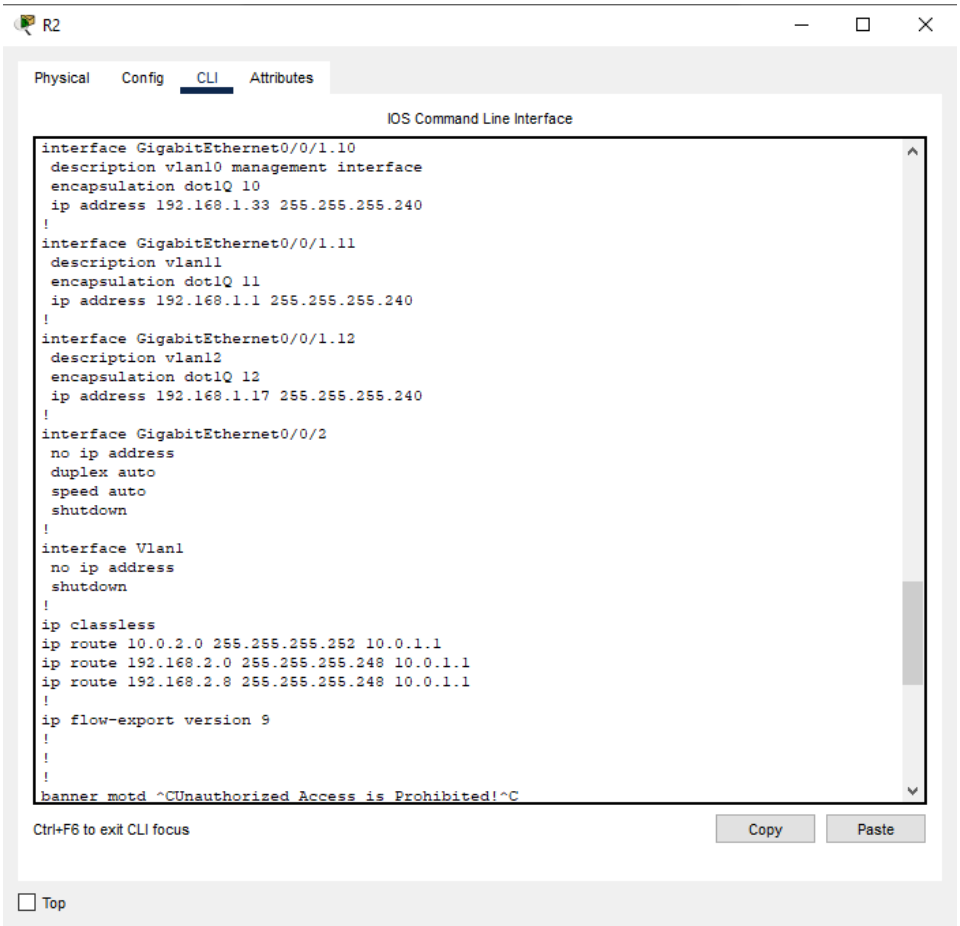
Top


R1
Physical
Config
CLI
Attributes
IOS Command Line Interface
ip classless
ip route 192.168.1.0 255.255.255.240 10.0.1.2
ip route 192.168.1.16 255.255.255.240 10.0.1.2
ip route 192.168.1.32 255.255.255.240 10.0.1.2
ip route 192.168.2.0 255.255.255.248 10.0.2.2
ip route 192.168.2.8 255.255.255.248 10.0.2.2
!
ip flow-export version 9
!
!
!
banner motd ^CUnauthorized Access is Prohibited!^C
!
!
!
!
!
logging 192.168.2.3
line con 0
password 7 08204843001706181C1B0D1739
login
!
line aux 0
!
line vty 0 4
login local
transport input ssh
line vty 5 15
login local
transport input ssh
!
!
ntp server 192.168.2.3
!
end
Ctrl+F6 to exit CLI focus
Copy
Paste
Top

b) R2

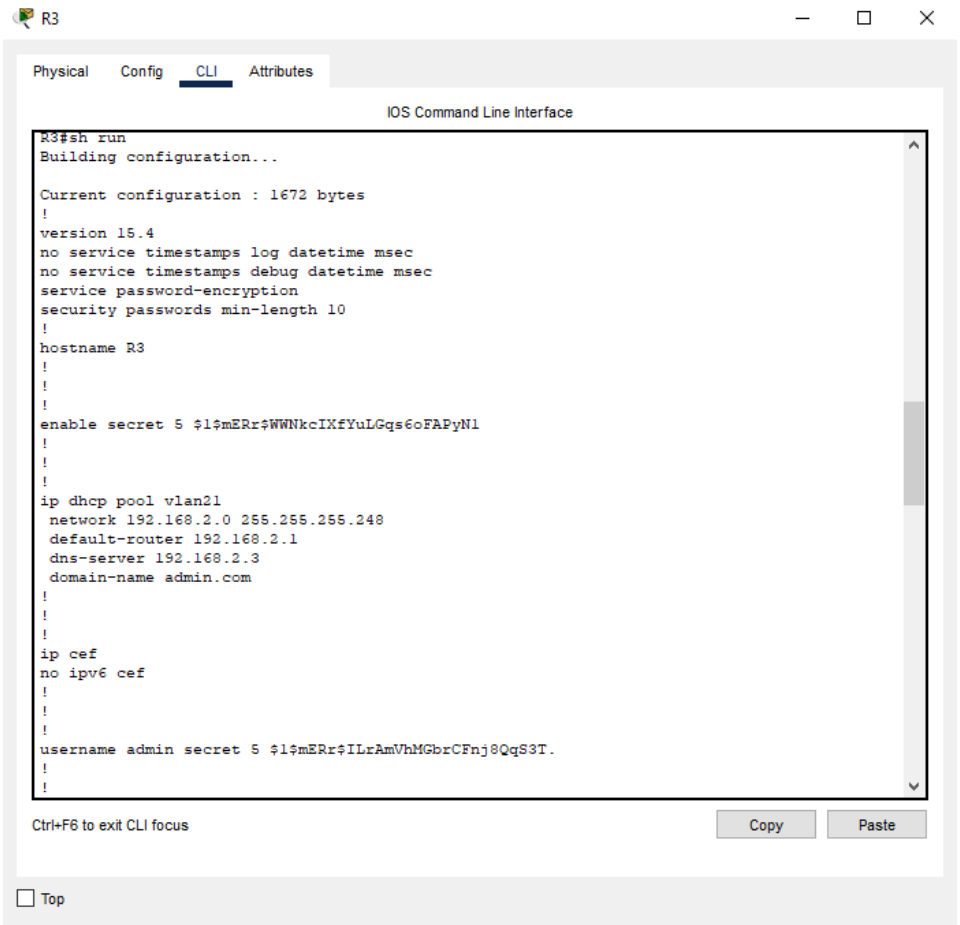

R2
Physical
Config
CLI
Attributes
IOS Command Line Interface
R2#sh running-config
Building configuration...
Current configuration : 1879 bytes
!
version 15.4
no service timestamps log datetime msec
no service timestamps debug datetime msec
service password-encryption
security passwords min-length 10
!
hostname R2
!
!
!
enable secret 5 1mERr$WWNkcIXfYuLGqs6oFAPyN1
!
!
!
ip dhcp pool vlan11
network 192.168.1.0 255.255.255.240
default-router 192.168.1.1
dns-server 192.168.2.3
domain-name admin.com
ip dhcp pool vlan12
network 192.168.1.16 255.255.255.240
default-router 192.168.1.17
dns-server 192.168.2.3
domain-name admin.com
!
!
!
ip cef
no ipv6 cef
Ctrl+F6 to exit CLI focus
Copy
Paste
Top


R2
Physical
Config
CLI
Attributes
IOS Command Line Interface
username admin secret 5 1mERr$ILrAmVhMGbrCFnj8QqS3T.
!
!
!
!
!
!
!
!
no ip domain-lookup
ip domain-name admin.com
ip name-server 192.168.2.3
!
!
spanning-tree mode pvst
!
!
!
!
!
!
interface GigabitEthernet0/0/0
description connect to R1
ip address 10.0.1.2 255.255.255.252
duplex auto
speed auto
!
interface GigabitEthernet0/0/1
no ip address
duplex auto
speed auto
!
interface GigabitEthernet0/0/1.10
description vlan10 management interface
Ctrl+F6 to exit CLI focus
Copy
Paste
Top


R2
Physical
Config
CLI
Attributes
IOS Command Line Interface
interface GigabitEthernet0/0/1.10
description vlan10 management interface
encapsulation dot1Q 10
ip address 192.168.1.33 255.255.255.240
!
interface GigabitEthernet0/0/1.11
description vlan11
encapsulation dot1Q 11
ip address 192.168.1.1 255.255.255.240
!
interface GigabitEthernet0/0/1.12
description vlan12
encapsulation dot1Q 12
ip address 192.168.1.17 255.255.255.240
!
interface GigabitEthernet0/0/2
no ip address
duplex auto
speed auto
shutdown
!
interface Vlan1
no ip address
shutdown
!
ip classless
ip route 10.0.2.0 255.255.255.252 10.0.1.1
ip route 192.168.2.0 255.255.255.248 10.0.1.1
ip route 192.168.2.8 255.255.255.248 10.0.1.1
!
ip flow-export version 9
!
!
!
banner motd ^CUnauthorized Access is Prohibited!^C
Ctrl+F6 to exit CLI focus
Copy
Paste
Top


R2
Physical
Config
CLI
Attributes
IOS Command Line Interface
!
!
!
banner motd ^CUnauthorized Access is Prohibited!^C
!
!
!
!
!
logging 192.168.2.3
line con 0
 password 7 08204843001706181C1B0D1739
 login
!
line aux 0
!
line vty 0 4
 login local
 transport input ssh
line vty 5 15
 login local
 transport input ssh
!
!
ntp server 192.168.2.3
!
end

c) R3


R3
Physical
Config
CLI
Attributes
IOS Command Line Interface
R3#sh run
Building configuration...
Current configuration : 1672 bytes
!
version 15.4
no service timestamps log datetime msec
no service timestamps debug datetime msec
service password-encryption
security passwords min-length 10
!
hostname R3
!
!
!
enable secret 5 1mERr$WWNkcIXfYuLGqs6oFAPyN1
!
!
!
ip dhcp pool vlan21
 network 192.168.2.0 255.255.255.248
 default-router 192.168.2.1
 dns-server 192.168.2.3
 domain-name admin.com
!
!
!
ip cef
no ipv6 cef
!
!
!
username admin secret 5 1mERr$ILrAmVhMGbrCFnj8QqS3T.
!
!
Ctrl+F6 to exit CLI focus
Copy
Paste
Top

R3

Physical Config CLI Attributes

IOS Command Line Interface

```
!
no ip domain-lookup
ip domain-name admin.com
ip name-server 192.168.2.3
!
!
spanning-tree mode pvst
!
!
!
!
!
!
interface GigabitEthernet0/0/0
 description connect to R1
 ip address 10.0.2.2 255.255.255.252
 duplex auto
 speed auto
!
interface GigabitEthernet0/0/1
 no ip address
 duplex auto
 speed auto
!
interface GigabitEthernet0/0/1.20
 description vlan20 management interface
 encapsulation dot1Q 20
 ip address 192.168.2.9 255.255.255.248
!
interface GigabitEthernet0/0/1.21
 description vlan21
 encapsulation dot1Q 21
 ip address 192.168.2.1 255.255.255.248
!
interface GigabitEthernet0/0/2
```

Ctrl+F6 to exit CLI focus

Copy Paste

Top

R3

Physical Config CLI Attributes

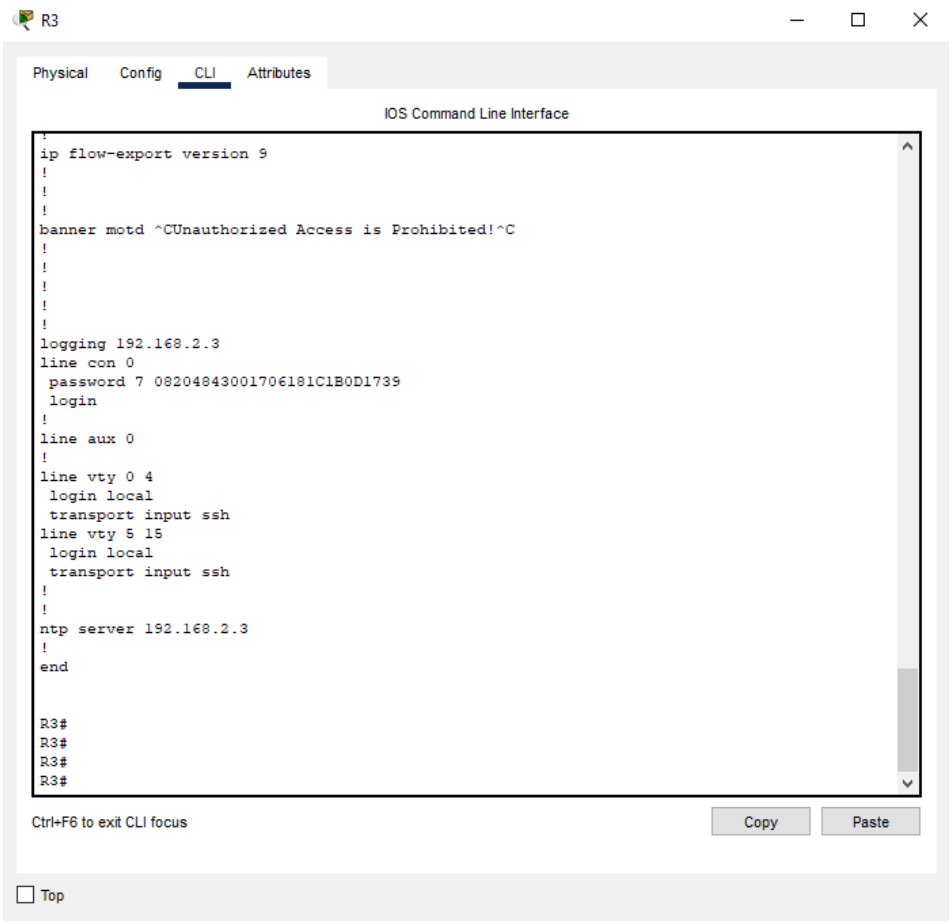
IOS Command Line Interface

```
!
interface GigabitEthernet0/0/2
 no ip address
 duplex auto
 speed auto
 shutdown
!
interface Vlan1
 no ip address
 shutdown
!
ip classless
ip route 10.0.1.0 255.255.255.252 10.0.2.1
ip route 192.168.1.0 255.255.255.240 10.0.2.1
ip route 192.168.1.16 255.255.255.240 10.0.2.1
ip route 192.168.1.32 255.255.255.240 10.0.2.1
!
ip flow-export version 9
!
!
!
banner motd ^CUnauthorized Access is Prohibited!^C
!
!
!
!
!
logging 192.168.2.3
line con 0
 password 7 0820484300170618lC1B0D1739
 login
!
line aux 0
!
line vty 0 4
```

Ctrl+F6 to exit CLI focus

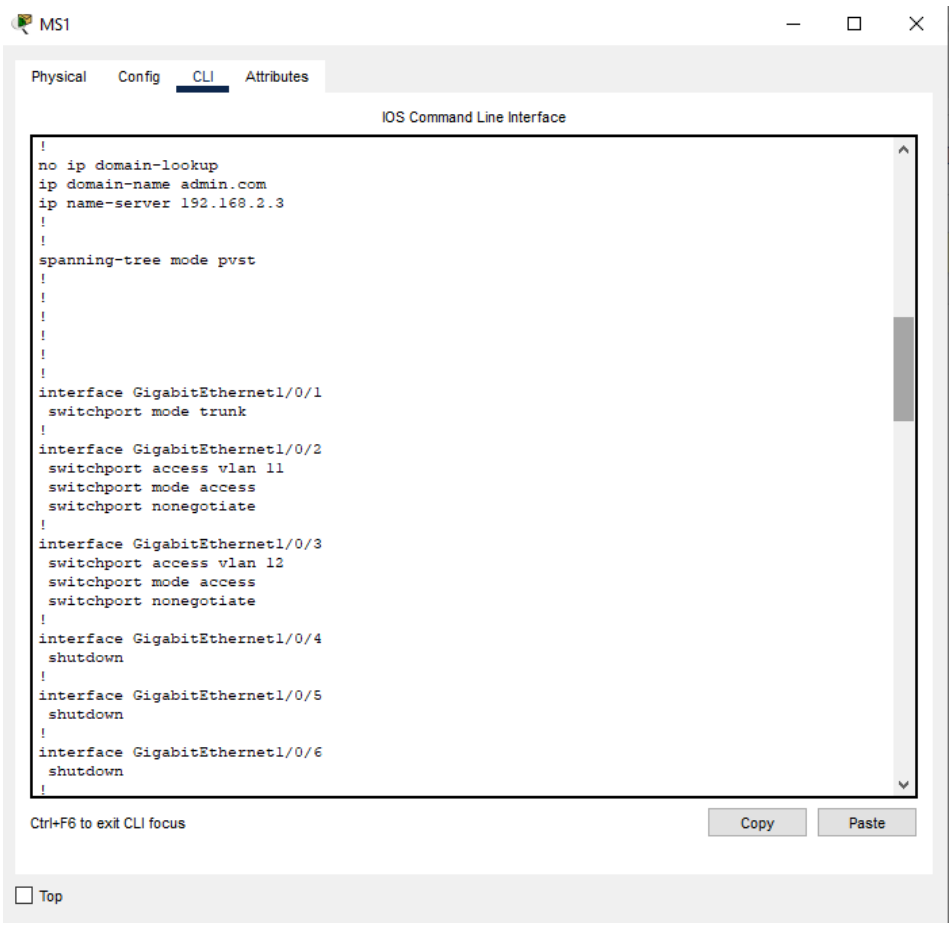
Copy Paste

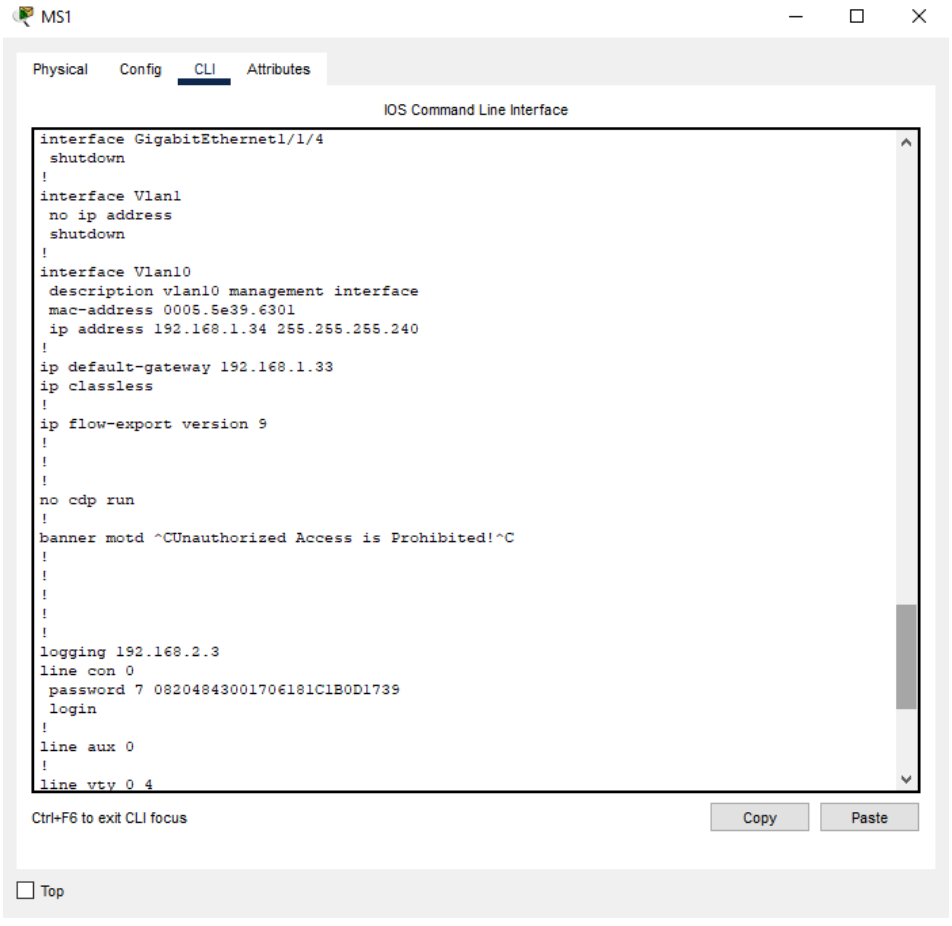
Top

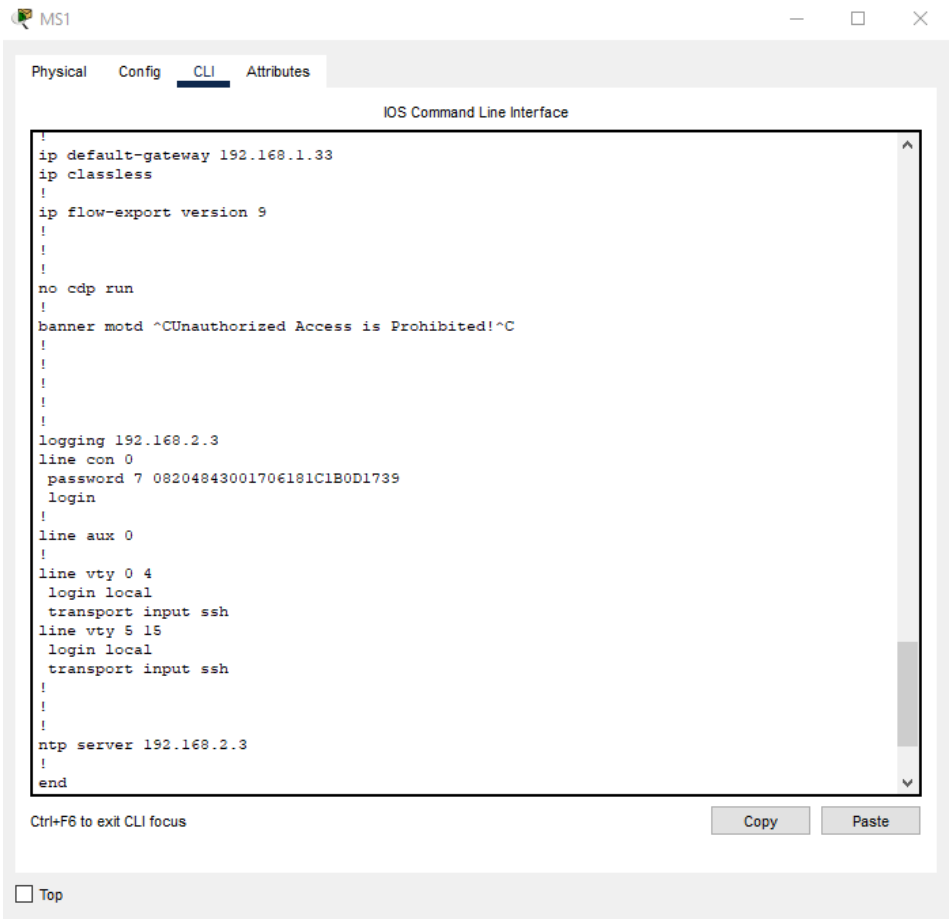

R3
Physical
Config
CLI
Attributes
IOS Command Line Interface
ip flow-export version 9
!
!
!
banner motd ^CUnauthorized Access is Prohibited!^C
!
!
!
!
!
logging 192.168.2.3
line con 0
password 7 08204843001706181C1B0D1739
login
!
line aux 0
!
line vty 0 4
login local
transport input ssh
line vty 5 15
login local
transport input ssh
!
!
ntp server 192.168.2.3
!
end
R3#
R3#
R3#
R3#
Ctrl+F6 to exit CLI focus
Copy
Paste
Top

d) MS1

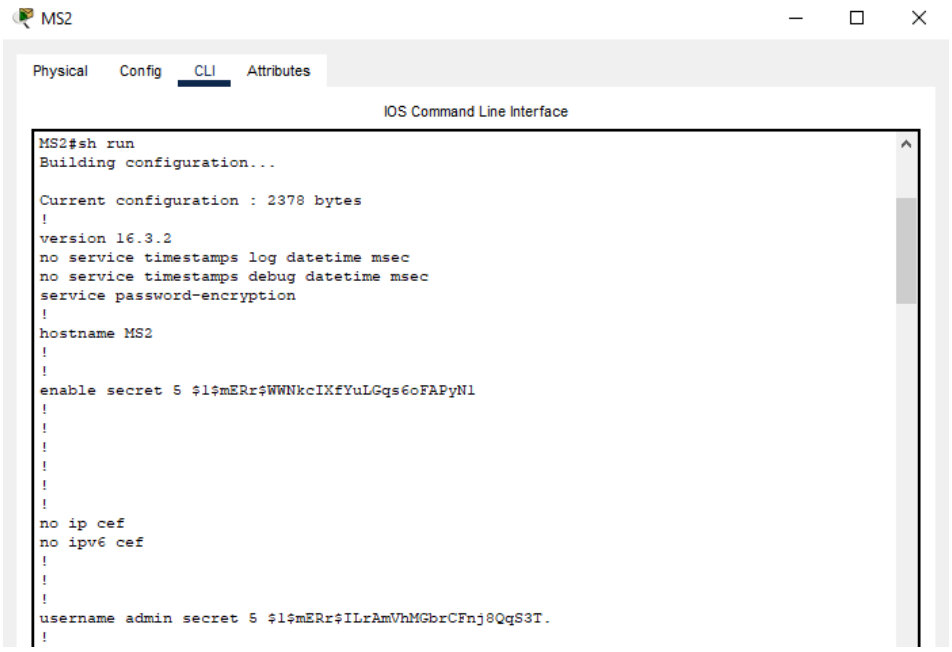

MS1
Physical
Config
CLI
Attributes
IOS Command Line Interface
MS1(config)#do sh run
Building configuration...
Current configuration : 2327 bytes
!
version 16.3.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
service password-encryption
!
hostname MS1
!
!
enable secret 5 1mERr$WWNkcIXfYuLGqs6oFAPyN1
!
!
!
!
!
!
no ip cef
no ipv6 cef
!
!
!
username admin secret 5 1mERr$ILrAmVhMGbrCFnj8QqS3T.
!


MS1
Physical
Config
CLI
Attributes
IOS Command Line Interface
!
no ip domain-lookup
ip domain-name admin.com
ip name-server 192.168.2.3
!
!
spanning-tree mode pvst
!
!
!
!
!
!
interface GigabitEthernet1/0/1
 switchport mode trunk
!
interface GigabitEthernet1/0/2
 switchport access vlan 11
 switchport mode access
 switchport nonegotiate
!
interface GigabitEthernet1/0/3
 switchport access vlan 12
 switchport mode access
 switchport nonegotiate
!
interface GigabitEthernet1/0/4
 shutdown
!
interface GigabitEthernet1/0/5
 shutdown
!
interface GigabitEthernet1/0/6
 shutdown
!
Ctrl+F6 to exit CLI focus
Copy
Paste
Top


MS1
Physical
Config
CLI
Attributes
IOS Command Line Interface
interface GigabitEthernet1/1/4
 shutdown
!
interface Vlan1
 no ip address
 shutdown
!
interface Vlan10
 description vlan10 management interface
 mac-address 0005.5e39.6301
 ip address 192.168.1.34 255.255.255.240
!
ip default-gateway 192.168.1.33
ip classless
!
ip flow-export version 9
!
!
!
no cdp run
!
banner motd ^CUnauthorized Access is Prohibited!^C
!
!
!
!
!
logging 192.168.2.3
line con 0
 password 7 08204843001706181C1B0D1739
 login
!
line aux 0
!
line vty 0 4
Ctrl+F6 to exit CLI focus
Copy
Paste
Top


MS1
Physical
Config
CLI
Attributes
IOS Command Line Interface
!
ip default-gateway 192.168.1.33
ip classless
!
ip flow-export version 9
!
!
!
no cdp run
!
banner motd ^CUnauthorized Access is Prohibited!^C
!
!
!
!
!
logging 192.168.2.3
line con 0
 password 7 0820484300170618lC1B0D1739
 login
!
line aux 0
!
line vty 0 4
 login local
 transport input ssh
line vty 5 15
 login local
 transport input ssh
!
!
!
ntp server 192.168.2.3
!
end
Ctrl+F6 to exit CLI focus
Copy
Paste
Top

e) MS2


MS2
Physical
Config
CLI
Attributes
IOS Command Line Interface
MS2#sh run
Building configuration...
Current configuration : 2378 bytes
!
version 16.3.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
service password-encryption
!
hostname MS2
!
!
enable secret 5 1mERr$WWNkcIXfYuLGqs6oFAPyN1
!
!
!
!
!
!
no ip cef
no ipv6 cef
!
!
!
username admin secret 5 1mERr$ILrAmVhMGbrCFnj8QqS3T.
!

MS2

Physical Config CLI Attributes

IOS Command Line Interface

```
!
no ip domain-lookup
ip domain-name admin.com
ip name-server 192.168.2.3
!
!
spanning-tree mode pvst
!
!
!
!
!
!
interface GigabitEthernet1/0/1
 switchport mode trunk
!
interface GigabitEthernet1/0/2
 switchport access vlan 21
 switchport mode access
 switchport nonegotiate
!
interface GigabitEthernet1/0/3
 switchport access vlan 21
 switchport mode access
 switchport nonegotiate
!
interface GigabitEthernet1/0/4
 switchport access vlan 21
 switchport mode access
 switchport nonegotiate
!
interface GigabitEthernet1/0/5
 shutdown
!
interface GigabitEthernet1/0/6
```

Ctrl+F6 to exit CLI focus

Copy Paste

Top

MS2

Physical Config CLI Attributes

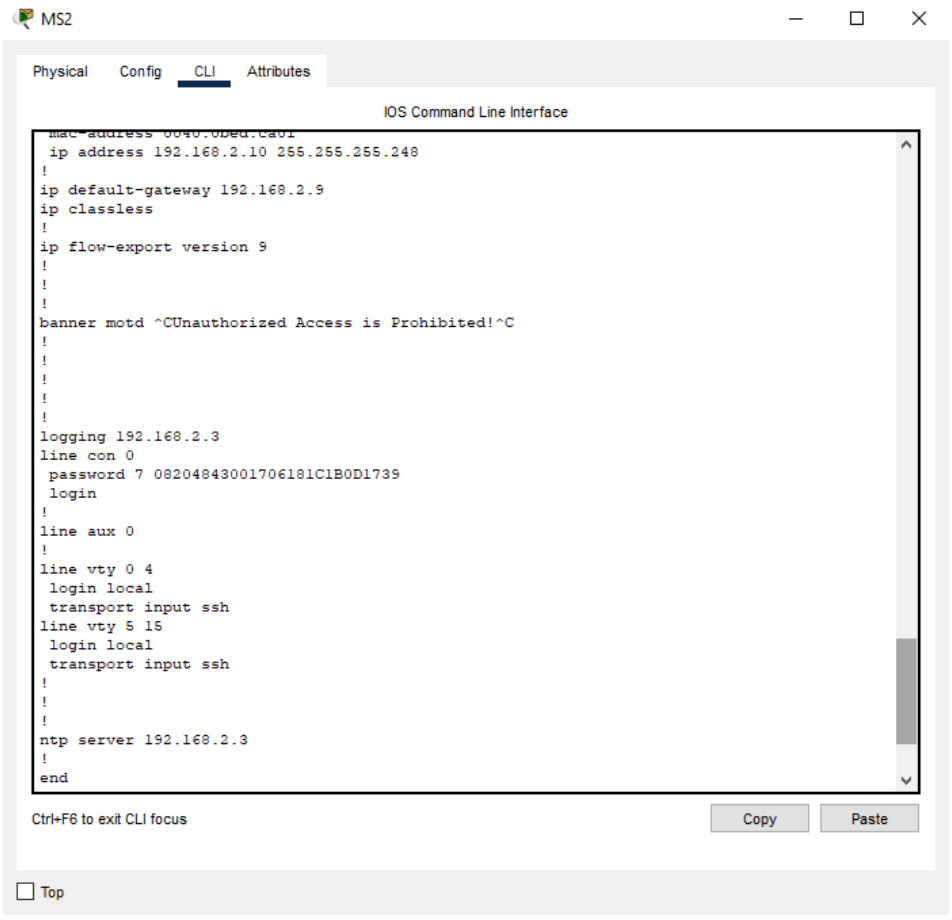
IOS Command Line Interface

```
interface GigabitEthernet1/1/4
 shutdown
!
interface Vlan1
 no ip address
 shutdown
!
interface Vlan20
 description vlan20 management interface
 mac-address 0040.0bed.ca01
 ip address 192.168.2.10 255.255.255.248
!
ip default-gateway 192.168.2.9
ip classless
!
ip flow-export version 9
!
!
!
banner motd ^CUnauthorized Access is Prohibited!^C
!
!
!
!
!
logging 192.168.2.3
line con 0
 password 7 0820484300170618lC1B0D1739
 login
!
line aux 0
!
line vty 0 4
 login local
 transport input ssh
```

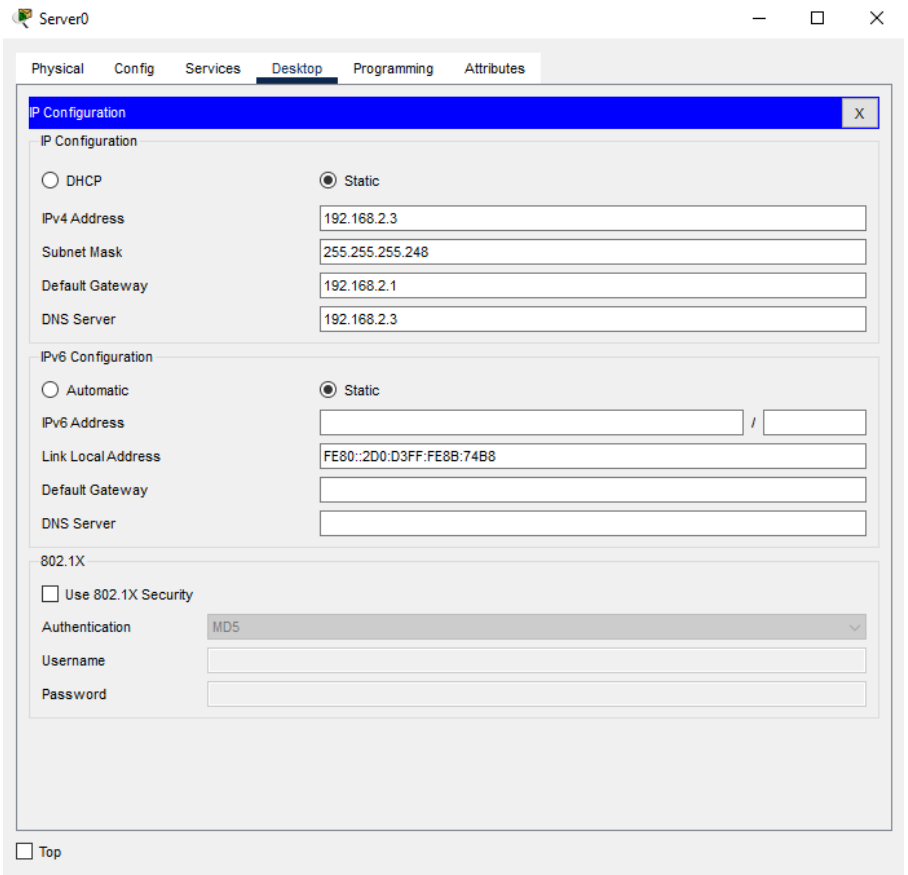
Ctrl+F6 to exit CLI focus

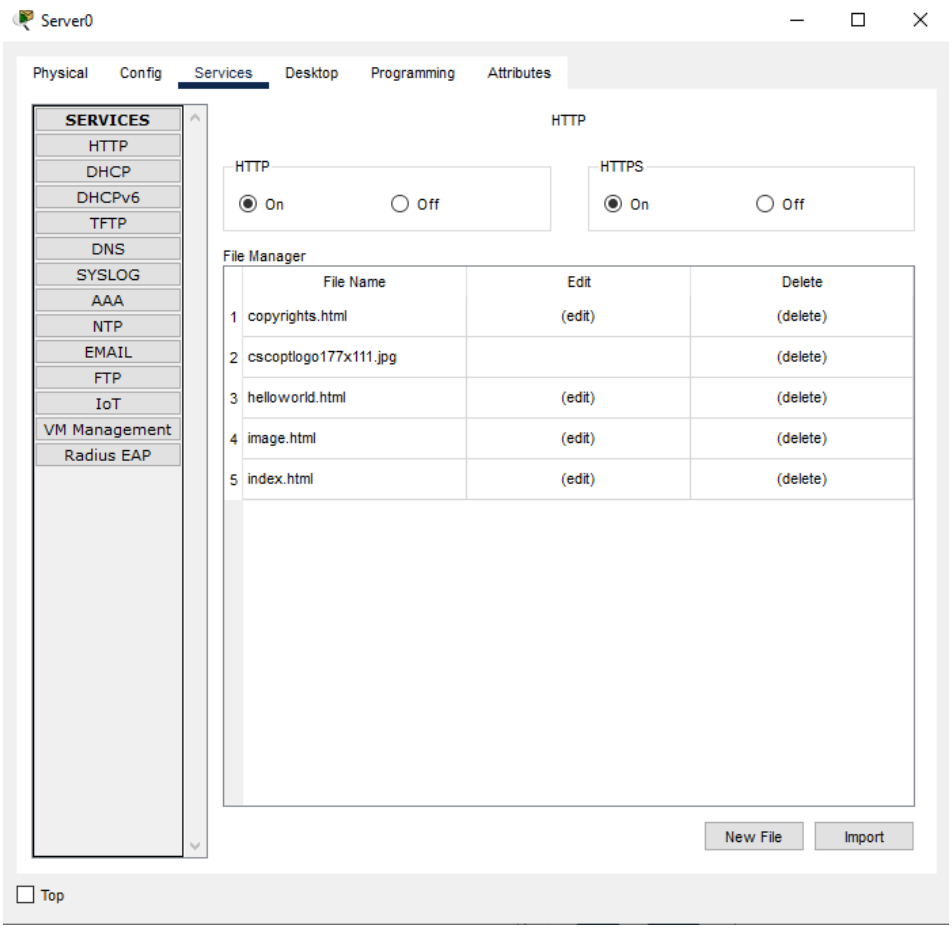
Copy Paste

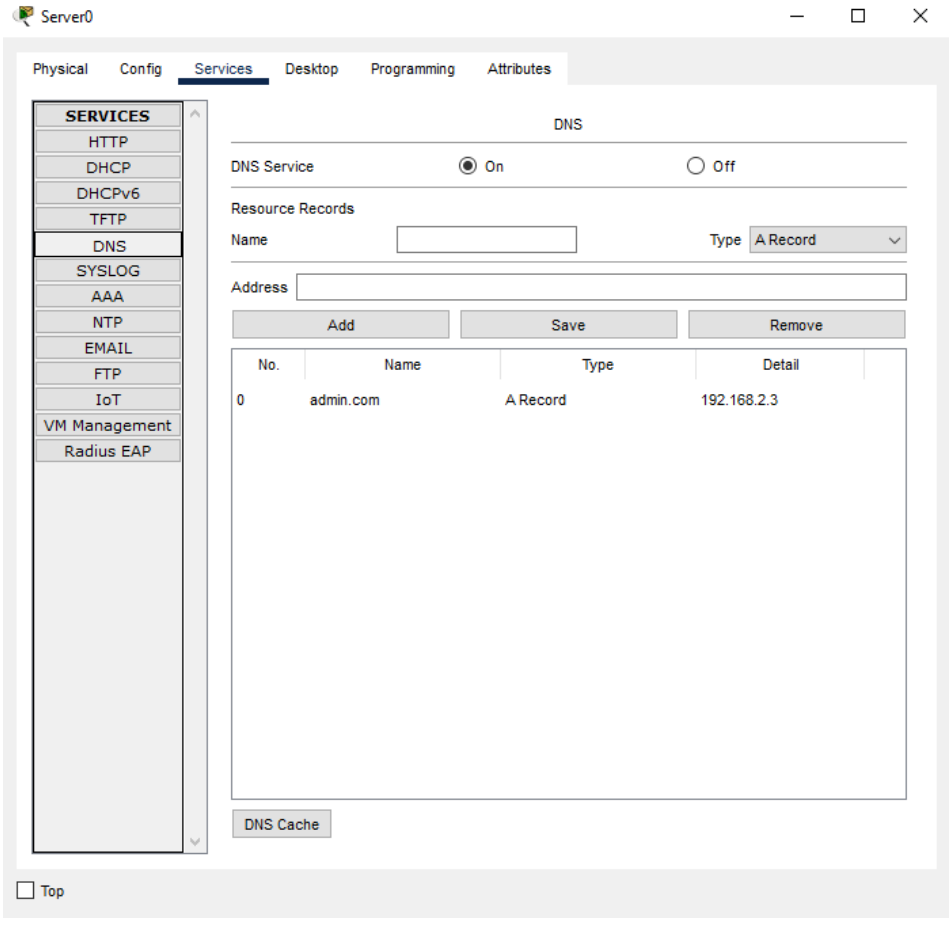
Top

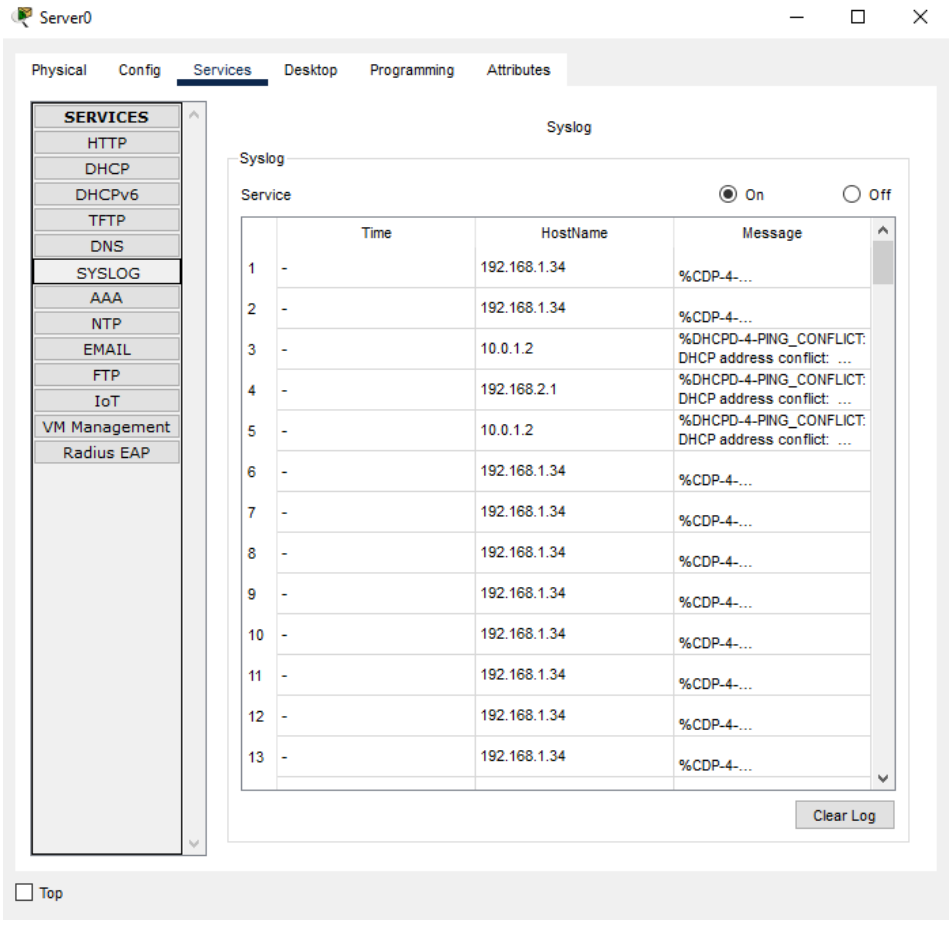

MS2
Physical
Config
CLI
Attributes
IOS Command Line Interface
ip address 192.168.2.10 255.255.255.248
!
ip default-gateway 192.168.2.9
ip classless
!
ip flow-export version 9
!
!
!
banner motd ^CUnauthorized Access is Prohibited!^C
!
!
!
!
!
logging 192.168.2.3
line con 0
password 7 0820484300170618lC1B0D1739
login
!
line aux 0
!
line vty 0 4
login local
transport input ssh
line vty 5 15
login local
transport input ssh
!
!
!
ntp server 192.168.2.3
!
end
Ctrl+F6 to exit CLI focus
Copy
Paste
Top

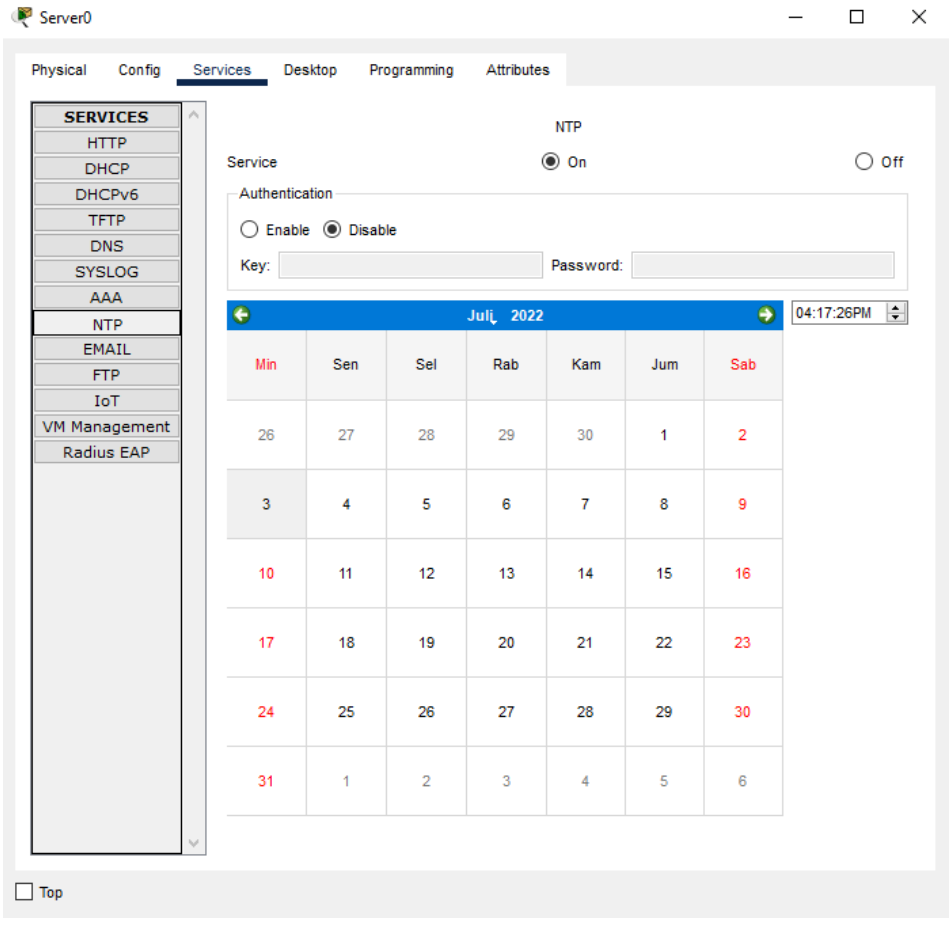
f) Server0


Server0
Physical
Config
Services
Desktop
Programming
Attributes
IP Configuration
X
IP Configuration
DHCP
Static
IPv4 Address
192.168.2.3
Subnet Mask
255.255.255.248
Default Gateway
192.168.2.1
DNS Server
192.168.2.3
IPv6 Configuration
Automatic
Static
IPv6 Address
/
Link Local Address
FE80::2D0:D3FF:FE8B:74B8
Default Gateway
DNS Server
802.1X
Use 802.1X Security
Authentication
MD5
Username
Password
Top

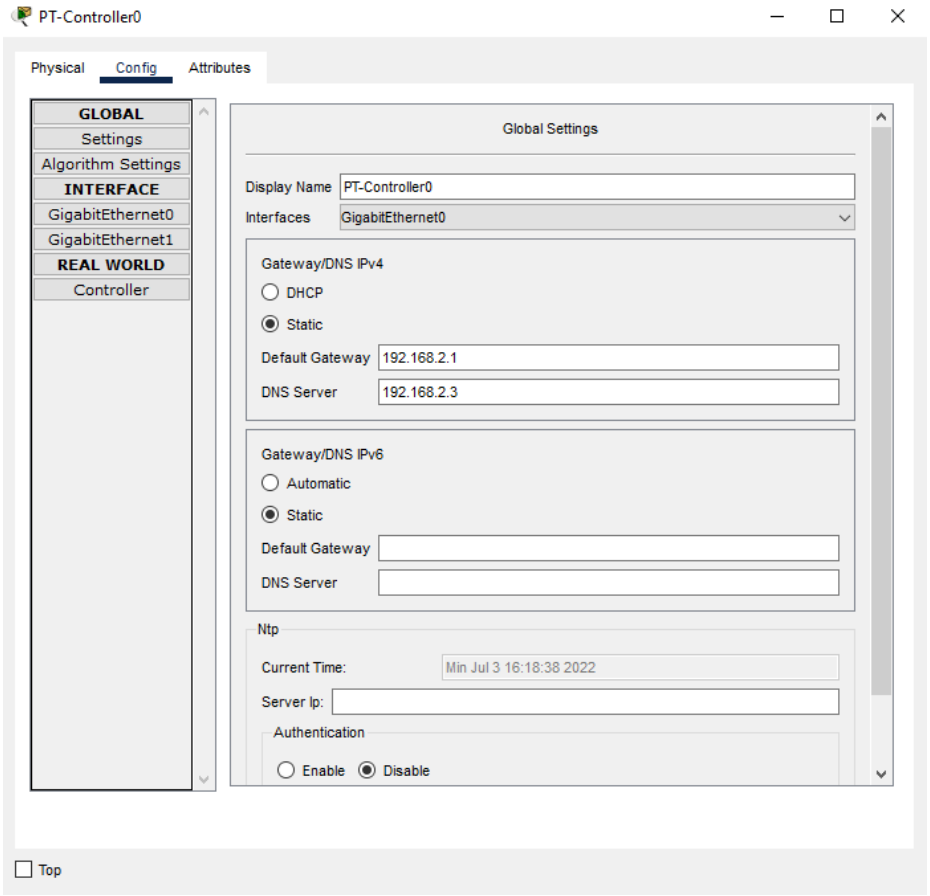

Server0
Physical
Config
Services
Desktop
Programming
Attributes
SERVICES
HTTP
DHCP
DHCPv6
TFTP
DNS
SYSLOG
AAA
NTP
EMAIL
FTP
IoT
VM Management
Radius EAP
HTTP
HTTP
On
Off
HTTPS
On
Off
File Manager
File Name
Edit
Delete
1 copyrights.html (edit) (delete)
2 cscoptlogo177x111.jpg (delete)
3 helloworld.html (edit) (delete)
4 image.html (edit) (delete)
5 index.html (edit) (delete)
New File
Import
Top

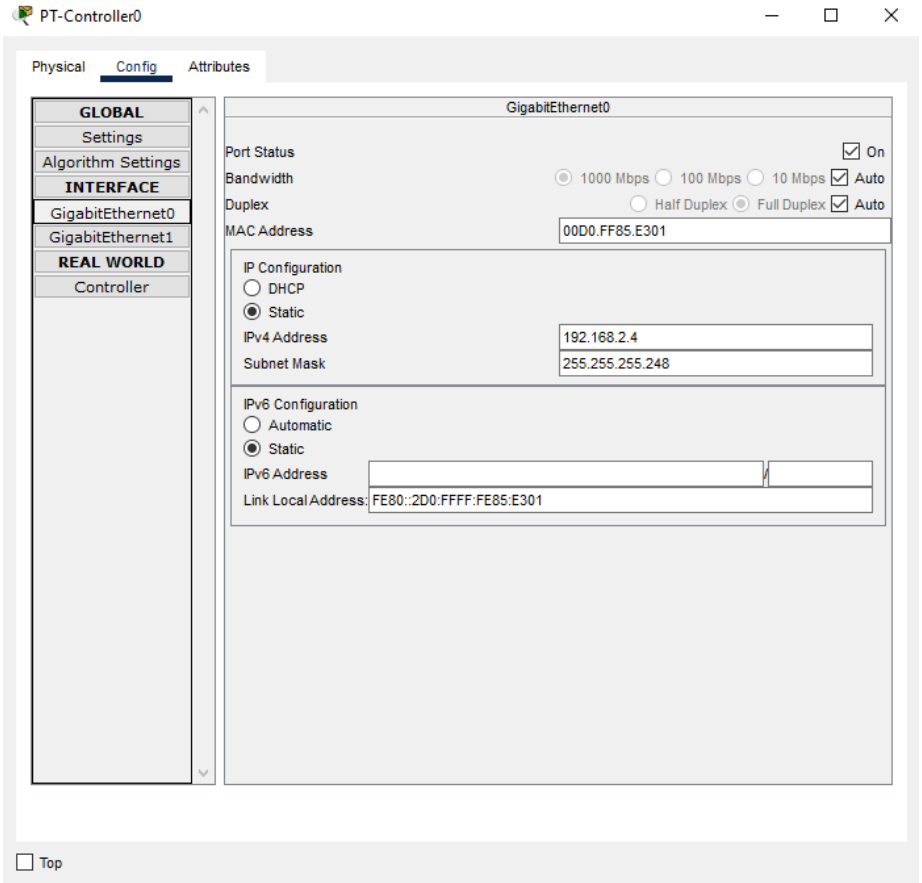

Server0
Physical
Config
Services
Desktop
Programming
Attributes
SERVICES
HTTP
DHCP
DHCPv6
TFTP
DNS
SYSLOG
AAA
NTP
EMAIL
FTP
IoT
VM Management
Radius EAP
DNS
DNS Service
On
Off
Resource Records
Name
Type
A Record
Address
Add
Save
Remove
No.
Name
Type
Detail
0 admin.com A Record 192.168.2.3
DNS Cache
Top

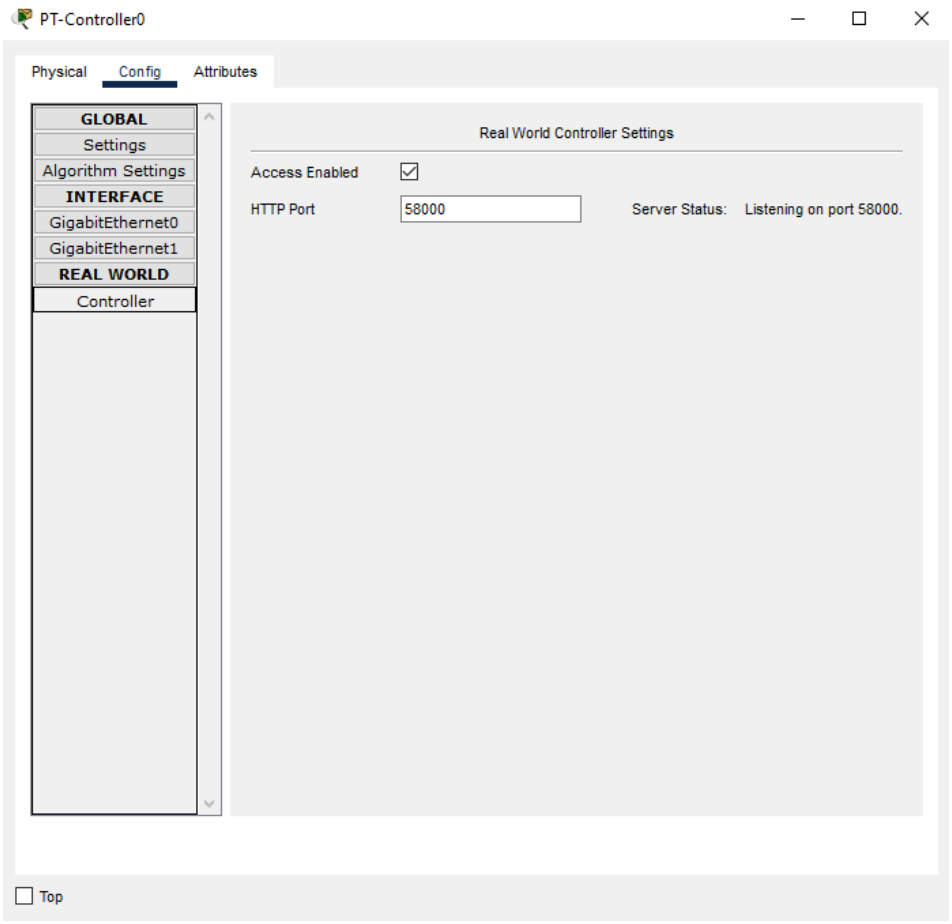

Server0
Physical
Config
Services
Desktop
Programming
Attributes
SERVICES
HTTP
DHCP
DHCPv6
TFTP
DNS
SYSLOG
AAA
NTP
EMAIL
FTP
IoT
VM Management
Radius EAP
Syslog
Syslog
Service
On
Off
Time
HostName
Message
1 - 192.168.1.34 %CDP-4-...
2 - 192.168.1.34 %CDP-4-...
3 - 10.0.1.2 %DHCPD-4-PING_CONFLICT: DHCP address conflict: ...
4 - 192.168.2.1 %DHCPD-4-PING_CONFLICT: DHCP address conflict: ...
5 - 10.0.1.2 %DHCPD-4-PING_CONFLICT: DHCP address conflict: ...
6 - 192.168.1.34 %CDP-4-...
7 - 192.168.1.34 %CDP-4-...
8 - 192.168.1.34 %CDP-4-...
9 - 192.168.1.34 %CDP-4-...
10 - 192.168.1.34 %CDP-4-...
11 - 192.168.1.34 %CDP-4-...
12 - 192.168.1.34 %CDP-4-...
13 - 192.168.1.34 %CDP-4-...
Clear Log
Top


Server0
Physical
Config
Services
Desktop
Programming
Attributes
SERVICES
HTTP
DHCP
DHCPv6
TFTP
DNS
SYSLOG
AAA
NTP
EMAIL
FTP
IoT
VM Management
Radius EAP
NTP
Service
On
Off
Authentication
Enable
Disable
Key:
Password:
Juli, 2022
04:17:26PM
Min Sen Sel Rab Kam Jum Sab
26 27 28 29 30 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 30
31 1 2 3 4 5 6
Top

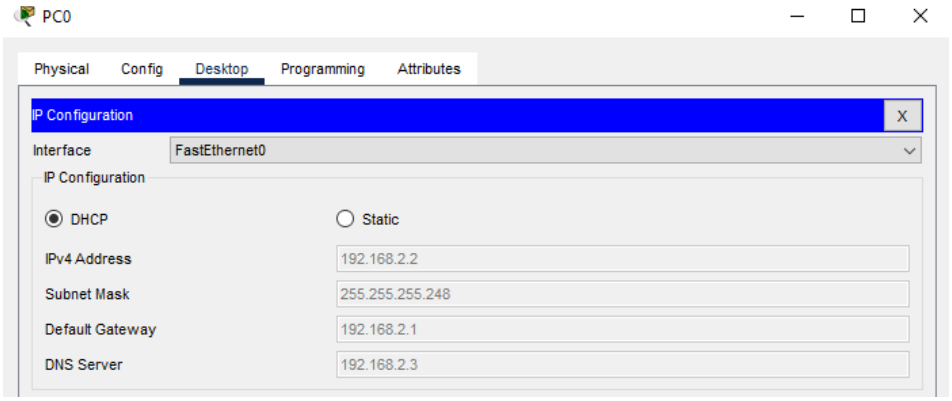
g) PT-Controller0

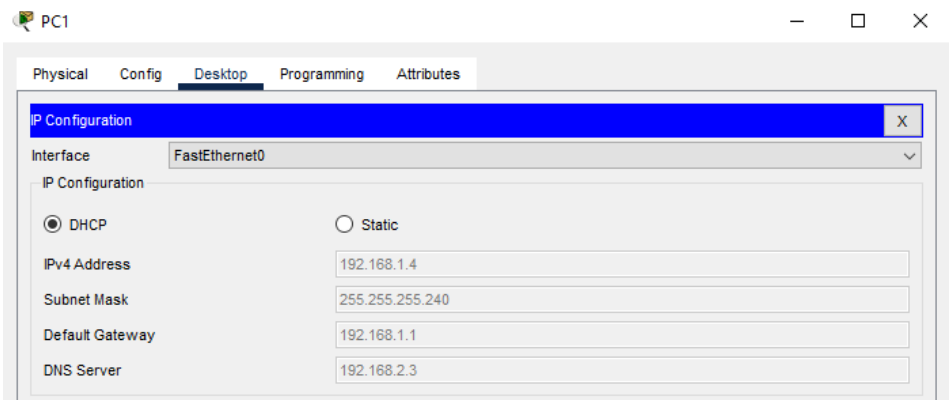


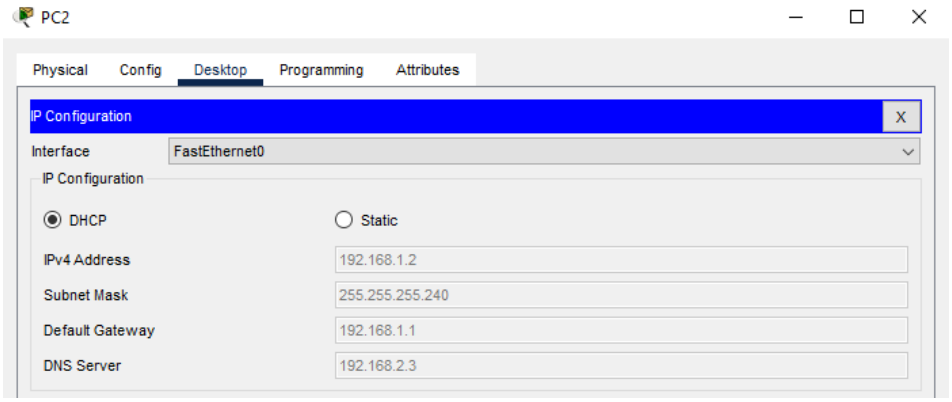


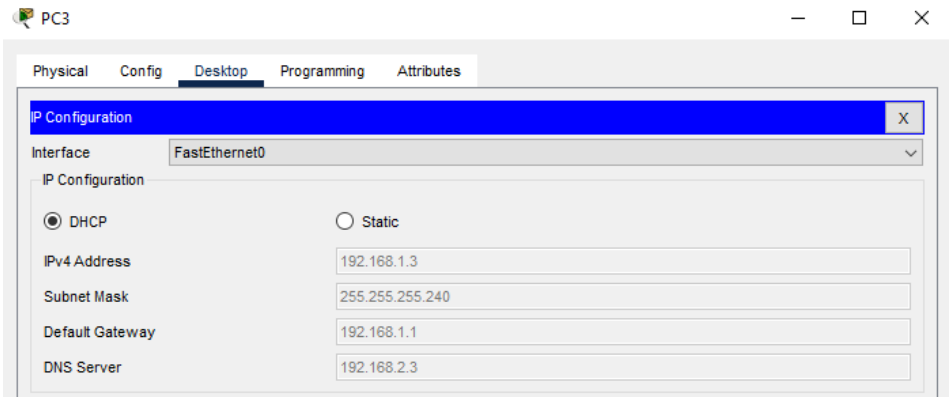

PT-Controller0
Physical
Config
Attributes
GLOBAL
Settings
Algorithm Settings
INTERFACE
GigabitEthernet0
GigabitEthernet1
REAL WORLD
Controller
Real World Controller Settings
Access Enabled
HTTP Port
58000
Server Status:
Listening on port 58000.
Top

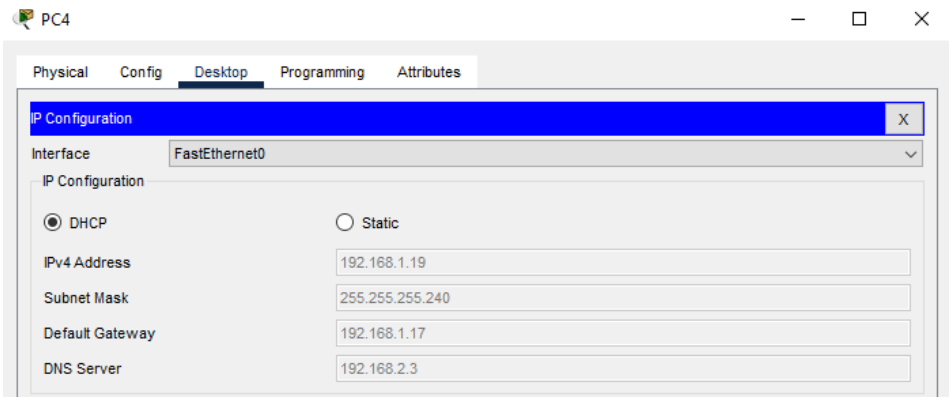
h) PC

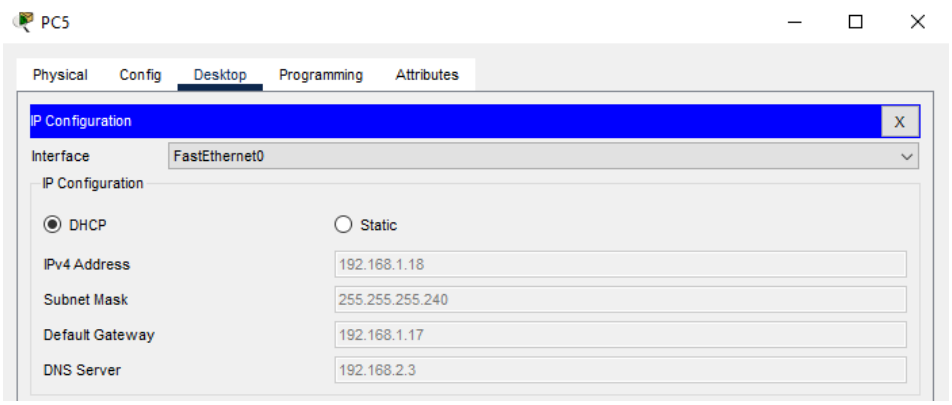

PC0
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
IPv4 Address
192.168.2.2
Subnet Mask
255.255.255.248
Default Gateway
192.168.2.1
DNS Server
192.168.2.3


PC1
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
IPv4 Address
192.168.1.4
Subnet Mask
255.255.255.240
Default Gateway
192.168.1.1
DNS Server
192.168.2.3









i) Kode Python REST APIs

01_get-ticket.py

```python
import json
import requests
api_url = "http://localhost:58000/api/v1/ticket"

headers = {
    "content-type": "application/json"
}

body_json = {
    "username": "risqi2",
    "password": "risqi2"
}

resp = requests.post(api_url, json.dumps(body_json), headers=headers, verify=False)

print("Ticket request status: ", resp.status_code)
response_json = resp.json()

serviceTicket = response_json["response"]["serviceTicket"]
print("The service ticket number is: ", serviceTicket)

```

02_get-network-device.py

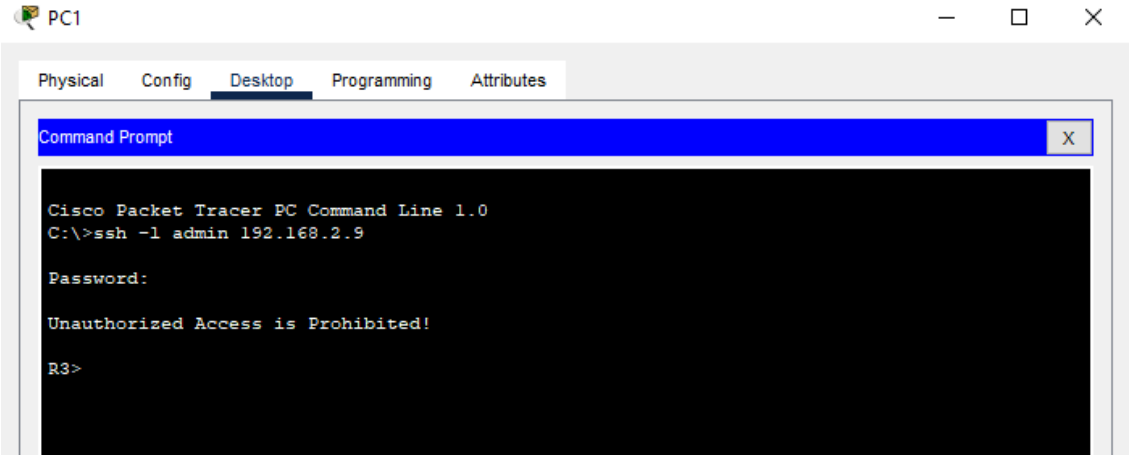
```python
import json
import requests
api_url = "http://localhost:58000/api/v1/network-device"

headers={"X-Auth-Token": "NC-6-968f2ba2a9bb4838989d-nbi"}

resp = requests.get(api_url, headers=headers, verify=False)

print("Request status: ", resp.status_code)

response_json = resp.json()
networkDevices = response_json["response"]

for networkDevice in networkDevices:
    print(networkDevice["hostname"], "\t", networkDevice["platformId"], "\t", networkDevice["managementIpAddres

```

03_get-host.py

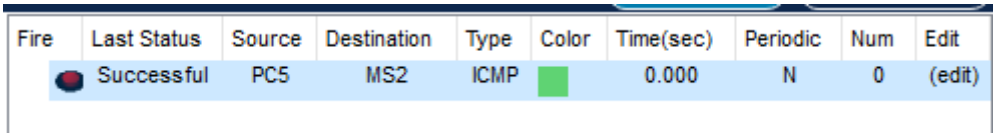
```python
import json
import requests
api_url = "http://localhost:58000/api/v1/host"

headers={"X-Auth-Token": "NC-6-968f2ba2a9bb4838989d-nbi"}

resp = requests.get(api_url, headers=headers, verify=False)

print("Request status: ", resp.status_code)

response_json = resp.json()
hosts = response_json["response"]

for host in hosts:
    print(host["hostName"], "\t", host["hostIp"], "\t", host["hostMac"], "\t", host["connectedInterfaceName"])

```

HASIL DAN PEMBAHASAN

Remote Access Secure Shell (SSH)

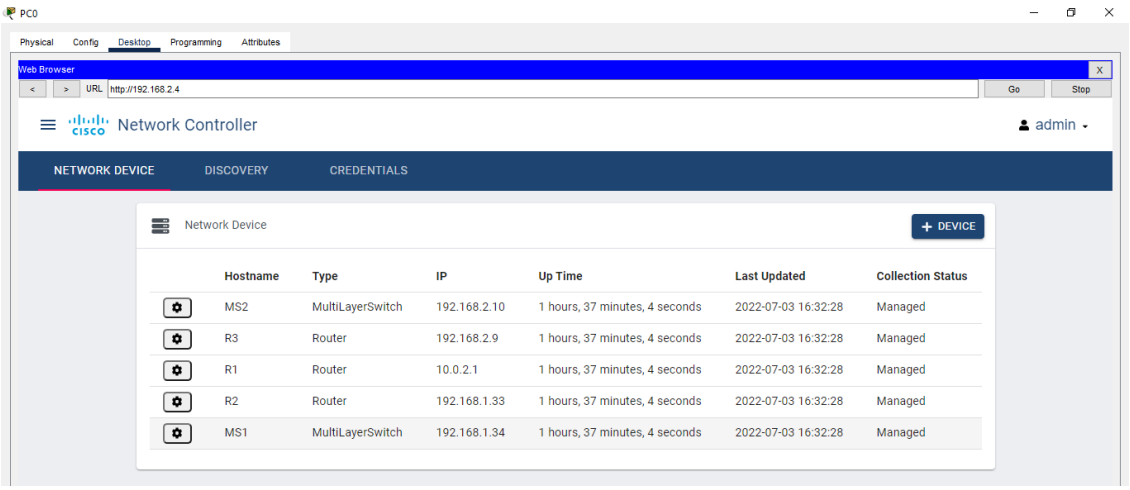


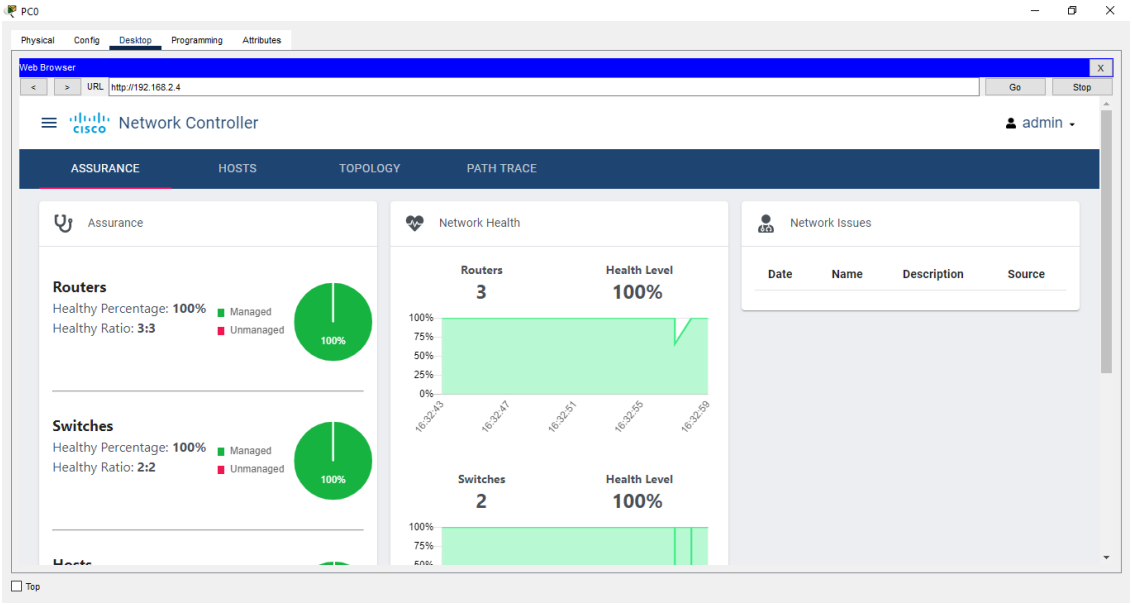
Test Ping Koneksi

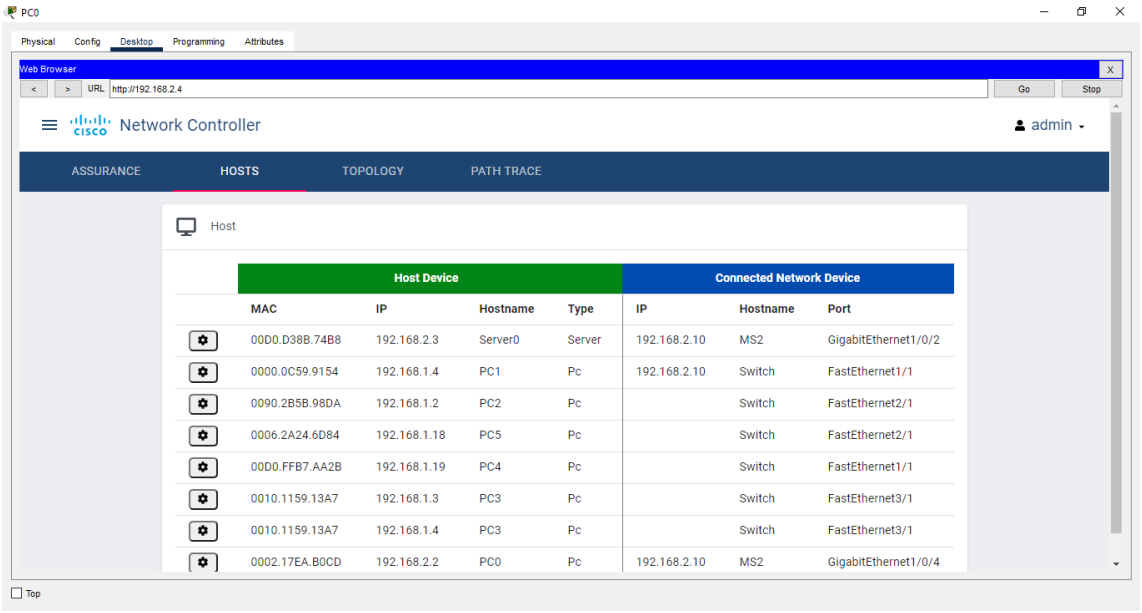


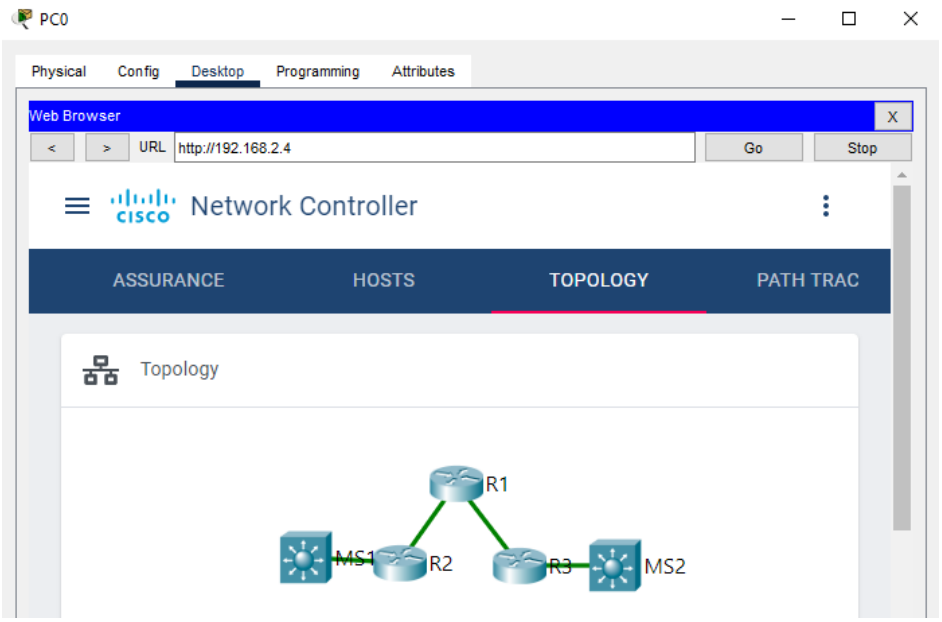
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit
	Successful	PC5	MS2	ICMP		0.000	N	0	(edit)

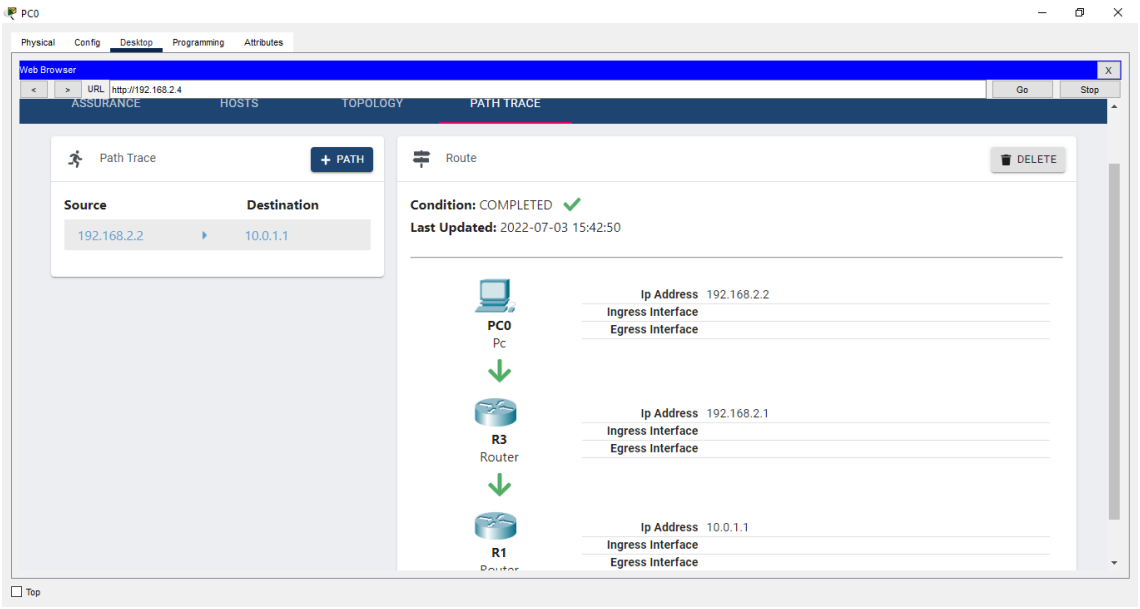
Network Controller




PC0
Physical
Config
Desktop
Programming
Attributes
Web Browser
URL
http://192.168.2.4
Go
Stop
Network Controller
admin
ASSURANCE
HOSTS
TOPOLOGY
PATH TRACE
Assurance
Routers
Healthy Percentage: 100%
Healthy Ratio: 3:3
Managed
Unmanaged
100%
Switches
Healthy Percentage: 100%
Healthy Ratio: 2:2
Managed
Unmanaged
100%
Network Health
Routers
3
Health Level
100%
100%
75%
50%
25%
0%
16:32:43
16:32:47
16:32:51
16:32:55
16:32:59
Switches
2
Health Level
100%
100%
75%
Network Issues
Date
Name
Description
Source
Top


PC0
Physical
Config
Desktop
Programming
Attributes
Web Browser
URL
http://192.168.2.4
Go
Stop
Network Controller
admin
ASSURANCE
HOSTS
TOPOLOGY
PATH TRACE
Host
Host Device
Connected Network Device
MAC
IP
Hostname
Type
IP
Hostname
Port
00D0.D38B.74B8
192.168.2.3
Server0
Server
192.168.2.10
MS2
GigabitEthernet1/0/2
0000.0C59.9154
192.168.1.4
PC1
Pc
192.168.2.10
Switch
FastEthernet1/1
0090.2B5B.98DA
192.168.1.2
PC2
Pc
Switch
FastEthernet2/1
0006.2A24.6D84
192.168.1.18
PC5
Pc
Switch
FastEthernet2/1
00D0.FFB7.AA2B
192.168.1.19
PC4
Pc
Switch
FastEthernet1/1
0010.1159.13A7
192.168.1.3
PC3
Pc
Switch
FastEthernet3/1
0010.1159.13A7
192.168.1.4
PC3
Pc
Switch
FastEthernet3/1
0002.17EA.B0CD
192.168.2.2
PC0
Pc
192.168.2.10
MS2
GigabitEthernet1/0/4
Top


PC0
Physical
Config
Desktop
Programming
Attributes
Web Browser
URL
http://192.168.2.4
Go
Stop
Network Controller
ASSURANCE
HOSTS
TOPOLOGY
PATH TRAC
Topology
R1
MS1
R2
R3
MS2

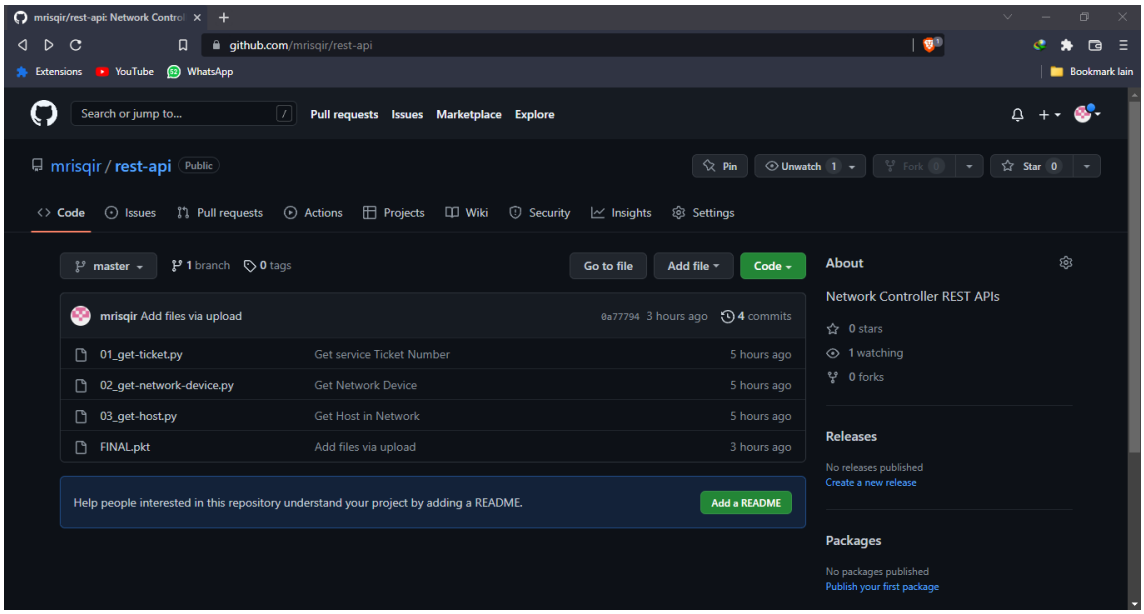


REST APIs

```
devasc@labvm: ~/Downloads/Final
File  Edit  View  Search  Terminal  Help
devasc@labvm:~/Downloads/Final$ python3 01_get-ticket.py
Ticket request status:  201
The service ticket number is:  NC-5-e29c8c845d9d4016a1dc-nbi
devasc@labvm:~/Downloads/Final$ python3 02_get-network-device.py
Request status:  200
MS2       3650    192.168.2.10
R3        ISR4300         192.168.2.9
R1        ISR4300         10.0.2.1
R2        ISR4300         192.168.1.33
MS1       3650    192.168.1.34
Traceback (most recent call last):
  File "02_get-network-device.py", line 15, in <module>
    print(networkDevice["hostname"], "\t", networkDevice["platformId"], "\t", ne
tworkDevice["managementIpAddress"])
KeyError: 'hostname'
devasc@labvm:~/Downloads/Final$ python3 02_get-network-device.py
```

```
devasc@labvm: ~/Downloads/Final
File  Edit  View  Search  Terminal  Help
The service ticket number is:  NC-5-e29c8c845d9d4016a1dc-nbi
devasc@labvm:~/Downloads/Final$ python3 02_get-network-device.py
Request status:  200
MS2       3650    192.168.2.10
R3        ISR4300         192.168.2.9
R1        ISR4300         10.0.2.1
R2        ISR4300         192.168.1.33
MS1       3650    192.168.1.34
Traceback (most recent call last):
  File "02_get-network-device.py", line 15, in <module>
    print(networkDevice["hostname"], "\t", networkDevice["platformId"], "\t", ne
tworkDevice["managementIpAddress"])
KeyError: 'hostname'
devasc@labvm:~/Downloads/Final$ python3 03_get-host.py
Request status:  200
PC0       192.168.2.2     0002.17EA.B0CD          GigabitEthernet1/0/4
PC0       192.168.2.2     0002.17EA.B0CD          GigabitEthernet1/0/4
PC3       192.168.1.4     0010.1159.13A7          FastEthernet3/1
PC5       192.168.1.18    0006.2A24.6D84          FastEthernet2/1
PC4       192.168.1.19    00D0.FFB7.AA2B          FastEthernet1/1
PC2       192.168.1.3     0090.2B5B.98DA          FastEthernet2/1
PC3       192.168.1.4     0010.1159.13A7          FastEthernet3/1
Server0           192.168.2.3     00D0.D38B.74B8          GigabitEthernet1/0/2
devasc@labvm:~/Downloads/Final$
```

Software Version Control



Untuk lebih lengkapnya mengenai tahapan penyelesaian project mulai dari desain dan implementasinya, dan demo final project ada pada link berikut https://youtu.be/nLfSwr0Hj9s dan untuk resource github terdapat pada link berikut https://github.com/mrisqir/rest-api.

PENUTUP

A. Kesimpulan

Final project ini diajukan untuk memenuhi persyaratan kelulusan Program MSIB di Balitbang SDM Kementerian Kominfo, Talent Scouting Academy dengan tema Network Programmability. Final project yang topik “Desain dan Implementasi jaringan skala kecil (Small Network) yang menerapkan Network Programmability” ini bertujuan untuk memudahkan kita dalam memahami dan menggunakan network automation yang memungkinkan kita untuk maintain, manajemen, dan monitoring konfigurasi perangkat jaringan.

Akhir kata, saya berharap laporan ini dapat memberikan informasi atau pembelajaran bagi kita semua, dan jika ada kesalahan dalam penulisan ataupun perkataan mohon dimaafkan. Oleh karena itu kritik dan saran yang membangun sangat diharapkan dari para pembaca sebagai bahan evaluasi untuk kedepannya