

**Department of Computer Science
Faisalabad Campus
University of Engineering and Technology, Lahore**



Project Manual

Submitted by: Asima Ashraf

**Registration Number : 2024-CS-823
Submitted To : Mr. Muhammad Tahir
Course Title: Computer Networking**

BranchLink Enterprise Network

1. Project Overview

This project demonstrates a complete enterprise-level network designed and implemented in Cisco Packet Tracer. The network connects two geographically separated branches using both static and dynamic (OSPF) routing. It includes VLAN segmentation, inter-VLAN routing, DHCP, and multiple application-layer services such as HTTP, FTP, SMTP, and POP3.

Major Features

- VLAN Segmentation
- Inter-VLAN Routing (Layer 3 Switching)
- OSPF Dynamic Routing
- Static Routing (Hybrid Routing)
- DHCP (Automatic IP Assignment)
- Trunk Links (802.1Q)
- HTTP Web Service
- FTP File Transfer
- SMTP / POP3 Email Services
- DNS Configuration
- End-to-End Connectivity Verification

2. Network Topology Summary

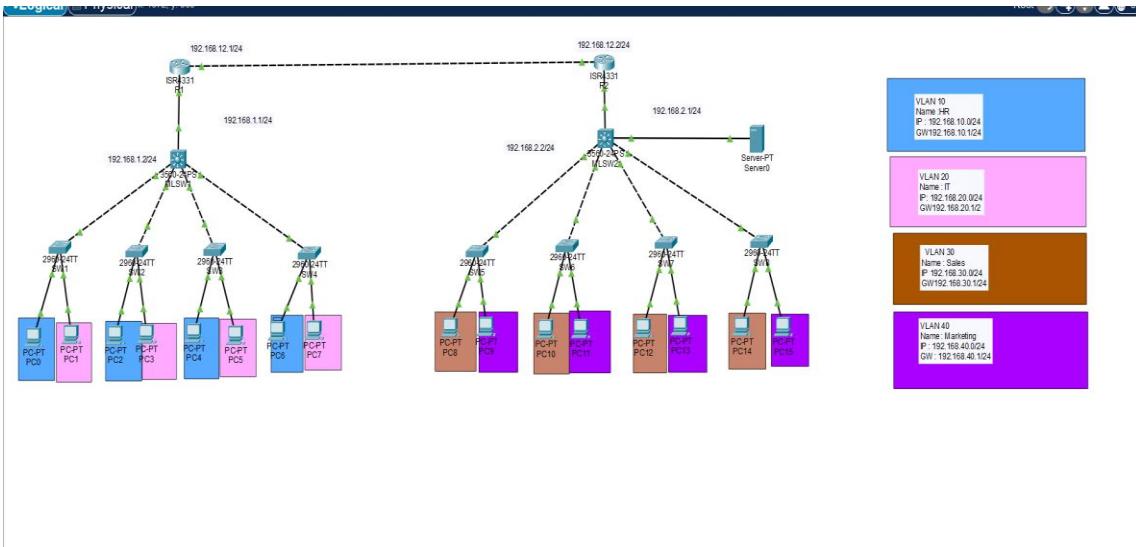
Branch A (Left Side)

- Router: ISR4331 (R1)
- Multilayer Switch: 3560-24PS (MLSW1)
- Access Switches: SW1, SW2, SW3, SW4
- PCs: PC0 – PC7

Branch B (Right Side)

- Router: ISR4331 (R2)
- Multilayer Switch: 3560-24PS (MLSW2)
- Access Switches: SW5, SW6, SW7, SW8
- PCs: PC8 – PC15
- Server: Server-PT

Complete Network Topology



3. VLAN Plan

VLAN ID	VLAN Name	Subnet	Default Gateway	Assigned PCs
10	HR	192.168.10.0 /24	192.168.10.1	PC0, PC2, PC4, PC6
20	IT	192.168.20.0 /24	192.168.20.1	PC1, PC3, PC5, PC7
30	Sales	192.168.30.0 /24	192.168.30.1	PC8, PC10, PC12, PC14
40	Marketing	192.168.40.0 /24	192.168.40.1	PC9, PC11, PC13, PC15

4. IP Addressing Plan

Router IP Addresses

Router	Interface	IP Address	Subnet Mask	Description
R1	G0/0/0	192.168.12.1	255.255.255.0	Link to R2
R1	G0/0/1	192.168.1.1	255.255.255.0	Link to MLSW1
R2	G0/0/0	192.168.12.2	255.255.255.0	Link to R1
R2	G0/0/1	192.168.2.1	255.255.255.0	Link to MLSW2

Multilayer Switch (Layer-3 Port) IP Addresses

Multilayer Switch	Interface	IP Address	Subnet Mask	Description
MLSW1 (Branch A)	Fa0/1	192.168.1.2	255.255.255.0	Link to R1
MLSW2 (Branch B)	Fa0/1	192.168.2.2	255.255.255.0	Link to R2

Multilayer Switch SVIs (Inter-VLAN Routing)

VLAN ID	SVI Interface	IP Address	Function
10	VLAN10	192.168.10.1	Gateway for HR VLAN
20	VLAN20	192.168.20.1	Gateway for IT VLAN
30	VLAN30	192.168.30.1	Gateway for Sales VLAN
40	VLAN40	192.168.40.1	Gateway for Marketing VLAN

5. Multilayer Switch Configuration

MLSW1 (Branch A)

```

enable
configure terminal
hostname MLSW1
! Physical interface to router
interface fa0/1
no switchport
ip address 192.168.1.2 255.255.255.0
no shutdown
exit
! Enable Layer 3 routing
ip routing
! VLANs
vlan 10
name HR
vlan 20
name IT
exit

```

```

! Trunk ports (connect to other switches)
interface range fa0/2-5
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk allowed vlan all
no shutdown
exit

! VLAN interfaces (SVIs) for inter-VLAN routing
interface vlan 10
ip address 192.168.10.1 255.255.255.0
no shutdown
exit

interface vlan 20
ip address 192.168.20.1 255.255.255.0
no shutdown
exit

```

```

! Dynamic routing using OSPF
router ospf 1
network 192.168.10.0 0.0.0.255 area 0
network 192.168.20.0 0.0.0.255 area 0
exit
! DHCP configuration
ip dhcp excluded-address 192.168.10.1 192.168.10.10
ip dhcp excluded-address 192.168.20.1 192.168.20.10

ip dhcp pool VLAN10
network 192.168.10.0 255.255.255.0
default-router 192.168.10.1
dns-server 8.8.8.8
exit

ip dhcp pool VLAN20
network 192.168.20.0 255.255.255.0
default-router 192.168.20.1
dns-server 8.8.8.8
exit

end

```

Screenshot taken from CLI showing VLANs, Trunk Ports, OSPF, and DHCP configuration. (show running-config)

```

MLSW1>enable
MLSW1#show running-config
Building configuration...

Current configuration : 2374 bytes
!
version 12.2(27)SE1
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname MLSW1
!
!
ip dhcp excluded-address 192.168.10.1 192.168.10.10
ip dhcp excluded-address 192.168.20.1 192.168.20.10
!
ip dhcp pool VLAN10
network 192.168.10.0 255.255.255.0
default-router 192.168.10.1
dns-server 8.8.8.8
ip dhcp pool VLAN20
network 192.168.20.0 255.255.255.0
default-router 192.168.20.1
dns-server 8.8.8.8
!
!
ip routing

```



```

interface FastEthernet0/1
no switchport
ip address 192.168.1.2 255.255.255.0
duplex auto
speed auto
!
interface FastEthernet0/2
switchport trunk allowed vlan 10,20,30,40
switchport trunk encapsulation dot1q
switchport mode trunk
!
interface FastEthernet0/3
switchport trunk allowed vlan 10,20,30,40
switchport trunk encapsulation dot1q
switchport mode trunk
!
interface FastEthernet0/4
switchport trunk allowed vlan 10,20,30,40
switchport trunk encapsulation dot1q
switchport mode trunk
!
interface FastEthernet0/5
switchport trunk allowed vlan 10,20,30,40
switchport trunk encapsulation dot1q
switchport mode trunk
!
interface FastEthernet0/6

```



```

!
interface GigabitEthernet0/2
!
interface Vlan1
no ip address
shutdown
!
interface Vlan10
mac-address 00e0.a32e.8a01
ip address 192.168.10.1 255.255.255.0
!
interface Vlan20
mac-address 00e0.a32e.8a02
ip address 192.168.20.1 255.255.255.0
!
router ospf 1
log-adjacency-changes
network 192.168.10.0 0.0.0.255 area 0
network 192.168.20.0 0.0.0.255 area 0
network 192.168.30.0 0.0.0.255 area 0
network 192.168.40.0 0.0.0.255 area 0
network 192.168.1.0 0.0.0.255 area 0
!
router rip
!
ip classless
!
ip flow-export version 9
!
```

MLSW2 (Branch B)

```
enable
configure terminal
hostname MLSW2

! Enable Layer 3 routing
ip routing
! VLANs
vlan 30
name Sales
vlan 40
name Marketing
exit
! Physical interface to router
interface fa0/1
no switchport
ip address 192.168.2.2 255.255.255.0
no shutdown
exit
```

```
! Trunk ports (connect to other switches)
interface range fa0/2-5
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk allowed vlan all
no shutdown
exit
! VLAN interfaces (SVIs)
interface vlan 30
ip address 192.168.30.1 255.255.255.0
no shutdown
exit

interface vlan 40
ip address 192.168.40.1 255.255.255.0
no shutdown
exit
```

```
! Dynamic routing using OSPF
router ospf 1
network 192.168.2.0 0.0.0.255 area 0
network 192.168.30.0 0.0.0.255 area 0
network 192.168.40.0 0.0.0.255 area 0
exit
! DHCP configuration
ip dhcp excluded-address 192.168.30.1 192.168.30.10
ip dhcp excluded-address 192.168.40.1 192.168.40.10

ip dhcp pool VLAN30
network 192.168.30.0 255.255.255.0
default-router 192.168.30.1
exit

ip dhcp pool VLAN40
network 192.168.40.0 255.255.255.0
default-router 192.168.40.1
exit
```

Screenshot taken from CLI showing VLANs, Trunk Ports, OSPF, and DHCP configuration.(show running-config)

```

MLSW2#enable
MLSW2#show running-config
Building configuration...

Current configuration : 2455 bytes
!
version 12.2(37)SE1
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname MLSW2
!
!
ip dhcp excluded-address 192.168.30.1 192.168.30.10
ip dhcp excluded-address 192.168.40.1 192.168.40.10
!
ip dhcp pool VLAN30
network 192.168.30.0 255.255.255.0
default-router 192.168.30.1
ip dhcp pool VLAN40
network 192.168.40.0 255.255.255.0
default-router 192.168.40.1
!
!
ip routing
!
```



```

MLSW2#enable
MLSW2#show running-config
Building configuration...

interface FastEthernet0/1
no switchport
ip address 192.168.2.2 255.255.255.0
duplex auto
speed auto
!
interface FastEthernet0/2
switchport trunk allowed vlan 1,10,20,30,40
switchport trunk encapsulation dot1q
switchport mode trunk
!
interface FastEthernet0/3
switchport trunk allowed vlan 1,10,20,30,40
switchport trunk encapsulation dot1q
switchport mode trunk
!
interface FastEthernet0/4
switchport trunk allowed vlan 1,10,20,30,40
switchport trunk encapsulation dot1q
switchport mode trunk
!
interface FastEthernet0/5
switchport trunk allowed vlan 1,10,20,30,40
switchport trunk encapsulation dot1q
switchport mode trunk
!
interface FastEthernet0/6
switchport access vlan 30
switchport mode access
!
interface FastEthernet0/7
switchport access vlan 20
switchport mode access
!
interface FastEthernet0/8
switchport access vlan 30
switchport mode access
!
interface FastEthernet0/9
switchport access vlan 40
switchport mode access
!
interface FastEthernet0/10
!
```

```

MLSW2#enable
MLSW2#show running-config
Building configuration...

interface GigabitEthernet0/2
!
interface Vlan1
no ip address
shutdown
!
interface Vlan30
mac-address 0090.2183.4501
ip address 192.168.30.1 255.255.255.0
!
interface Vlan40
mac-address 0090.2183.4502
ip address 192.168.40.1 255.255.255.0
!
router ospf 1
log adjacency-changes
network 192.168.2.0 0.0.0.255 area 0
network 192.168.30.0 0.0.0.255 area 0
network 192.168.40.0 0.0.0.255 area 0
!
ip classless
ip flow-export version 9
!
!
!
line con 0
line aux 0
line vty 0 4
!
```

6. Router Configuration

R1 – Branch A

```

enable
configure terminal
hostname R1
interface g0/0/0
  ip address 192.168.12.1 255.255.255.0
  no shutdown
exit
interface g0/0/1
  ip address 192.168.1.1 255.255.255.0
  no shutdown
exit
router ospf 1
  network 192.168.12.0 0.0.0.255 area 0
  network 192.168.1.0 0.0.0.255 area 0

! Static Routes to Branch B VLANs
ip route 192.168.30.0 255.255.255.0 192.168.12.2
ip route 192.168.40.0 255.255.255.0 192.168.12.2
exit
end
!
```

Screenshot taken from CLI using "show running-config" to display hostname, interfaces, IP addresses, and OSPF configuration.

R1

Physical Config **CLI** Attributes

IOS Command Line Interface

```
00:00:45: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.12.2 on GigabitEthernet0/0/0 from LOADING to FULL, Loading Done
00:01:18: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.20.1 on GigabitEthernet0/0/1 from LOADING to FULL, Loading Done

R1>enable
R1#show running-config
Building configuration...

Current configuration : 883 bytes
!
version 15.4
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname R1
!
!
!
!
!
!
ip cef
no ipv6 cef
```

R1

Physical Config **CLI** Attributes

IOS Command Line Interface

```
!interface GigabitEthernet0/0/0
 ip address 192.168.12.1 255.255.255.0
 duplex auto
 speed auto
!
interface GigabitEthernet0/0/1
 ip address 192.168.1.1 255.255.255.0
 duplex auto
 speed auto
!
interface GigabitEthernet0/0/2
 no ip address
 duplex auto
 speed auto
 shutdown
!
interface Vlan1
 no ip address
 shutdown
!
router ospf 1
 log-adjacency-changes
 network 192.168.12.0 0.0.0.255 area 0
 network 192.168.1.0 0.0.0.255 area 0
!
ip classless
ip route 192.168.30.0 255.255.255.0 192.168.12.2
ip route 192.168.40.0 255.255.255.0 192.168.12.2
!
ip flow-export version 9
!
```

R2 – Branch B

```
enable
configure terminal
hostname R2
interface g0/0/0
 ip address 192.168.12.2 255.255.255.0
 no shutdown
exit
interface g0/0/1
 ip address 192.168.2.1 255.255.255.0
 no shutdown
exit
router ospf 1
 network 192.168.12.0 0.0.0.255 area 0
 network 192.168.2.0 0.0.0.255 area 0

! Static Routes to Branch A VLANs
ip route 192.168.10.0 255.255.255.0 192.168.12.1
ip route 192.168.20.0 255.255.255.0 192.168.12.1
exit
end
```

Screenshot taken from CLI using "show running-config" to display hostname, interfaces, IP addresses, and OSPF configuration.

 R2
Physical Config CLI Attributes

IOS Command Line Interface

```
R2>enable
R2#show running-config
Building configuration...

Current configuration : 883 bytes
!
version 15.4
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname R2
!
!
!
!
!
!
!
ip cef
no ipv6 cef
!
```

```
!R2
Physical Config CLI Attributes
IOS Command Line Interface

interface GigabitEthernet0/0/0
ip address 192.168.12.2 255.255.255.0
duplex auto
speed auto
!
interface GigabitEthernet0/0/1
ip address 192.168.2.1 255.255.255.0
duplex auto
speed auto
!
interface GigabitEthernet0/0/2
no ip address
duplex auto
speed auto
shutdown
!
interface Vlan1
no ip address
shutdown
!
router ospf 1
log-adjacency-changes
network 192.168.12.0 0.0.0.255 area 0
network 192.168.2.0 0.0.0.255 area 0
!
ip classless
ip route 192.168.10.0 255.255.255.0 192.168.12.1
ip route 192.168.20.0 255.255.255.0 192.168.12.1
!
ip flow-export version 9
```

Hybrid Routing Verification (Dynamic + Static)

```
R1>enable
R1#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

  192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.168.1.0/24 is directly connected, GigabitEthernet0/0/1
L    192.168.1.1/32 is directly connected, GigabitEthernet0/0/1
O    192.168.2.0/24 [110/2] via 192.168.12.2, 02:26:01, GigabitEthernet0/0/0
O    192.168.10.0/24 [110/2] via 192.168.1.2, 02:25:33, GigabitEthernet0/0/1
     192.168.12.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.168.12.0/24 is directly connected, GigabitEthernet0/0/0
L    192.168.12.1/32 is directly connected, GigabitEthernet0/0/0
O    192.168.20.0/24 [110/2] via 192.168.1.2, 02:25:33, GigabitEthernet0/0/1
S    192.168.30.0/24 [1/0] via 192.168.12.2
S    192.168.40.0/24 [1/0] via 192.168.12.2

R1#
```

```
R2>enable
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

O    192.168.1.0/24 [110/2] via 192.168.12.1, 02:24:55, GigabitEthernet0/0/0
     192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.168.2.0/24 is directly connected, GigabitEthernet0/0/1
L    192.168.2.1/32 is directly connected, GigabitEthernet0/0/1
S    192.168.10.0/24 [1/0] via 192.168.12.1
     192.168.12.0/24 is variably subnetted, 2 subnets, 2 masks
C    192.168.12.0/24 is directly connected, GigabitEthernet0/0/0
L    192.168.12.2/32 is directly connected, GigabitEthernet0/0/0
S    192.168.20.0/24 [1/0] via 192.168.12.1
O    192.168.30.0/24 [110/2] via 192.168.2.2, 02:25:33, GigabitEthernet0/0/1
O    192.168.40.0/24 [110/2] via 192.168.2.2, 02:25:33, GigabitEthernet0/0/1

R2#
```

7. Access Switch Configuration (SW1 – SW8)

```

enable
configure terminal
hostname SWx ! Replace x with switch number
(SW1–SW8)

! VLANs
vlan 10
name HR
vlan 20
name IT
vlan 30
name Sales
vlan 40
name Marketing
exit
! Trunk port to MLSW
interface fa0/1
switchport trunk encapsulation dot1q
switchport mode trunk
no shutdown
exit

```

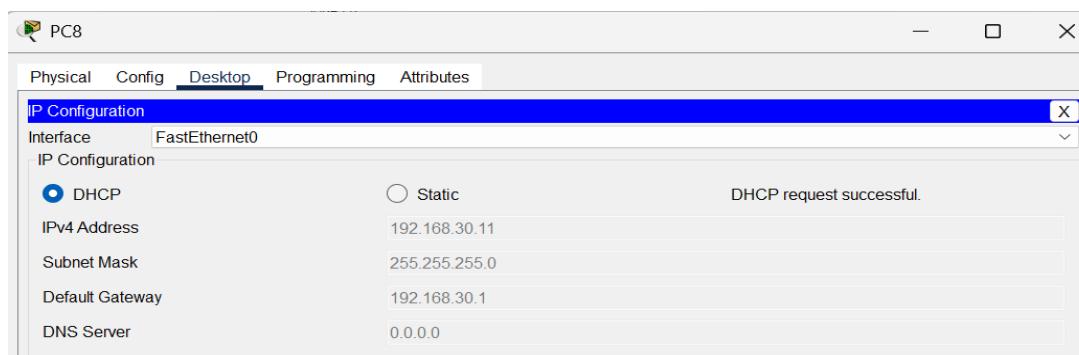
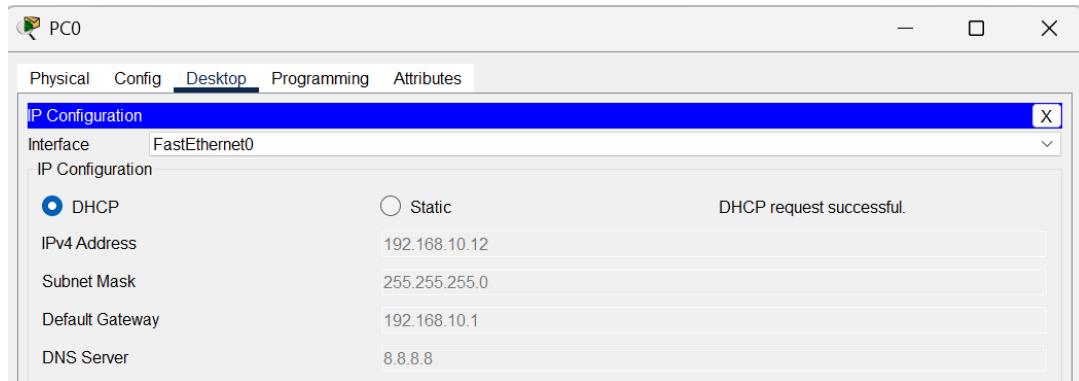
```

! Access ports
! Branch A (SW1–SW4)
interface fa0/2
switchport mode access
switchport access vlan 10 ! HR
no shutdown
exit
interface fa0/3
switchport mode access
switchport access vlan 20 ! IT
no shutdown
exit
! Branch B (SW5–SW8)
interface fa0/2
switchport mode access
switchport access vlan 30 ! Sales
no shutdown
exit
interface fa0/3
switchport mode access
switchport access vlan 40 ! Marketing
no shutdown
exit

```

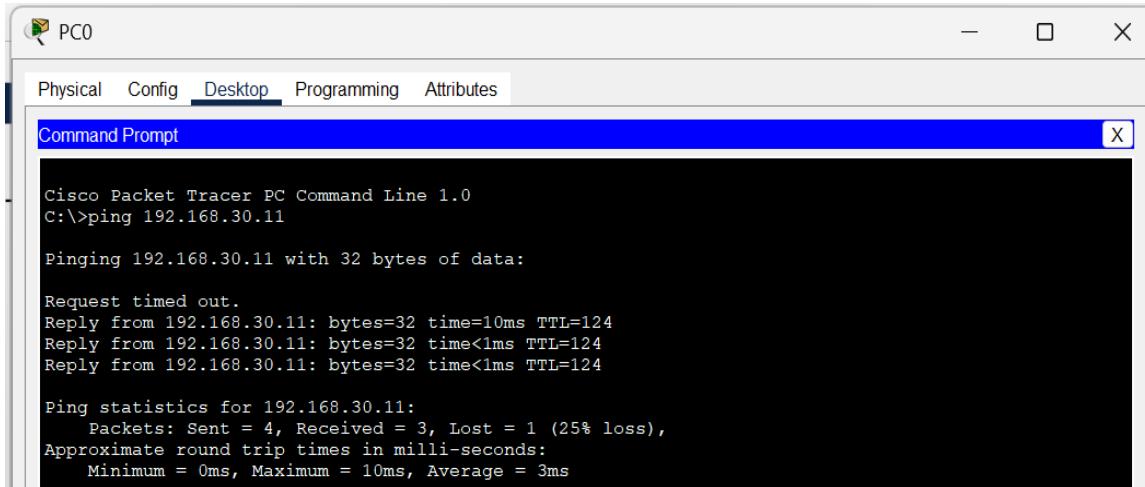
8. Network Connectivity & Configuration Verification

DHCP Working Verification



Connectivity Across VLANs

- PC0 → PC8 ping successful
- PC1 → PC15 ping successful



PC0

Physical Config Desktop Programming Attributes

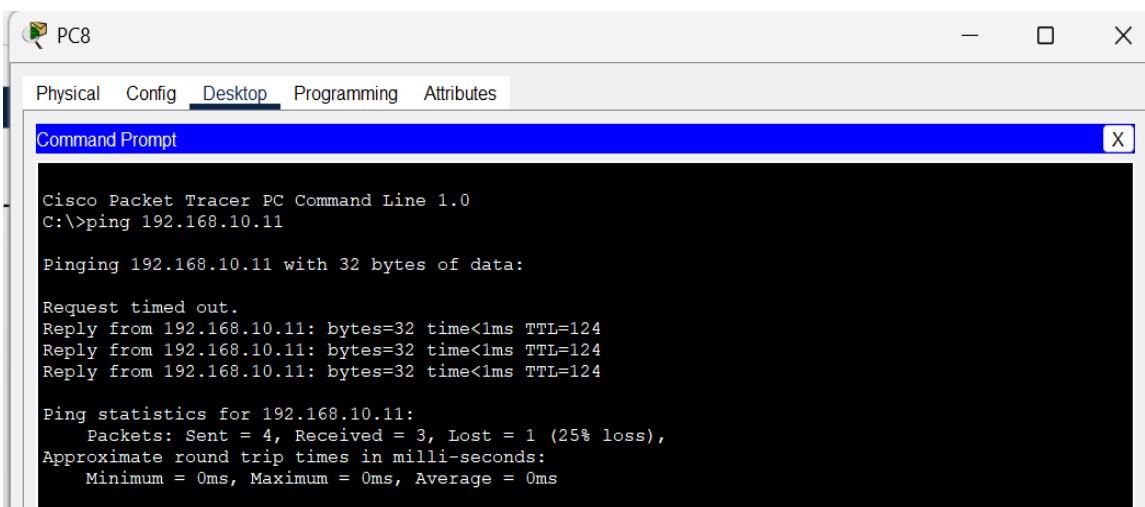
Command Prompt

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.30.11

Pinging 192.168.30.11 with 32 bytes of data:

Request timed out.
Reply from 192.168.30.11: bytes=32 time=10ms TTL=124
Reply from 192.168.30.11: bytes=32 time<1ms TTL=124
Reply from 192.168.30.11: bytes=32 time<1ms TTL=124

Ping statistics for 192.168.30.11:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 10ms, Average = 3ms
```



PC8

Physical Config Desktop Programming Attributes

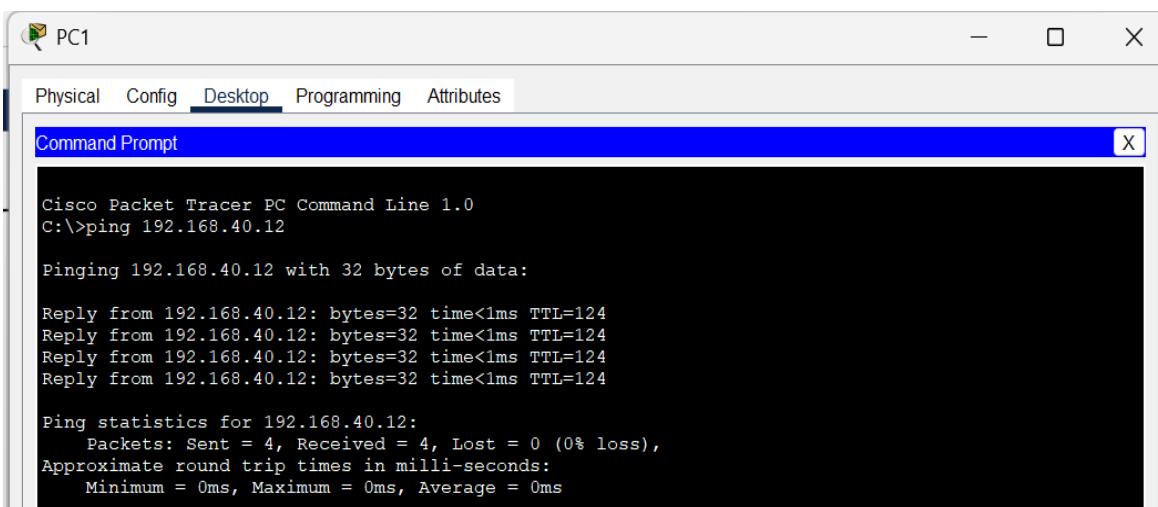
Command Prompt

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.10.11

Pinging 192.168.10.11 with 32 bytes of data:

Request timed out.
Reply from 192.168.10.11: bytes=32 time<1ms TTL=124
Reply from 192.168.10.11: bytes=32 time<1ms TTL=124
Reply from 192.168.10.11: bytes=32 time<1ms TTL=124

Ping statistics for 192.168.10.11:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```



PC1

Physical Config Desktop Programming Attributes

Command Prompt

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.40.12

Pinging 192.168.40.12 with 32 bytes of data:

Reply from 192.168.40.12: bytes=32 time<1ms TTL=124

Ping statistics for 192.168.40.12:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

PC15

Physical Config **Desktop** Programming Attributes

Command Prompt X

```
Cisco Packet Tracer PC Command Line 1.0
C:>ping 192.168.20.11

Pinging 192.168.20.11 with 32 bytes of data:

Request timed out.
Reply from 192.168.20.11: bytes=32 time=1ms TTL=124
Reply from 192.168.20.11: bytes=32 time<1ms TTL=124
Reply from 192.168.20.11: bytes=32 time<1ms TTL=124

Ping statistics for 192.168.20.11:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

VLAN and Trunk Port Verification

```
MLSW1>enable
MLSW1#show vlan brief
-----  

VLAN Name          Status     Ports  

-----  

1     default       active     Fa0/6, Fa0/7, Fa0/8, Fa0/9  

                      Fa0/10, Fa0/11, Fa0/12, Fa0/13  

                      Fa0/14, Fa0/15, Fa0/16, Fa0/17  

                      Fa0/18, Fa0/19, Fa0/20, Fa0/21  

                      Fa0/22, Fa0/23, Fa0/24, Gig0/1  

                      Gig0/2  

10    HR            active  

20    IT            active  

30    Sales          active  

40    Marketing      active  

1002  fddi-default  active  

1003  token-ring-default  active  

1004  fddinet-default  active  

1005  trnet-default   active  

MLSW1#
MLSW1#show interface trunk
Port      Mode      Encapsulation  Status      Native vlan
Fa0/2    on       802.1q        trunking    1
Fa0/3    on       802.1q        trunking    1
Fa0/4    on       802.1q        trunking    1
Fa0/5    on       802.1q        trunking    1

Port      Vlans allowed on trunk
Fa0/2    10,20,30,40
Fa0/3    10,20,30,40
Fa0/4    10,20,30,40
Fa0/5    10,20,30,40

Port      Vlans allowed and active in management domain
Fa0/2    10,20,30,40
Fa0/3    10,20,30,40
Fa0/4    10,20,30,40
Fa0/5    10,20,30,40

Port      Vlans in spanning tree forwarding state and not pruned
Fa0/2    10,20,30,40
Fa0/3    10,20,30,40
Fa0/4    10,20,30,40
Fa0/5    10,20,30,40
```

```

MLSW2>enable
MLSW2#show vlan brief

VLAN Name                               Status    Ports
--- -----
1      default                            active    Fa0/10, Fa0/11, Fa0/12, Fa0/13
                                            Fa0/14, Fa0/15, Fa0/16, Fa0/17
                                            Fa0/18, Fa0/19, Fa0/20, Fa0/21
                                            Fa0/22, Fa0/23, Fa0/24, Gig0/1
                                            Gig0/2
10     HR                                 active    Fa0/7
20     IT                                 active    Fa0/8
30     Sales                             active    Fa0/6, Fa0/9
40     Marketing                          active
1002   fddi-default                      active
1003   token-ring-default                active
1004   fddinet-default                  active
1005   trnet-default                    active
MLSW2#show interfaces trunk
Port      Mode       Encapsulation  Status      Native vlan
Fa0/2    on        802.1q        trunking    1
Fa0/3    on        802.1q        trunking    1
Fa0/4    on        802.1q        trunking    1
Fa0/5    on        802.1q        trunking    1

Port      Vlans allowed on trunk
Fa0/2    1,10,20,30,40
Fa0/3    1,10,20,30,40
Fa0/4    1,10,20,30,40
Fa0/5    1,10,20,30,40

Port      Vlans allowed and active in management domain
Fa0/2    1,10,20,30,40
Fa0/3    1,10,20,30,40
Fa0/4    1,10,20,30,40
Fa0/5    1,10,20,30,40

Port      Vlans in spanning tree forwarding state and not pruned
Fa0/2    1,10,20,30,40
Fa0/3    1,10,20,30,40
Fa0/4    1,10,20,30,40
Fa0/5    1,10,20,30,40

```

9. Server Configuration (VLAN 30)

Parameter	Value
Device	Server0
IP Address	192.168.30.10
Subnet Mask	255.255.255.0
Default Gateway	192.168.30.1
HTTP Service	Enabled
FTP Service	Enabled (Username: user1 / Password: 123)
SMTP Service	Enabled
POP3 Service	Enabled
Domain Name	branchlink.com

MLSW1 – Port connecting to Server0 (Fa0/6)

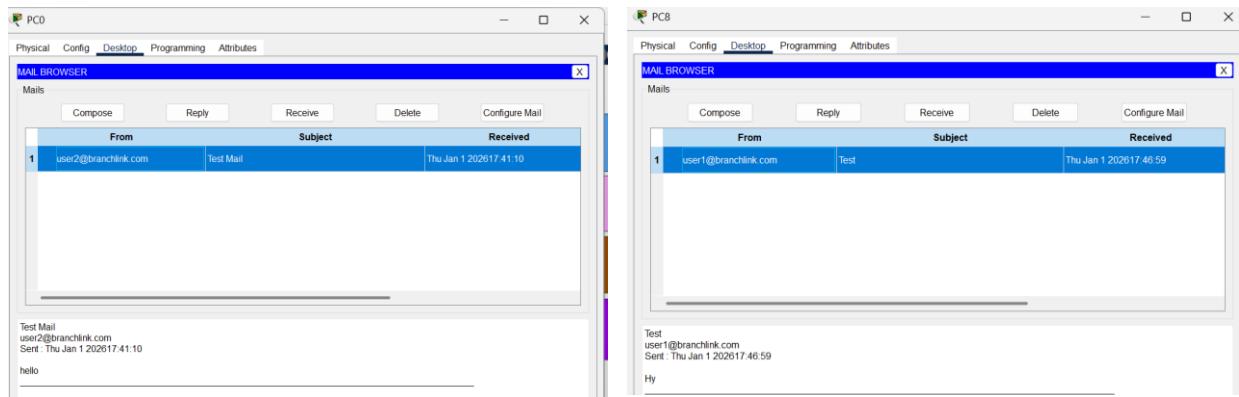
```

MLSW2> enable
MLSW2# configure terminal
MLSW2(config)# interface FastEthernet0/6
MLSW2(config-if)# switchport mode access
MLSW2(config-if)# switchport access vlan 30
MLSW2(config-if)# no shutdown
MLSW2(config-if)# exit
MLSW2(config)# exit
MLSW2# write memory

```

PC Email Configuration (SMTP / POP3)

PC	Name	Email Address	Incoming Mail Server (POP3)	Outgoing Mail Server (SMTP)	Username	Password
PC0	User1	user1@branchlink.com	192.168.30.10	192.168.30.10	user1	1234
PC8	User2	user2@branchlink.com	192.168.30.10	192.168.30.10	user2	1234



HTTP Web Access Configuration

- Server IP: 192.168.30.10
- PC browser test: <http://192.168.30.10>
- Ping test from any PC to server: ping 192.168.30.10

PC2

Physical Config Desktop Programming Attributes

Command Prompt

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.30.10

Pinging 192.168.30.10 with 32 bytes of data:

Reply from 192.168.30.10: bytes=32 time=20ms TTL=124
Reply from 192.168.30.10: bytes=32 time<1ms TTL=124
Reply from 192.168.30.10: bytes=32 time<1ms TTL=124
Reply from 192.168.30.10: bytes=32 time<1ms TTL=124

Ping statistics for 192.168.30.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 20ms, Average = 5ms
```

PC2

Physical Config Desktop Programming Attributes

Web Browser

< > URL <http://192.168.30.10> Go Stop X

Welcome to BranchLink Enterprise Network

Sales Department Server (VLAN 30)

This HTTP service is accessible according to network security rules.
Only authorized VLANs can access this web server to ensure secure communication.

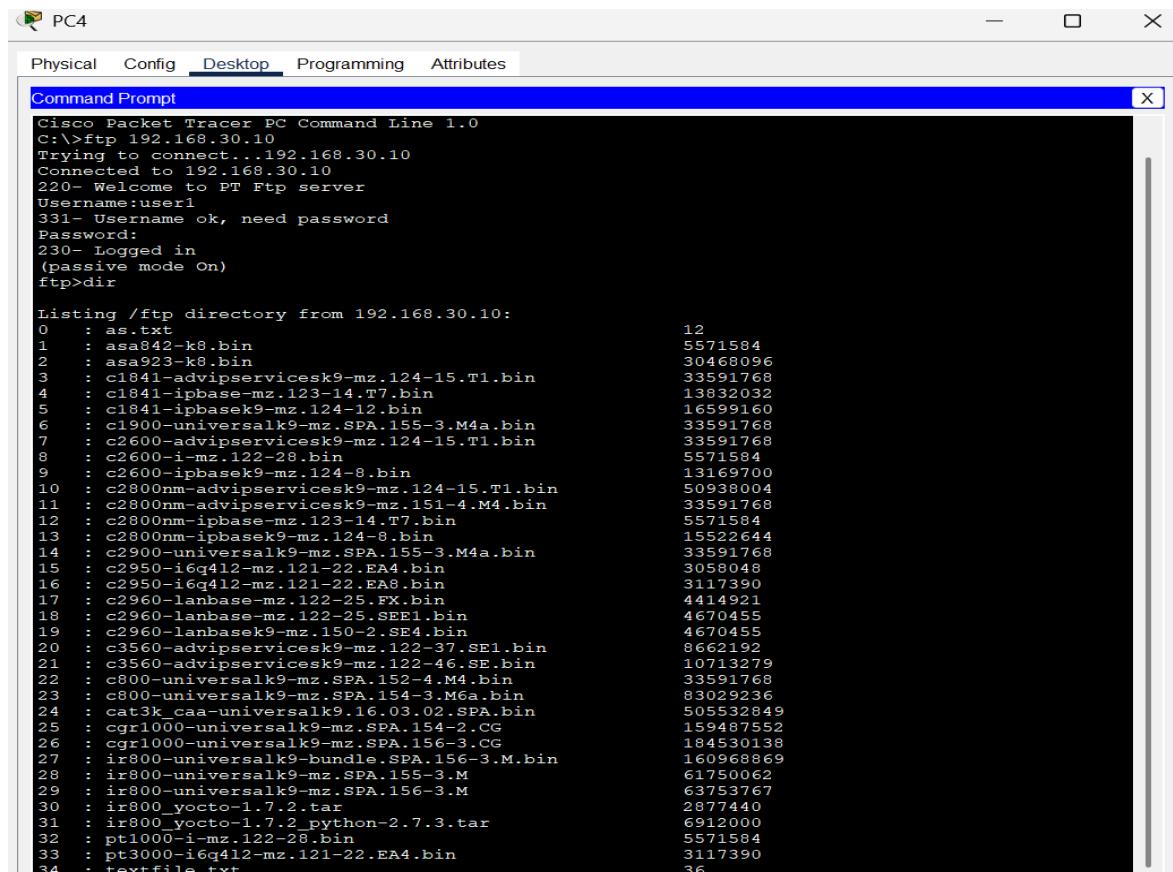
[Access HTTP Server](#)

Configured by: **Asima Ashraf**
Course: Computer Networks

FTP File Transfer Configuration

- Server (VLAN 30):
- IP: 192.168.30.10
- Username: user1
- Password: 123

Command / Action	Description
ftp 192.168.30.10	Connect to the FTP server at IP 192.168.30.10
Username: user1	Enter FTP username user1
Password: 123	Enter FTP password 123
put as.txt	Upload local file as.txt to the server
get testfile.txt	Download file testfile.txt from the server
dir	List all files in the current FTP directory
bye	Exit FTP session



The screenshot shows the Cisco Packet Tracer PC Command Line interface. The window title is "PC4". The tabs at the top are Physical, Config, Desktop, Programming, and Attributes, with "Desktop" selected. A sub-menu window titled "Command Prompt" is open, showing the following command-line session:

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ftp 192.168.30.10
Trying to connect...192.168.30.10
Connected to 192.168.30.10
220- Welcome to PT Ftp server
Username:user1
331- Username ok, need password
Password:
230- Logged in
(passive mode On)
ftp>dir
Listing /ftp directory from 192.168.30.10:
0 : as.txt
1 : asa842-k8.bin
2 : asa923-k8.bin
3 : c1841-adviservicesk9-mz.124-15.T1.bin
4 : c1841-ipbasek9-mz.123-14.T7.bin
5 : c1841-ipbasek9-mz.124-12.bin
6 : c1900-universalk9-mz.SPA.155-3.M4a.bin
7 : c2600-adviservicesk9-mz.124-15.T1.bin
8 : c2600-i-mz.122-28.bin
9 : c2600-ipbasek9-mz.124-8.bin
10 : c2800nm-adviservicesk9-mz.124-15.T1.bin
11 : c2800nm-adviservicesk9-mz.151-4.M4.bin
12 : c2800nm-ipbasek9-mz.123-14.T7.bin
13 : c2800nm-ipbasek9-mz.124-8.bin
14 : c2900-universalk9-mz.SPA.155-3.M4a.bin
15 : c2950-i6q412-mz.121-22.EA4.bin
16 : c2950-i6q412-mz.121-22.EA8.bin
17 : c2960-lanbase-mz.122-25.FX.bin
18 : c2960-lanbase-mz.122-25.SE1.bin
19 : c2960-lanbasek9-mz.150-2.SE4.bin
20 : c3560-adviservicesk9-mz.122-37.SE1.bin
21 : c3560-adviservicesk9-mz.122-46.SE.bin
22 : c800-universalk9-mz.SPA.152-4.M4.bin
23 : c800-universalk9-mz.SPA.154-3.M6a.bin
24 : cat3k_caa-universalk9.16.03.02.SPA.bin
25 : cgr1000-universalk9-mz.SPA.154-2.CG
26 : cgr1000-universalk9-mz.SPA.156-3.CG
27 : ir800-universalk9-bundle.SPA.156-3.M.bin
28 : ir800-universalk9-mz.SPA.155-3.M
29 : ir800-universalk9-mz.SPA.156-3.M
30 : ir800_vocto-1.7.2.tar
31 : ir800_yocto-1.7.2_python-2.7.3.tar
32 : pt1000-i-mz.122-28.bin
33 : pt3000-i6q412-mz.121-22.EA4.bin
34 : testfile.txt
```

10. Conclusion

The BranchLink Enterprise Network project demonstrates a fully functional enterprise-level network with two geographically separated branches.

All major networking concepts and services were successfully implemented, including:

- **VLAN Segmentation & Inter-VLAN Routing:**
Each department (HR, IT, Sales, Marketing) was isolated into separate VLANs, with multilayer switches providing Layer 3 routing.
- **Hybrid Routing (OSPF + Static):**
Dynamic OSPF routing ensures network resiliency and automatic route discovery, while static routes guarantee fixed paths for inter-branch communication.
Verified using show ip route and ping tests.
- **DHCP & IP Addressing:**
PCs automatically obtained IP addresses, default gateways, and DNS servers, ensuring proper network configuration without manual setup.
- **Trunk Links & VLAN Traffic:**
All VLAN traffic passes correctly through trunk ports, verified with show interfaces trunk.
- **Application-Layer Services:**
 - HTTP – Web server access from all VLANs verified.
 - FTP – File transfer tested successfully between PCs and server.
 - SMTP/POP3 – Email communication established between PCs in different branches.
 - DNS – Domain name resolution verified for server and email services.
 -

Overall Outcome:

The project confirms end-to-end connectivity, proper routing (dynamic + static), VLAN segmentation, and functional application services. It demonstrates a realistic enterprise network scenario, suitable for both learning and professional reference.

All objectives of the project have been successfully met. The network is fully operational, and the verification steps (DHCP, ping tests, service tests) confirm complete functionality.