PROJECT REPORT

IT-377 NETWORK DESIGN Report T

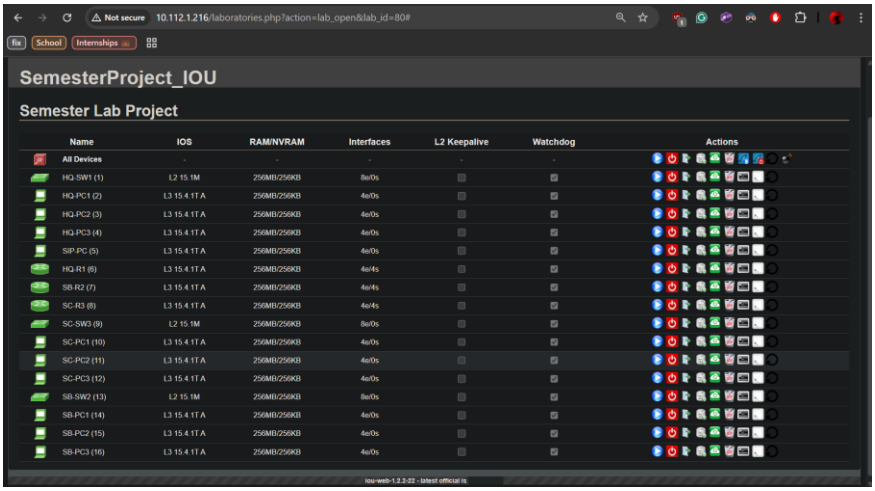
BY : Name

This report focusses on network design and their configuration. We have created this network design using CISCO IOU. IOU mostly used for building network topology on a single PC without the need for physical routers. This is useful for validating network designs, proof-of-concept testing.

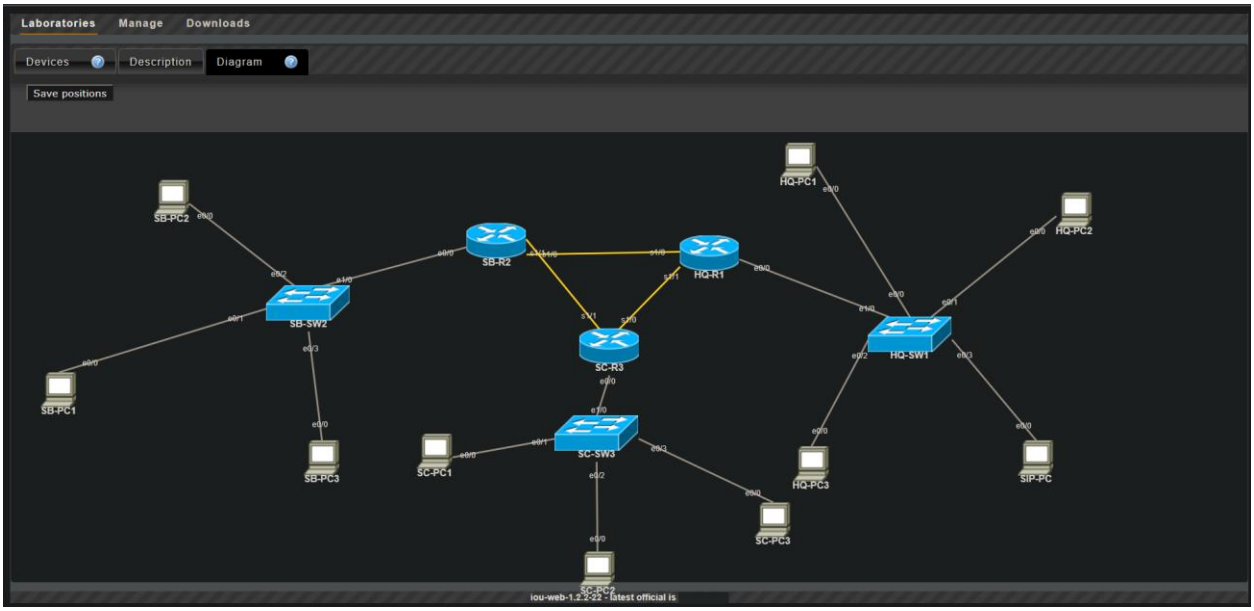
Scenario: - In an organization, there are three Zone:

- HQ
- Site B
- Site C

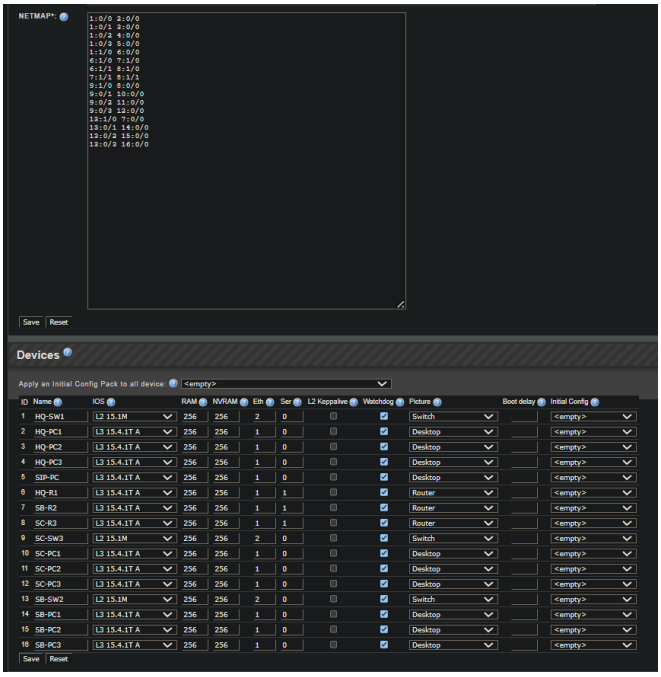
I. In CISCO IOU first we have to configure all the device which we are going to use in our network design. This screenshot shows the device configuration. We configured 10 PCs, 3 switches and 3 routers.



Network Topology: It defines the logical and physical layout of a network. Here I define all the zones specific device name and their IP address and VLANs.



In this slide Router information's are present Each router is having their loopback address and two interface information.



After configuration of each PCs, switches and router using PUTTY.

First, configure all PCs

HQ

PUTTY command:

Enable means you have to enable the device

Hostname HQ-PC1 means change your device name

Config t – config terminal

Wr - save your information.

HQ-PC1:

```
HQ-PC1#show ip interface brie
Interface                  IP-Address      OK? Method Status                Protocol
Ethernet0/0                142.100.64.10   YES NVRAM  up                    up
Ethernet0/1                unassigned      YES NVRAM  administratively down down
Ethernet0/2                unassigned      YES NVRAM  administratively down down
Ethernet0/3                unassigned      YES NVRAM  administratively down down
HQ-PC1#show ip
% Incomplete command.

HQ-PC1#show ip interface
Ethernet0/0 is up, line protocol is up
  Internet address is 142.100.64.10/24
  Broadcast address is 255.255.255.255
```

HQ-PC2:

```
HQ-PC2#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
Ethernet0/0                142.102.64.20   YES NVRAM  up                    up
Ethernet0/1                unassigned      YES NVRAM  administratively down down
Ethernet0/2                unassigned      YES NVRAM  administratively down down
Ethernet0/3                unassigned      YES NVRAM  administratively down down
HQ-PC2#show ip interface
Ethernet0/0 is up, line protocol is up
  Internet address is 142.102.64.20/24
  Broadcast address is 255.255.255.255
```

HQ-PC3:

```
HQ-PC3>enable
HQ-PC3#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
Ethernet0/0                142.202.64.30   YES NVRAM  up                    up
Ethernet0/1                unassigned      YES NVRAM  administratively down down
Ethernet0/2                unassigned      YES NVRAM  administratively down down
Ethernet0/3                unassigned      YES NVRAM  administratively down down
HQ-PC3#show ip interface
Ethernet0/0 is up, line protocol is up
  Internet address is 142.202.64.30/24
  Broadcast address is 255.255.255.255
```

SIP-PC:

```
SIP-PC#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
Ethernet0/0                157.26.1.250    YES manual up                    up
Ethernet0/1                unassigned      YES unset  administratively down down
Ethernet0/2                unassigned      YES unset  administratively down down
Ethernet0/3                unassigned      YES unset  administratively down down
SIP-PC#show ip interface
Ethernet0/0 is up, line protocol is up
  Internet address is 157.26.1.250/24
  Broadcast address is 255.255.255.255
```

SITE B

Screenshot 4,5,6 shows the configuration of Site B PCs.

SB-PC1:

```
SB-PC1#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
Ethernet0/0                142.100.66.10   YES NVRAM  up                    up
Ethernet0/1                unassigned      YES NVRAM  administratively down down
Ethernet0/2                unassigned      YES NVRAM  administratively down down
Ethernet0/3                unassigned      YES NVRAM  administratively down down
SB-PC1#show ip interface
Ethernet0/0 is up, line protocol is up
  Internet address is 142.100.66.10/24
  Broadcast address is 255.255.255.255
```

SB-PC2:

```
SB-PC2#show ip interface brief
Interface                  IP-Address      OK? Method Status                Proto
Ethernet0/0                142.102.66.20   YES NVRAM  up                    up
Ethernet0/1                unassigned      YES NVRAM  administratively down down
Ethernet0/2                unassigned      YES NVRAM  administratively down down
Ethernet0/3                unassigned      YES NVRAM  administratively down down
SB-PC2#show ip interface
Ethernet0/0 is up, line protocol is up
  Internet address is 142.102.66.20/24
  Broadcast address is 255.255.255.255
```

SB-PC3:

```
SB-PC3#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
Ethernet0/0                142.202.66.30   YES NVRAM  up                    up
Ethernet0/1                unassigned      YES NVRAM  administratively down down
Ethernet0/2                unassigned      YES NVRAM  administratively down down
Ethernet0/3                unassigned      YES NVRAM  administratively down down
SB-PC3#show ip interface
Ethernet0/0 is up, line protocol is up
  Internet address is 142.202.66.30/24
  Broadcast address is 255.255.255.255
```

SITE C

Screenshot 7,8,9 shows site C PCs.

SC-PC1:

```
SC-PC1#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
Ethernet0/0                142.100.65.10   YES NVRAM  up                    up
Ethernet0/1                unassigned      YES NVRAM  administratively down down
Ethernet0/2                unassigned      YES NVRAM  administratively down down
Ethernet0/3                unassigned      YES NVRAM  administratively down down
SC-PC1#show ip interface
Ethernet0/0 is up, line protocol is up
  Internet address is 142.100.65.10/24
  Broadcast address is 255.255.255.255
```

SC-PC2:

```
SC-PC2#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
Ethernet0/0                142.102.65.20   YES NVRAM  up                    up
Ethernet0/1                unassigned      YES NVRAM  administratively down down
Ethernet0/2                unassigned      YES NVRAM  administratively down down
Ethernet0/3                unassigned      YES NVRAM  administratively down down
SC-PC2#show ip interface
Ethernet0/0 is up, line protocol is up
  Internet address is 142.102.65.20/24
  Broadcast address is 255.255.255.255
```

SC-PC3:

```
SC-PC3#show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
Ethernet0/0                142.202.65.30   YES NVRAM  up                    up
Ethernet0/1                unassigned      YES NVRAM  administratively down down
Ethernet0/2                unassigned      YES NVRAM  administratively down down
Ethernet0/3                unassigned      YES NVRAM  administratively down down
SC-PC3#show ip interface
Ethernet0/0 is up, line protocol is up
  Internet address is 142.202.65.30/24
  Broadcast address is 255.255.255.255
```

II. SWITCH CONFIGURATION

Now we configured switches and VLANs.VLAN are used to divide the physical network into several broadcast domain.

VLAN: A VLAN is assigned a specific id. This id can be anything between 1 and 4094. VLAN1 is most commonly used for management so this should not be sed.

- VOICE
  - 102 – HQ
  - 302 - SITE B
  - 502 – SITE C

- Data
    - 202 - HQ
    - 402 – Site B
    - 602 – Site C

creating a new VLAN by using this command

config t

(config)# **vlan database**
(config-vlan)# **vlan 102**
(config-vlan)# **int vlan 102**
(config-if)# **name voice (name your vlan)**
(config-vlan)# **end**
show run

screenshot 10

HQ SWITCH CONFIGURATION HQ-SW1

Show VLAN

HQ-SW1:

```
interface Ethernet0/0
 switchport access vlan 100
 switchport mode access
 duplex auto
 spanning-tree portfast
!
interface Ethernet0/1
 switchport access vlan 102
 switchport mode access
 duplex auto
 spanning-tree portfast
!
interface Ethernet0/2
 switchport access vlan 202
 switchport mode access
 duplex auto
 spanning-tree portfast
!
interface Ethernet0/3
 switchport access vlan 157
 switchport mode access
 duplex auto
 spanning-tree portfast
!
interface Ethernet1/0
 switchport trunk encapsulation dot1q
 switchport mode trunk
 duplex auto
!
interface Ethernet1/1
 duplex auto
```

```
HQ-SW1>show vlan

VLAN Name                              Status    Ports
---- --------------------------------- --------- -------------------------------
1    default                           active    Et1/1, Et1/2, Et1/3
100  server                            active    Et0/0
102  voice                             active    Et0/1
157  SIP                               active    Et0/3
202  data                              active    Et0/2
1002 fddi-default                      act/unsup
1003 token-ring-default                act/unsup
1004 fddinet-default                   act/unsup
1005 trnet-default                     act/unsup

VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------
1    enet  100001     1500  -      -      -        -    -        0      0
100  enet  100100     1500  -      -      -        -    -        0      0
102  enet  100102     1500  -      -      -        -    -        0      0
157  enet  100157     1500  -      -      -        -    -        0      0
202  enet  100202     1500  -      -      -        -    -        0      0
1002 fddi  101002     1500  -      -      -        -    -        0      0
1003 tr    101003     1500  -      -      -        -    -        0      0
1004 fdnet 101004     1500  -      -      -        ieee -        0      0
 --More--
```

SITE B SWITCH CONFIGURATION SB-SW2

```
interface Ethernet0/0
 switchport trunk encapsulation dot1q
 duplex auto
!
interface Ethernet0/1
 switchport access vlan 100
 switchport mode access
 duplex auto
 spanning-tree portfast
!
interface Ethernet0/2
 switchport access vlan 502
 switchport mode access
 duplex auto
 spanning-tree portfast
!
interface Ethernet0/3
 switchport access vlan 602
 switchport mode access
 duplex auto
 spanning-tree portfast
!
interface Ethernet1/0
 switchport trunk encapsulation dot1q
 switchport mode trunk
 duplex auto
!
interface Ethernet1/1
```

```
VLAN Name                              Status    Ports
---- --------------------------------- --------- -------------------------------
1    default                           active    Et0/0, Et1/1, Et1/2, Et1/3
100  server                            active    Et0/1
502  voice                             active    Et0/2
602  data                              active    Et0/3
1002 fddi-default                      act/unsup
1003 token-ring-default                act/unsup
1004 fddinet-default                   act/unsup
1005 trnet-default                     act/unsup
SB-SW2#
```

SITE C – SWITCH CONFIGURATION

```
interface Ethernet0/0
 duplex auto
!
interface Ethernet0/1
 switchport access vlan 100
 switchport mode access
 duplex auto
 spanning-tree portfast
!
interface Ethernet0/2
 switchport access vlan 302
 switchport mode access
 duplex auto
 spanning-tree portfast
!
interface Ethernet0/3
 switchport access vlan 402
 switchport mode access
 duplex auto
 spanning-tree portfast
!
interface Ethernet1/0
 switchport trunk encapsulation dot1q
 switchport mode trunk
 duplex auto
!
interface Ethernet1/1
 duplex auto
!
interface Ethernet1/2
 --More--
```

```
SC-SW3#show vlan brief

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Et0/0, Et1/1, Et1/2, Et1/3
100  server                           active    Et0/1
302  voice                            active    Et0/2
402  data                             active    Et0/3
1002 fddi-default                     act/unsup
1003 token-ring-default               act/unsup
1004 fddinet-default                  act/unsup
1005 trnet-default                    act/unsup
SC-SW3#show run  brief
Building configuration...
```

III. ROUTER CONFIGURATION

HQ – R1

In this slide first we created loopback address, then e0/0 is having no IP address.
Encapsulation dot1Q. 100(VLAN ID) Assigns a VLAN ID to a sub interface (or modifies the VLAN ID that is currently assigned to a sub interface).
Creating OSPF
When configuring any OSPF router, you must establish which area assignment to enable the interface for. OSPF has some basic rules when it comes to area assignment. OSPF must be configured with areas. The backbone area 0, or 0.0.0.0, must be configured if you use more than one area assignment. You can configure OSPF in one area; you can choose any area, although good OSPF design dictates that you configure area 0.

To enable OSPF, the following tasks are required:

- **Step 1** Use the command **router ospf** *process ID* to start OSPF.
- **Step 2** Use the **network** command to enable the interfaces.
- **Step 3** Identify area assignments.
- **Step 4** (Optional) Assign the router ID.

Example 3-1 displays OSPF with a process ID of 1 and places all interfaces configured with an IP address in area 0. The network command **network 0.0.0.0 255.255.255.255 area 0** dictates that you do not care (255.255.255.255) what the IP address is, but if an IP address is enabled on any interface, place it in area 0.

router ospf 1

network 0.0.0.0255.255.255.255 area 0

- OSPF understands variable-length subnet masks (VLSMs) and allows for summarization.
- OSPF uses multicasts (not broadcasts) to send updates.
- OSPF propagates changes immediately.
- OSPF allows for load balancing with up to six equal-cost paths.
- OSPF has authentication available.
- OSPF allows for tagging of external routes injected by other autonomous systems.
- OSPF configuration, monitoring, and troubleshooting have a far greater IOS tool base.

OSPF does have some disadvantages, including the level of difficulty and understanding required to configure, monitor, and troubleshoot it. The other two factors are the memory and Central Processing Unit (CPU) requirements that can affect even high-end router performance.

```
HQ-R1>show ip ospf interface brief
Interface    PID   Area            IP Address/Mask    Cost  State Nbr
s F/C
Se1/1        100   0               10.3.3.2/30        64    P2P   1/1
Se1/0        100   0               10.1.1.1/30        64    P2P   1/1
Lo0          100   1               142.1.64.254/24    1     LOOP  0/0
Et0/0.202    100   1               157.26.1.254/24    10    DR    0/0
Et0/0.102    100   1               142.102.64.254/24  10    DR    0/0
Et0/0.100    100   1               142.100.64.254/24  10    DR    0/0
HQ-R1>
```

SITE -R2

```
SB-R2>show ip ospf interface brief
Interface    PID   Area            IP Address/Mask    Cost  State Nbr
s F/C
Se1/1        100   0               10.2.2.2/30        64    P2P   1/1
Se1/0        100   0               10.1.1.2/30        64    P2P   1/1
Lo0          100   2               142.1.66.254/24    1     LOOP  0/0
Et0/0.602    100   2               142.202.66.254/24  10    DR    0/0
Et0/0.502    100   2               142.102.66.254/24  10    DR    0/0
Et0/0.100    100   2               142.100.66.254/24  10    DR    0/0
SB-R2>
```

SITE C – R3

```
SC-R3>show ip ospf interface brief
Interface    PID   Area            IP Address/Mask    Cost  State Nbr
s F/C
Se1/0        100   0               10.3.3.1/30        64    P2P   1/1
Se1/1        100   0               10.2.2.1/30        64    P2P   1/1
Lo0          100   3               142.1.65.254/24    1     LOOP  0/0
Et0/0.402    100   3               142.202.65.254/24  10    DR    0/0
Et0/0.302    100   3               142.102.65.254/24  10    DR    0/0
Et0/0.100    100   3               142.100.65.254/24  10    DR    0/0
SC-R3>
```

IV. Conclution

In this project, I was able to configure and verify OSPF routing across multiple interconnected sites. I feel this was one of the more difficult labs, definitely harder than the last one. However, with this project I learned a lot more and gained more hands-on experience. It feels like this one combined everything we learned by setting up VLANS,assigning swith ports, and establishing protocols for end-to-end communication. I followed with the video that helped a lot more and ensured I did not run into issues and I was able to achieve full connectivity. Overall I enjoyed this project more and feel like I learned more and will be able to apply this knowledge in the future.

V. Extra credit MPLS and others