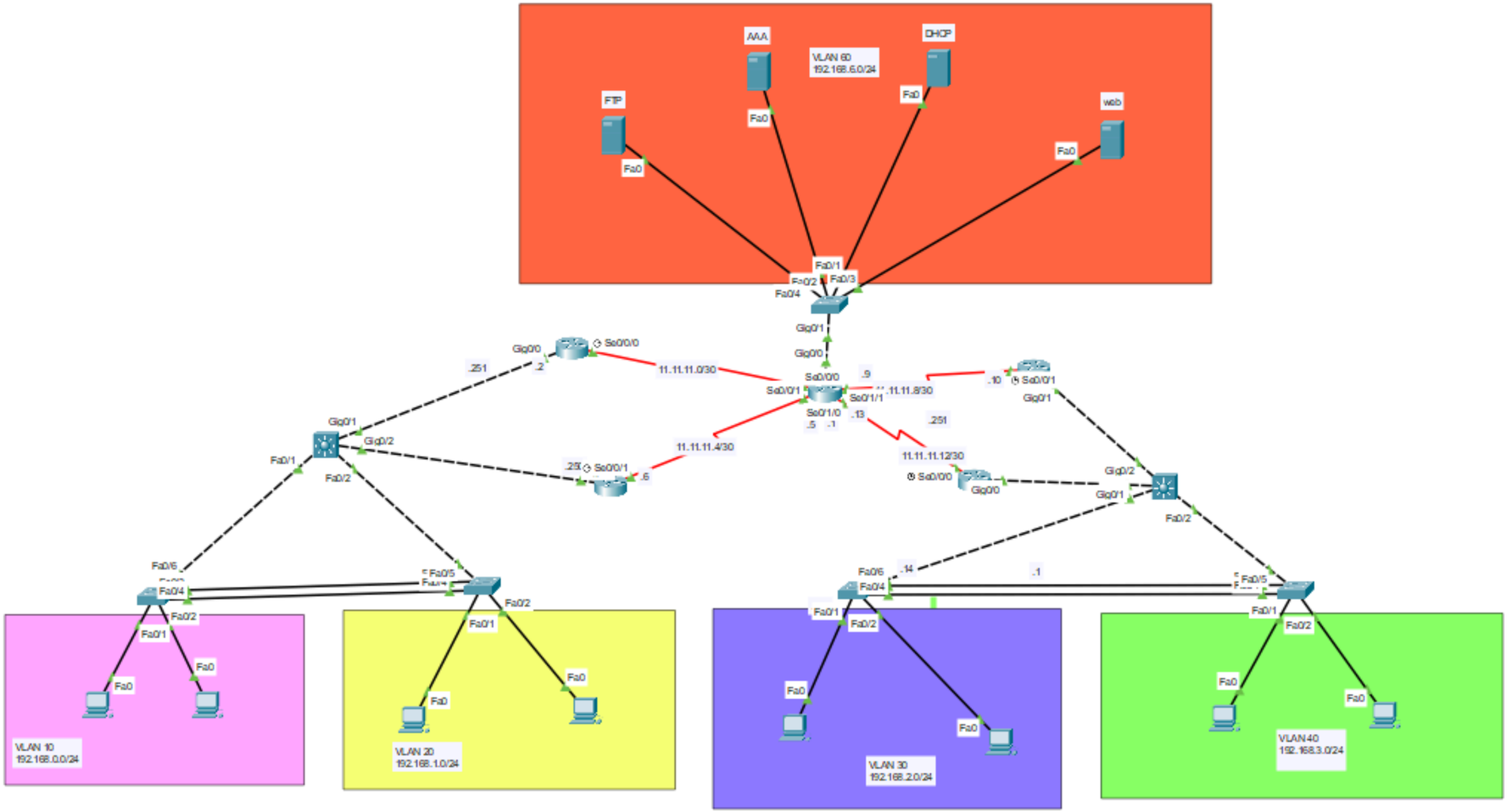
VLAN 60
192.168.6.0/24
AAA
DHCP
FTP
web
Fa0
Fa0/1
Fa0/2
Fa0/3
Fa0/4
Gig0/1
Gig0/0
Se0/0/0
11.11.11.0/30
.251
.2
.9
Se0/0/1
Se0/1/1
11.11.11.8/30
.10
Se0/1/0
.5
.1
.13
.251
11.11.11.4/30
11.11.11.12/30
.25
.6
Gig0/2
Fa0/5
Fa0/6
Fa0/4
Fa0/1
Fa0/2
VLAN 10
192.168.0.0/24
VLAN 20
192.168.1.0/24
VLAN 30
192.168.2.0/24
VLAN 40
192.168.3.0/24
.14
.1

CCNA

NETWORK PROJECT

ITI

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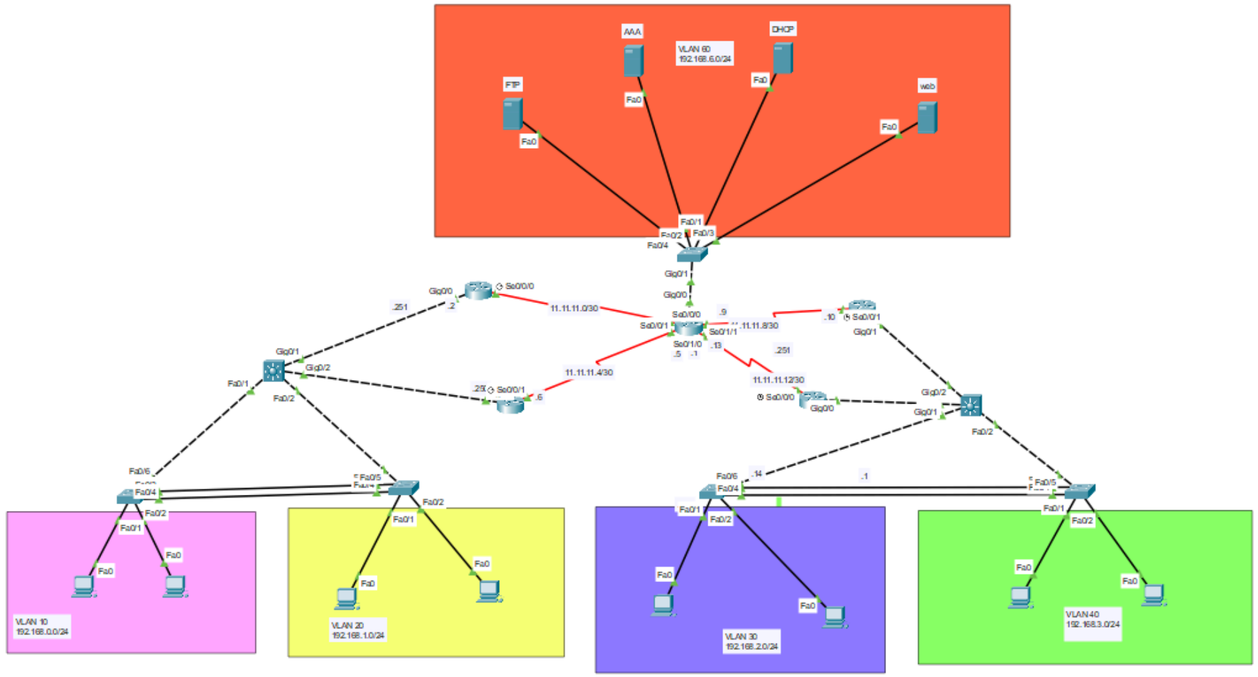
Network Overview

This project represents a multi-site enterprise network consisting of two main branches, with two departments located in each branch. The network is fully segmented using VLANs to separate and organize the different teams and ensure secure and efficient communication.

Branch Structure

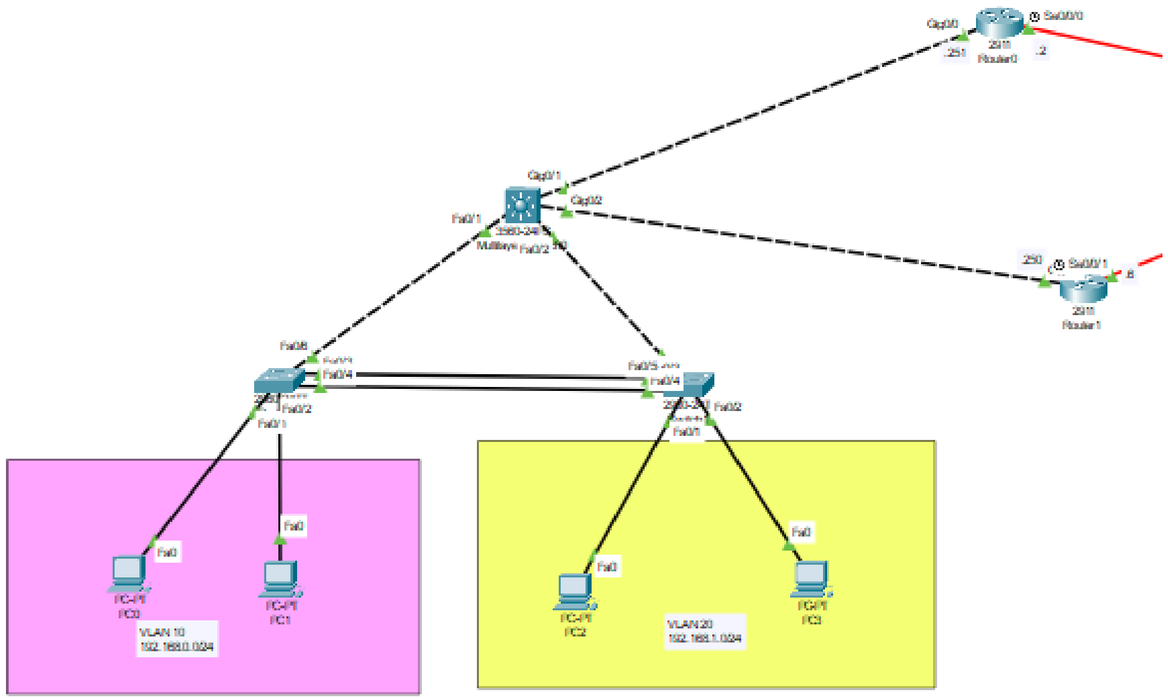
- Branch 1
  - Cyber Security Department (VLAN)
  - AI Department (VLAN)
- Branch 2
  - Network Department (VLAN)
  - Data Management (VLAN)

Each department operates within its own VLAN to improve performance, security, and traffic management across the entire network



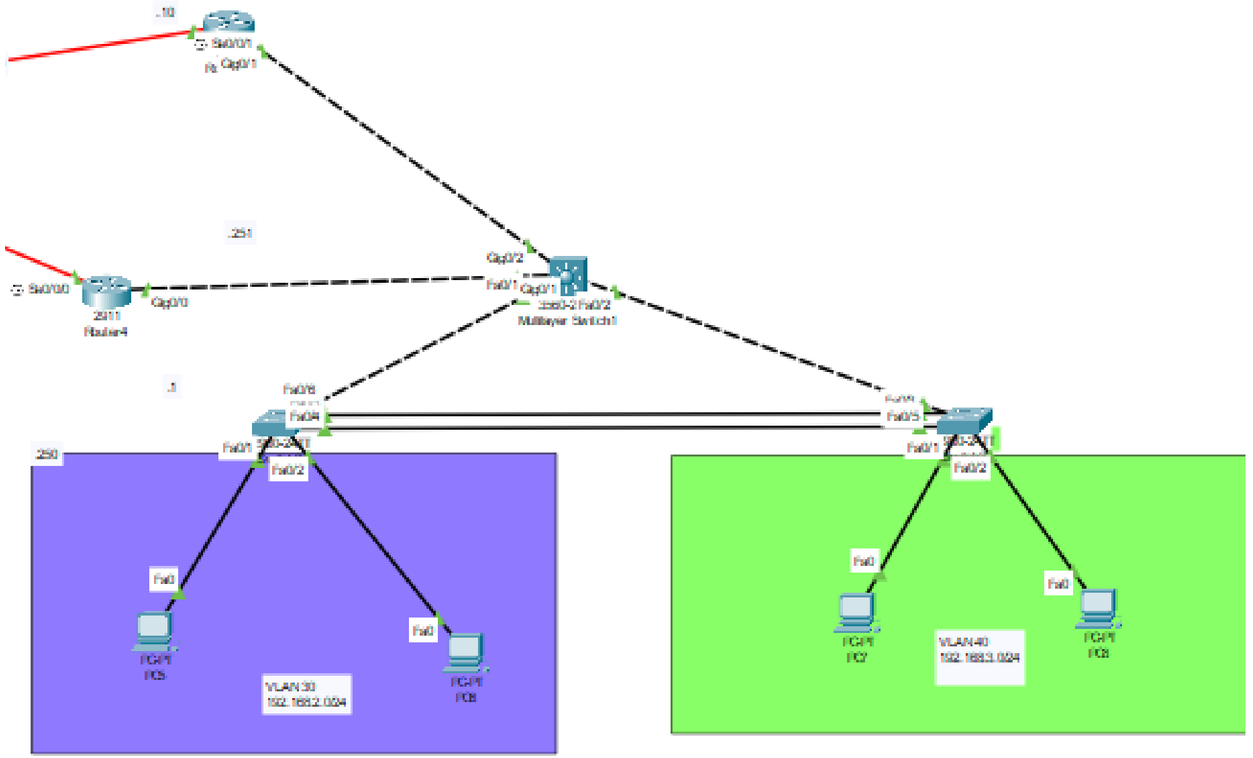
Branch 1

- Devices
  - Two Routers
  - Two access switch
  - One distributed switch
  - Multiple PCS and Laptops
- Services
  - DHCP
  - WEB
- Vlans
  - 10 for Cybersecuirty
  - 20 for AI



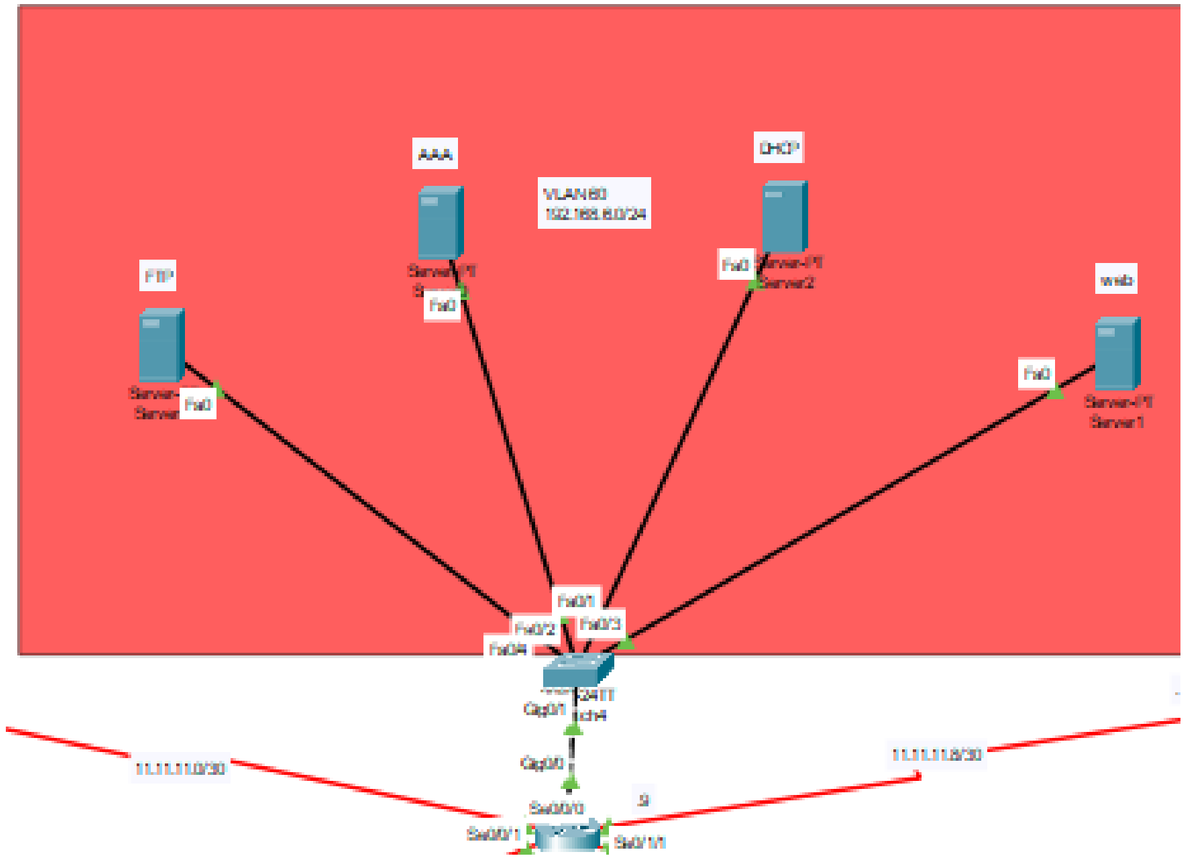
Branch 2

- Devices
  - Two Routers
  - Two access switch
  - One distributed switch
  - Multiple PCS and Laptops
- Services
  - DHCP
  - WEB
  - FTP
  - AAA
- Vlans
  - 30 for Network
  - 40 for Data Management



Branch 3: Data Center

- Devices
  - Router
  - access switch
  - Multiple Servers
- Services
  - DHCP
  - WEB
  - FTP
  - AAA
  - SSH
  - OSPF
  - NAT
- Vlans
  - 60 for Data Center



Protocols Used

- Vlans: for different departments
- Inter-Vlan Routing using router(ROAS)
- OSPF :Routing Between Branches
- LACP :Etherchannel
- HSRP :Redundancy for routers
- SSH :Remote connection
- AAA :Authentication and Authorization
- Web
- FTP
- DHCP

Ips versus Vlans

Vlans	Departments	Subnet	Gateway
10	Cybersecurity	192.168.0.0/24	192.168..0.1
20	AI	192.168.1.0/24	192.168..1.1
30	Network	192.168.2.0/24	192.168.2.1
40	Data-Management	192.168.3.0/24	192.168.3.1
60	Servers	192.168.6.0/24	192.168.6.1

Access and Trunk Ports Conf

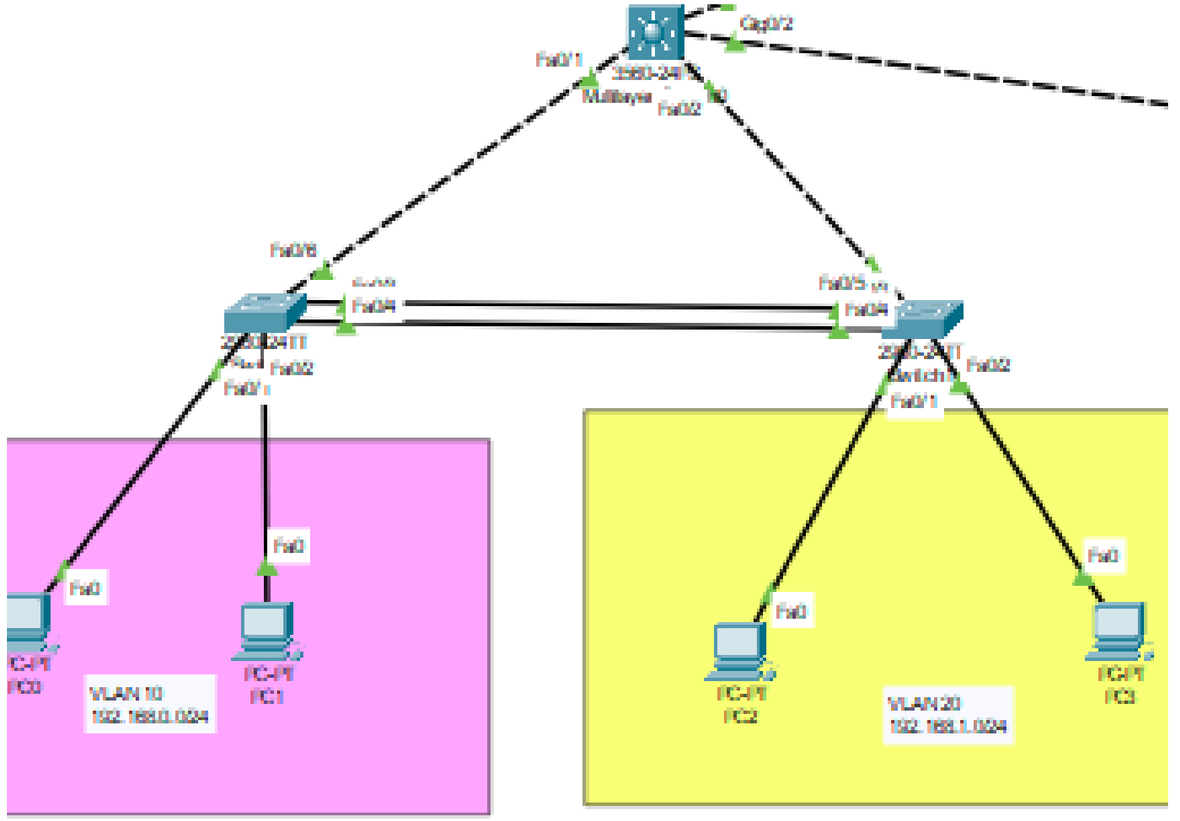
```
!
interface Port-channel1
 switchport mode trunk
!
interface FastEthernet0/1
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/2
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/3
 switchport mode trunk
 channel-group 1 mode auto
!
interface FastEthernet0/4
 switchport mode trunk
 channel-group 1 mode auto
!
interface FastEthernet0/5
```

```
S1#show interfaces status
Port      Name               Status       Vlan       Duplex  Speed Type
Po1                          connected    trunk      auto    auto
Fa0/1                        connected    10         auto    auto  10/100BaseTX
Fa0/2                        connected    10         auto    auto  10/100BaseTX
Fa0/3                        connected    trunk      auto    auto  10/100BaseTX
Fa0/4                        connected    trunk      auto    auto  10/100BaseTX
Fa0/5                        notconnect   20         auto    auto  10/100BaseTX
Fa0/6                        connected    trunk      auto    auto  10/100BaseTX
Fa0/7                        notconnect   1          auto    auto  10/100BaseTX
Fa0/8                        notconnect   1          auto    auto  10/100BaseTX
Fa0/9                        notconnect   1          auto    auto  10/100BaseTX
Fa0/10                       notconnect   1          auto    auto  10/100BaseTX
Fa0/11                       notconnect   1          auto    auto  10/100BaseTX
Fa0/12                       notconnect   1          auto    auto  10/100BaseTX
Fa0/13                       notconnect   1          auto    auto  10/100BaseTX
Fa0/14                       notconnect   1          auto    auto  10/100BaseTX
Fa0/15                       notconnect   1          auto    auto  10/100BaseTX
Fa0/16                       notconnect   1          auto    auto  10/100BaseTX
Fa0/17                       notconnect   1          auto    auto  10/100BaseTX
Fa0/18                       notconnect   1          auto    auto  10/100BaseTX
Fa0/19                       notconnect   1          auto    auto  10/100BaseTX
Fa0/20                       notconnect   1          auto    auto  10/100BaseTX
Fa0/21                       notconnect   1          auto    auto  10/100BaseTX
Fa0/22                       notconnect   1          auto    auto  10/100BaseTX
Fa0/23                       notconnect   1          auto    auto  10/100BaseTX
Fa0/24                       notconnect   1          auto    auto  10/100BaseTX
Gig0/1                       notconnect   1          auto    auto  10/100BaseTX
Gig0/2                       notconnect   1          auto    auto  10/100BaseTX

S1#
S1#
S1#
S1#
S1#
```

PVSTP

In this project, PVST+ (Per-VLAN Spanning Tree Protocol) was implemented to manage Layer 2 redundancy.
Each VLAN runs its own spanning tree instance, allowing better load balancing and control.
For optimal path selection, we manually configured a root bridge for each VLAN, ensuring that traffic in every VLAN uses the best and most stable switch in the topology as its root



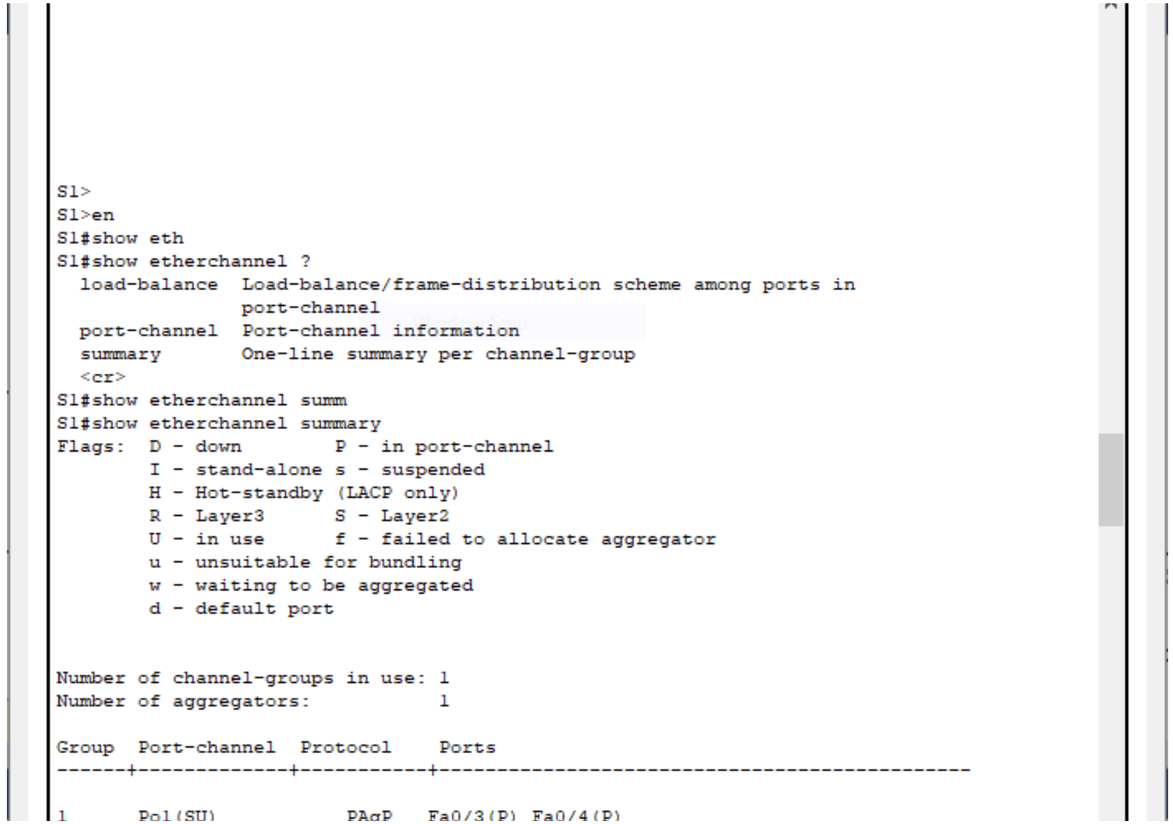

```
spanning-tree mode pvst
spanning-tree extend system-id
spanning-tree vlan 10 priority 24576
spanning-tree vlan 20 priority 28672
!
```

ETHER-Channel

In this project, EtherChannel was implemented between the Layer 2 switches to increase bandwidth and provide link redundancy.

Multiple physical links were bundled into a single logical port-channel, allowing the switches to treat them as one interface. This configuration improves network performance, prevents single-link failure issues, and ensures stable connectivity between the switches

```
interface FastEthernet0/3
 switchport mode trunk
 channel-group 1 mode desirable
!
interface FastEthernet0/4
 switchport mode trunk
 channel-group 1 mode desirable
!
```



```
S1>
S1>en
S1#show eth
S1#show etherchannel ?
  load-balance  Load-balance/frame-distribution scheme among ports in
                port-channel
  port-channel  Port-channel information
  summary       One-line summary per channel-group
  <cr>
S1#show etherchannel summ
S1#show etherchannel summary
Flags:  D - down        P - in port-channel
        I - stand-alone s - suspended
        H - Hot-standby (LACP only)
        R - Layer3      S - Layer2
        U - in use      f - failed to allocate aggregator
        u - unsuitable for bundling
        w - waiting to be aggregated
        d - default port


Number of channel-groups in use: 1
Number of aggregators:           1

Group  Port-channel  Protocol    Ports
------+-------------+-----------+-----------------------------------------------

1      Po1(SU)           PAgP    Fa0/3(P) Fa0/4(P)
```

```
interface Port-channel1
 switchport mode trunk
!
```

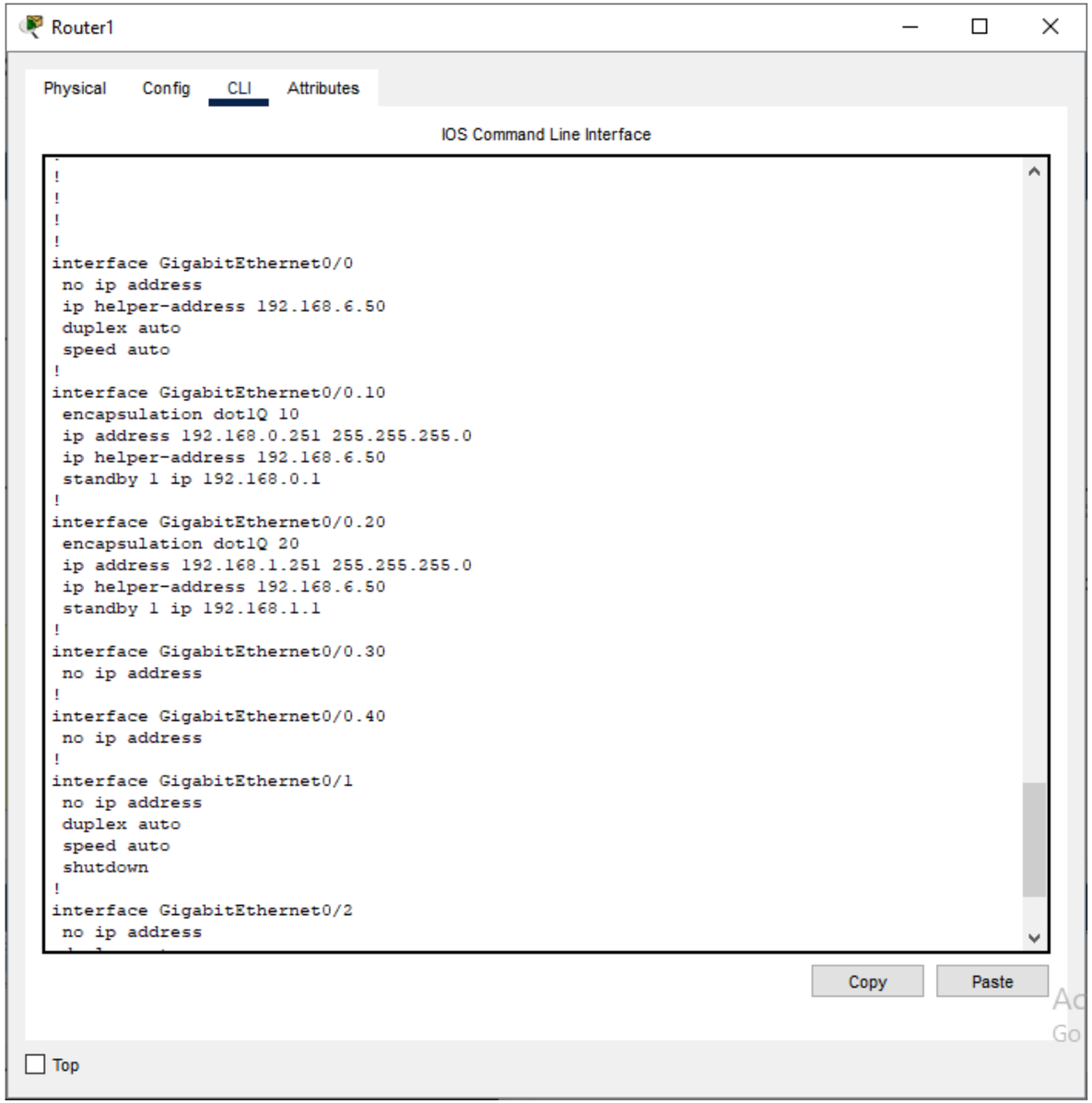
```
!
interface FastEthernet0/3
 switchport mode trunk
 channel-group 1 mode auto
!
interface FastEthernet0/4
 switchport mode trunk
 channel-group 1 mode auto
!
```

Branch1 intervlan-routing

In this project, Inter-VLAN routing was configured using router-on-a-stick with sub-interfaces.
Two VLANs were created:

- VLAN 10 – Network: 192.168.0.0/24, Gateway: 192.168.0.1
- VLAN 20 – Network: 192.168.1.0/24, Gateway: 192.168.1.1

Each VLAN was assigned to a separate sub-interface on the router, enabling devices in different VLANs to communicate through the router. This setup allows logical network segmentation while maintaining controlled inter-VLAN connectivity

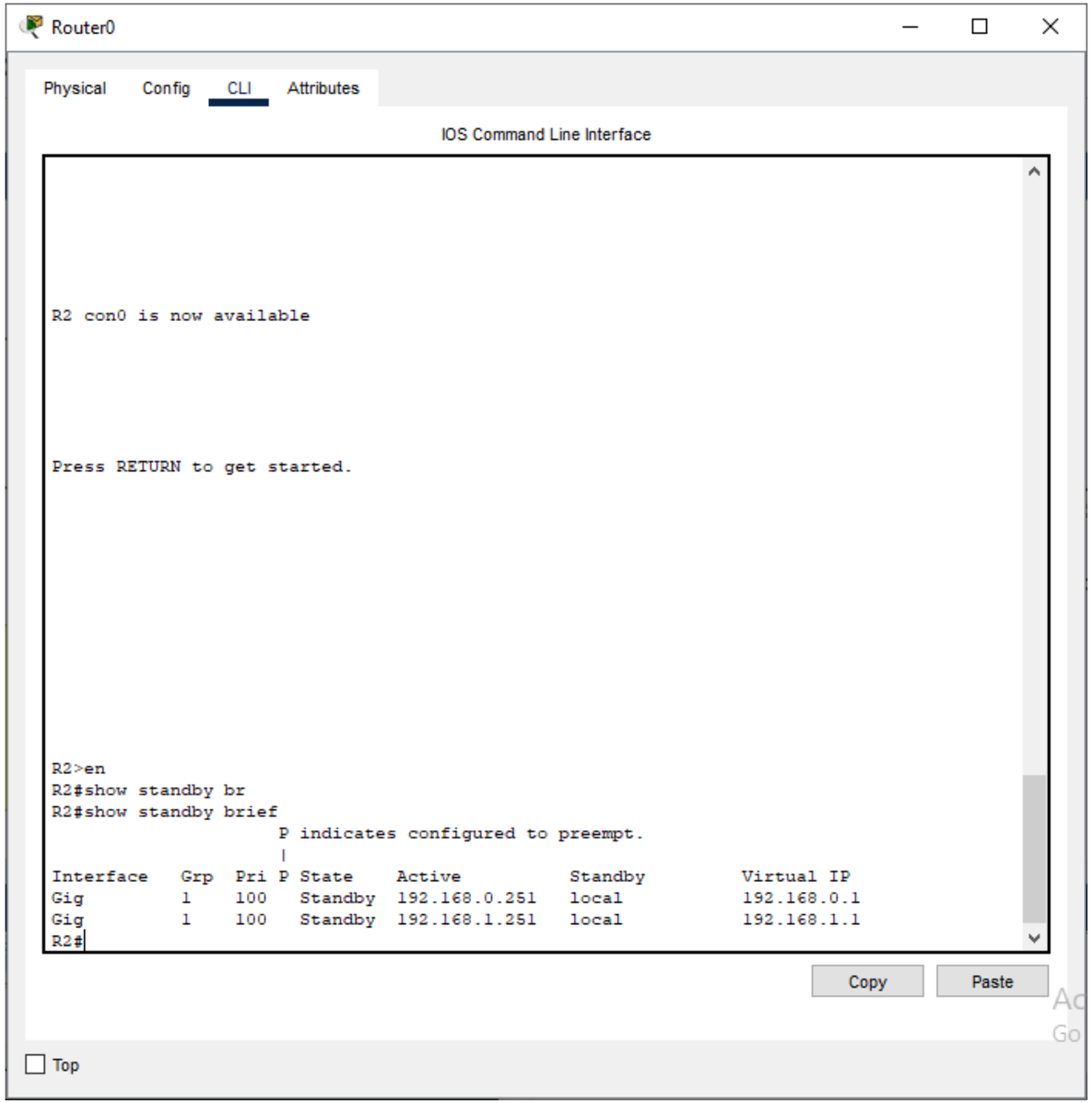


HSRP:Redundancy Protocol

To ensure high availability and redundancy, two routers were configured using the HSRP (Hot Standby Router Protocol).
Each VLAN gateway uses a virtual IP address (.1) on the corresponding sub-interface:

- VLAN 10 – Virtual IP: 192.168.0.1
- VLAN 20 – Virtual IP: 192.168.1.1

With HSRP, one router operates as the active gateway while the second serves as a standby. If the active router fails, the standby router automatically takes over using the same virtual IP, providing seamless failover and maintaining network connectivity



OSPF Routing Protocol

OSPF was configured to provide dynamic routing between all routers in the topology.
The following networks were advertised into OSPF:

1. VLAN Networks (Internal LANs)
   - VLAN 10: 192.168.0.0/24
   - VLAN 20: 192.168.1.0/24
   - VLAN 30: 192.168.2.0/24
   - VLAN 40: 192.168.3.0/24
   - Server VLAN 60: 192.168.6.0/24
2. WAN /30 Point-to-Point Links
(Used for router interconnections)
   - 11.11.11.0/30
   - 11.11.11.4/30
   - 11.11.11.8/30
   - 11.11.11.12/30

These /30 networks connect the distribution routers with the core router and provide redundant paths through OSPF

```
router ospf 1
 router-id 1.1.1.1
 log-adjacency-changes
 network 192.168.0.0 0.0.0.255 area 0
 network 192.168.1.0 0.0.0.255 area 0
 network 11.11.11.0 0.0.0.3 area 0
!
router ospf 1
 router-id 4.4.4.4
 log-adjacency-changes
 network 192.168.2.0 0.0.0.255 area 0
 network 192.168.3.0 0.0.0.255 area 0
 network 11.11.11.8 0.0.0.3 area 0
!
router ospf 1
 router-id 5.5.5.5
 log-adjacency-changes
 redistribute static subnets
 network 11.11.11.0 0.0.0.3 area 0
 network 11.11.11.4 0.0.0.3 area 0
 network 11.11.11.8 0.0.0.3 area 0
 network 11.11.11.12 0.0.0.3 area 0
 network 192.168.6.0 0.0.0.255 area 0
 network 50.50.50.0 0.0.0.3 area 0
```

Physical Config CLI Attributes

IOS Command Line Interface

```
R2#show ip rou
R2#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

     11.0.0.0/8 is variably subnetted, 5 subnets, 2 masks
C       11.11.11.0/30 is directly connected, Serial0/0/0
L       11.11.11.2/32 is directly connected, Serial0/0/0
O       11.11.11.4/30 [110/65] via 192.168.0.251, 01:19:45, GigabitEthernet0/0.10
                      [110/65] via 192.168.1.251, 01:19:45, GigabitEthernet0/0.20
O       11.11.11.8/30 [110/128] via 11.11.11.1, 01:20:20, Serial0/0/0
O       11.11.11.12/30 [110/128] via 11.11.11.1, 01:20:20, Serial0/0/0
     50.0.0.0/30 is subnetted, 1 subnets
S       50.50.50.0/30 [1/0] via 11.11.11.1
     192.168.0.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.0.0/24 is directly connected, GigabitEthernet0/0.10
L       192.168.0.250/32 is directly connected, GigabitEthernet0/0.10
     192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.1.0/24 is directly connected, GigabitEthernet0/0.20
L       192.168.1.250/32 is directly connected, GigabitEthernet0/0.20
O    192.168.2.0/24 [110/129] via 11.11.11.1, 01:19:55, Serial0/0/0
O    192.168.3.0/24 [110/129] via 11.11.11.1, 01:19:55, Serial0/0/0
O    192.168.6.0/24 [110/65] via 11.11.11.1, 01:20:20, Serial0/0/0

R2#
R2#
R2#
R2#
R2#show ip route  b
R2#
```

Copy Paste

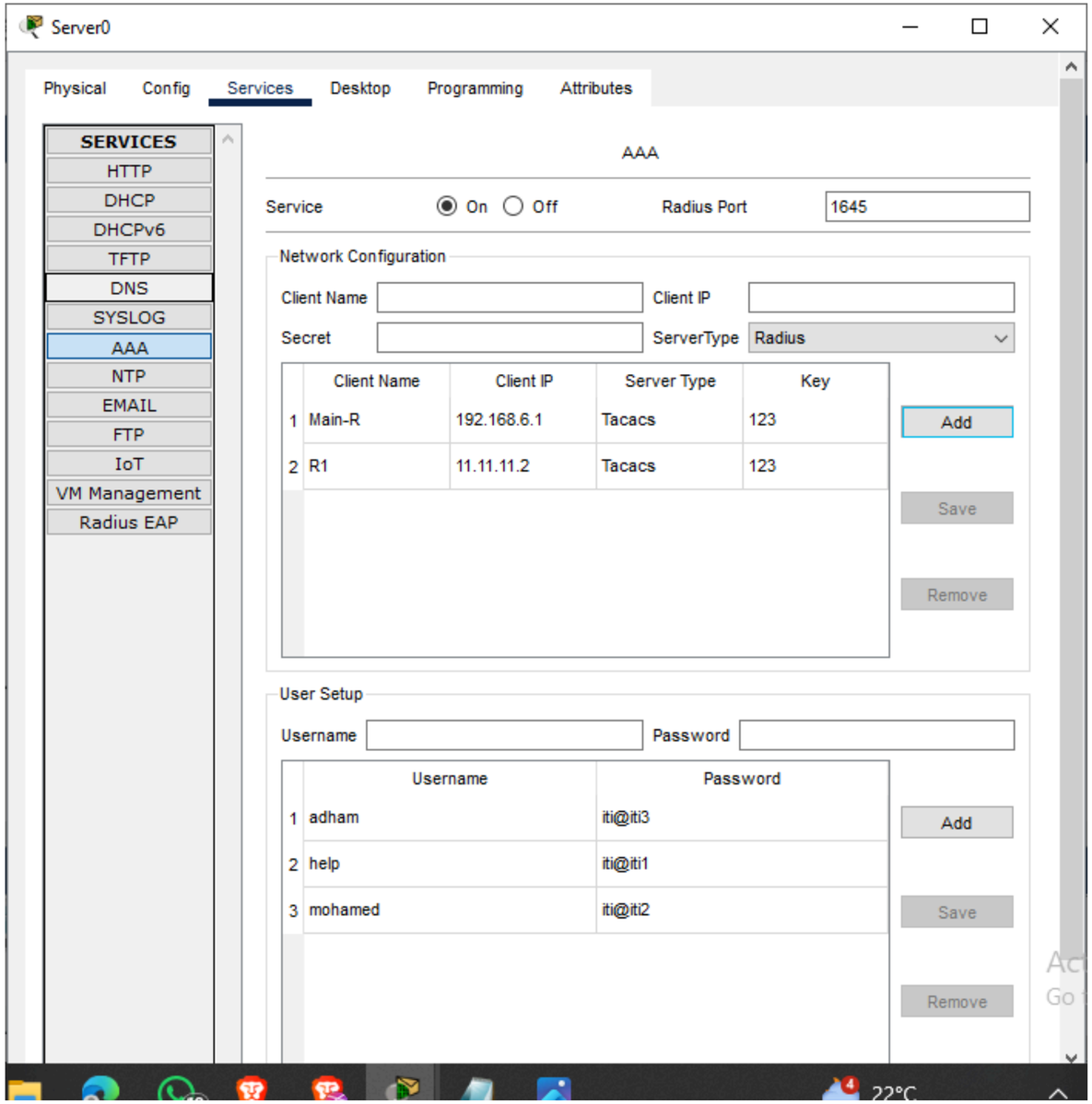
Top

The configuration of Branch 2 was replicated to match Branch 1

Services

AAA For Authentication & SSH

```
!
!
!
aaa new-model
!
aaa authentication login default group tacacs+ local
!
!
!
!
!
!
!
line con 0
 login authentication default
!
line aux 0
!
line vty 0 4
 login authentication default
 transport input ssh
!
!
!
```

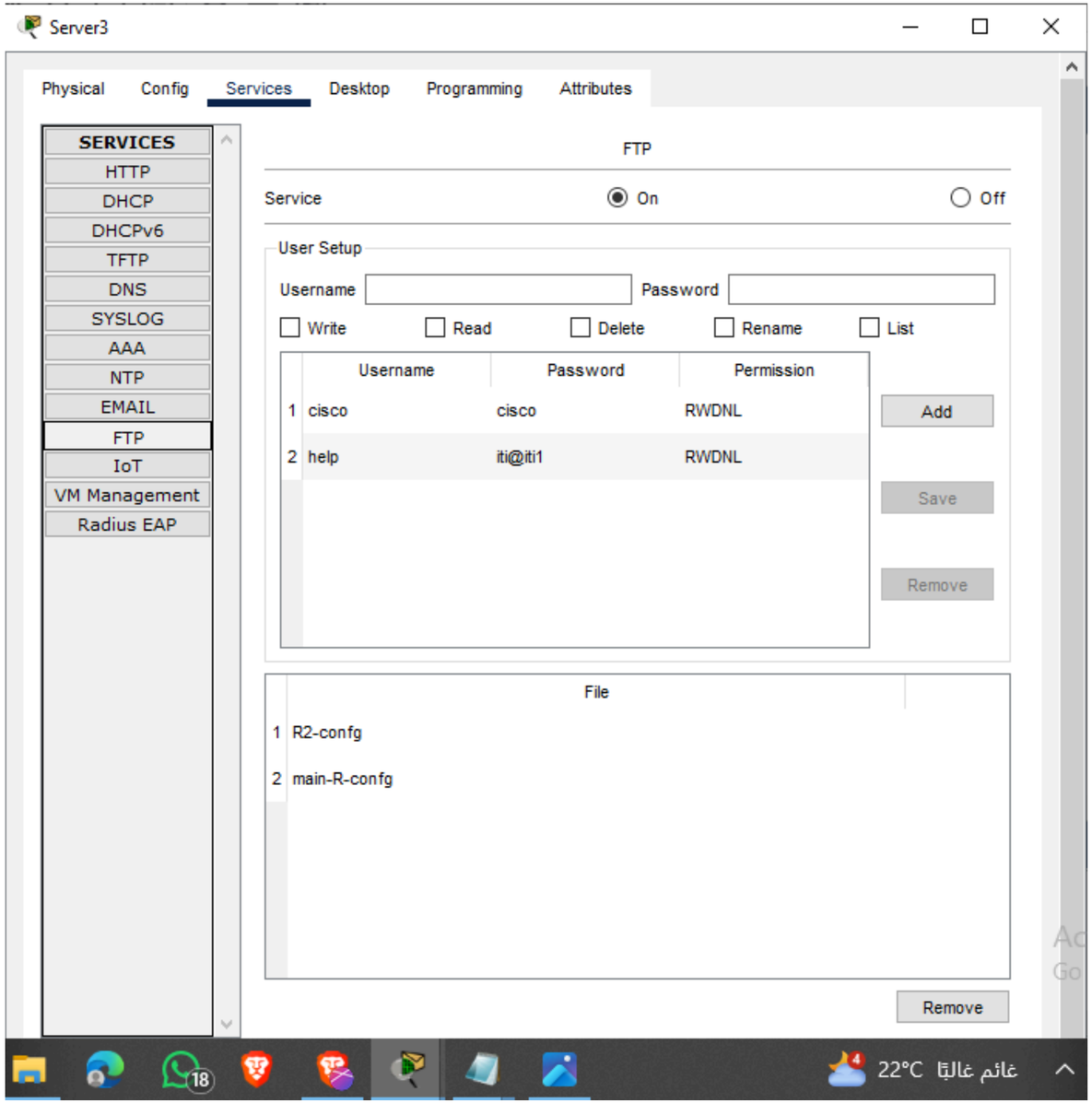


FTP for File Transferring

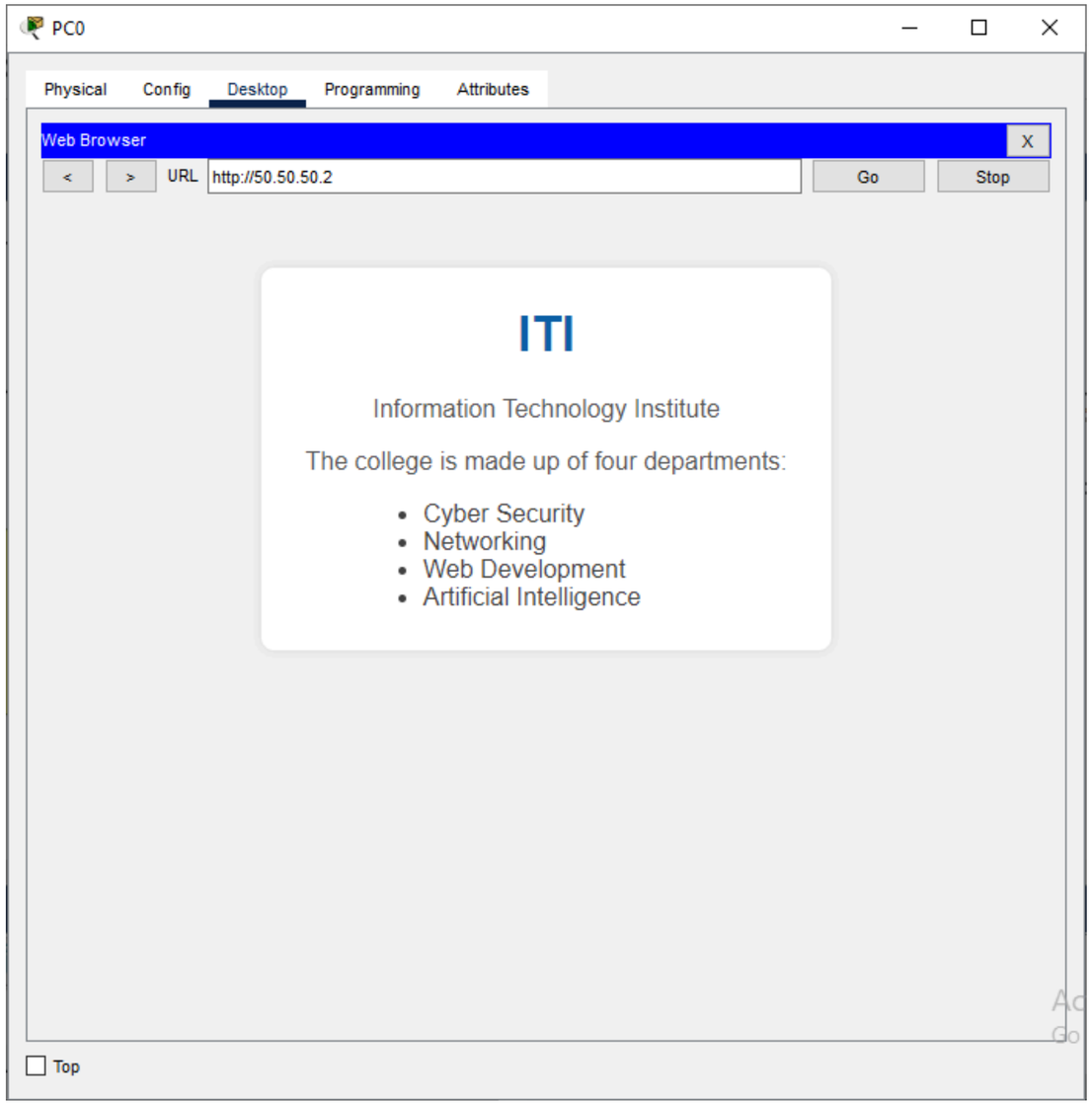
```
!
ip ftp username help
ip ftp password iti@itil
ip ssh version 1
ip domain-name iti.com
!
```

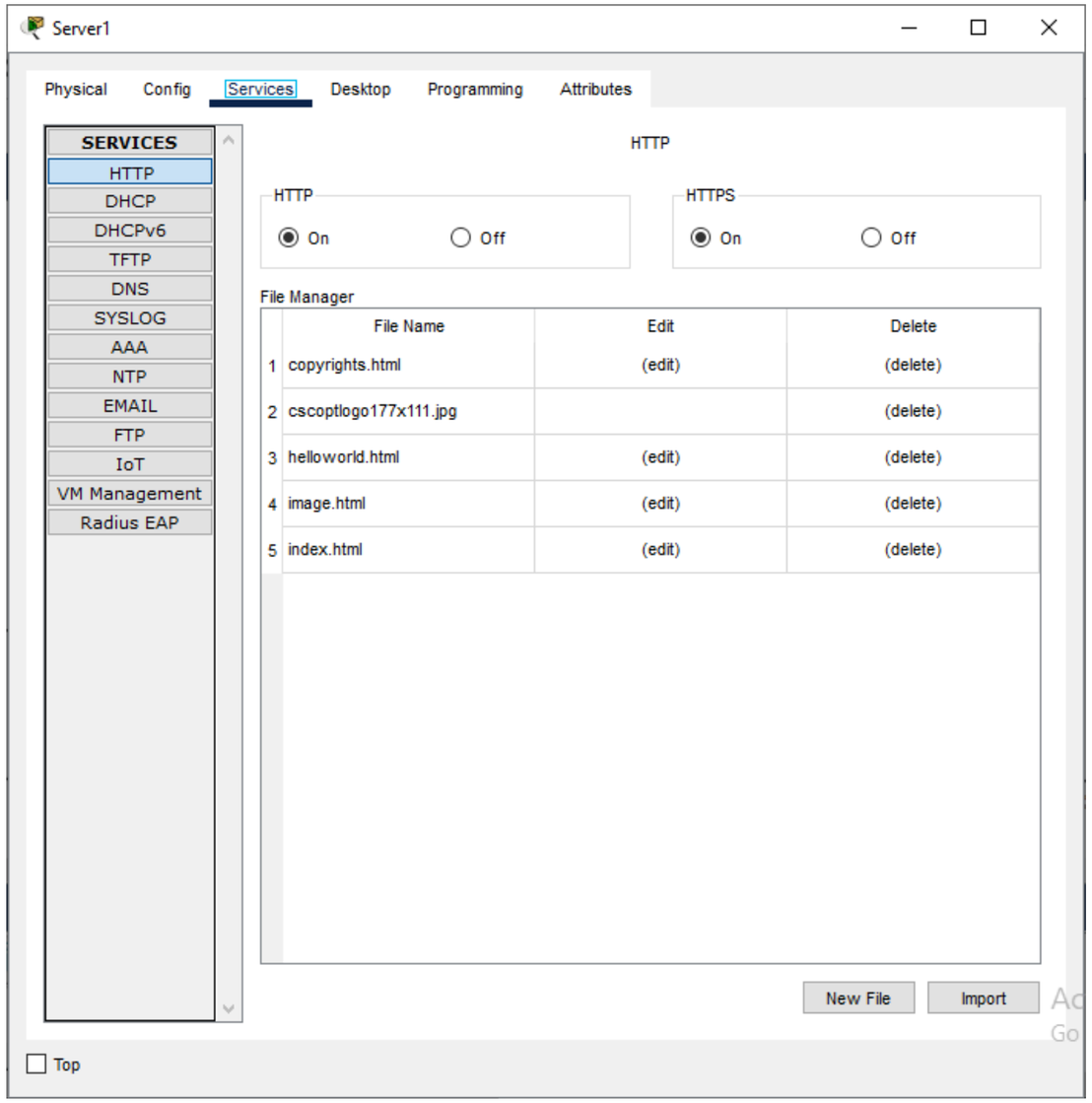
```
copy running-config ftp:?

copy running-config ftp:
 or name of remote host []? 192.168.6.3
tion filename [main-R-confg]?
```



Web Using HTTP & HTTPS





Static Nat :Why 50.50.50.2?

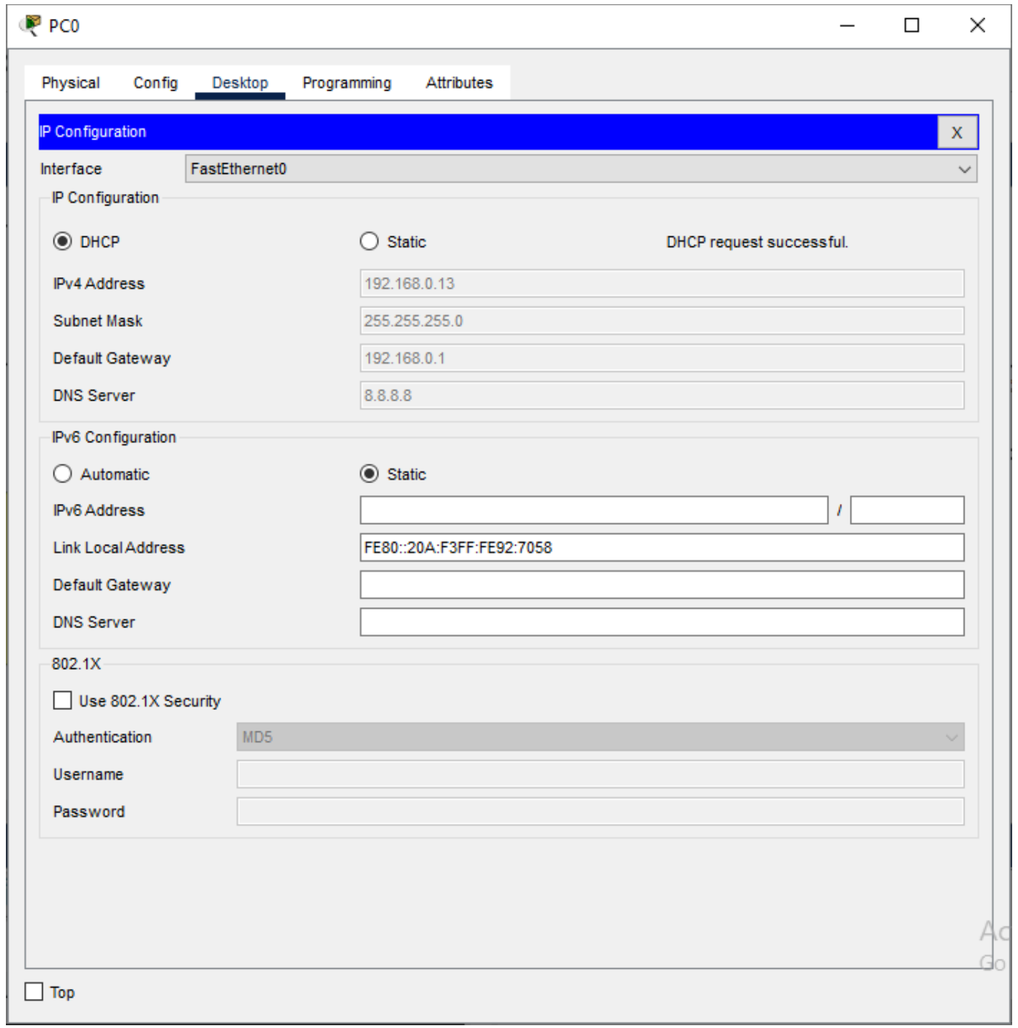
Static NAT was configured to provide a one-to-one mapping between an internal private IP and a public IP.
In this project, the internal server 192.168.6.20 was statically mapped to the public IP 50.50.50.2.
This allows external users to reach the internal server using the public address while keeping the internal network structure hidden and secure

```
ip nat inside source static 192.168.6.20 50.50.50.2
ip classless
!
```

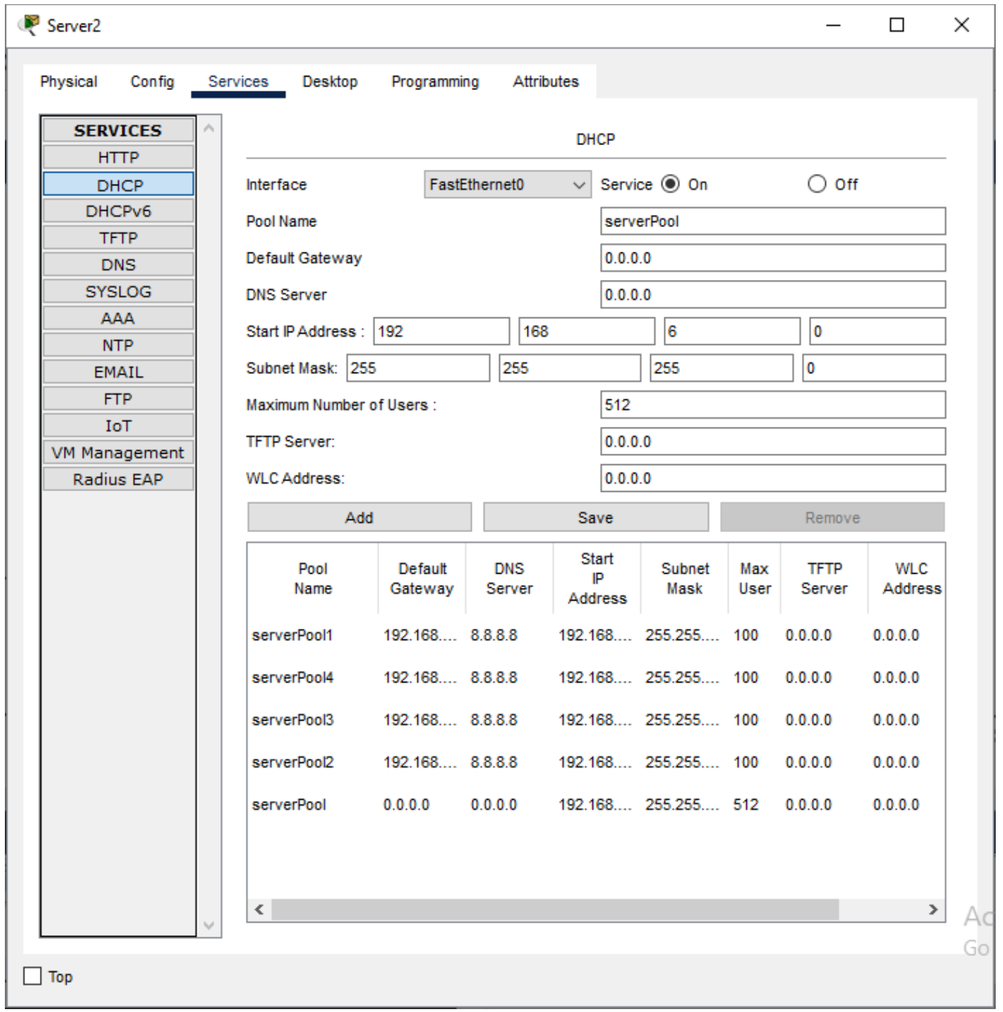
```
main-R#show ip nat translations
Pro  Inside global     Inside local       Outside local      Outside global
---  50.50.50.2        192.168.6.20       ---                ---
tcp 50.50.50.2:80      192.168.6.20:80    192.168.0.15:1025  192.168.0.15:1025
tcp 50.50.50.2:80      192.168.6.20:80    192.168.0.15:1026  192.168.0.15:1026
```

DHCP Protocol

Client



Server



DHCP

In this project, DHCP was used to automatically assign IP addresses and network settings to all client devices.
Since the DHCP server is located in a different subnet, the router closest to the clients was configured with a DHCP helper-address: 192.168.6.50.
This helper-address forwards DHCP broadcast requests to the DHCP server, ensuring proper IP assignment across all VLANs

```
ip helper-address 192.168.6.50
```

Thanks