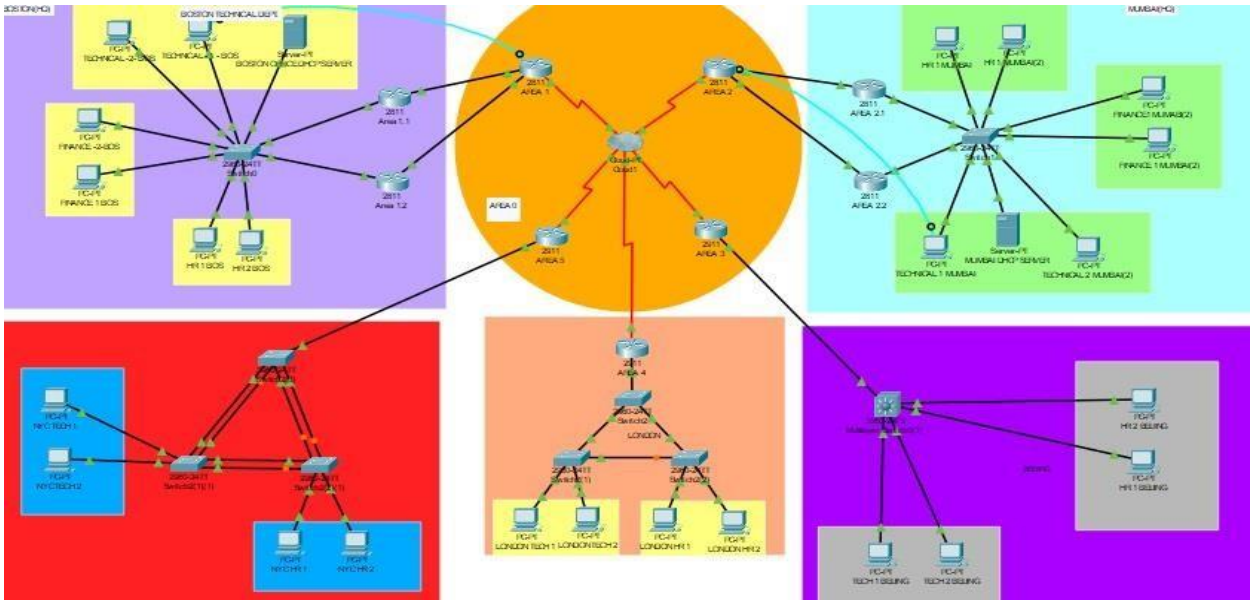
PROJECT DESIGN:

An inter-geographical network connecting offices from five different locations (Boston, Mumbai, Beijing, London, New York). Head-quarters of organization will be based at Boston and Mumbai.

HIGH-LEVEL DIAGRAM DIAGRAM



NETWORK DETAILS:

- Boston & Mumbai office will be having technical, finance & HR department, whereas other locations will be having technical & HR departments respectively
- Each office will be having 250 hosts (85% redundancy for their addresses)
- Address for each host will be assigned dynamically by DHCP servers based at technical department of head-quarter locations (Boston & Mumbai)
- Dedicated VLAN is created for each department
- Offices at different geographical locations will be connected via internet service provider(ISP)
  - Security feature is deployed for restricting the access to the finance department
- Router redundancy is implemented at head-quarter locations & switch redundancy is done at New York & Beijing location
- OSPF network protocol is implemented for communication between different locations
- MAC flooding & port security is activated for machines at HQ locations
- BPDU, Port fast enabled in all machines connected to the network
- Rapid spanning tree protocol is activated between redundant switches at New York & London location
- Multilayer switch at Beijing & LACP at New York are the additional features

Address allocation to offices

Department	Address Range	Subnet Mask	Number of hosts
BOSTON			
Technical	192.168.69.5 – 192.168.69.254	255.255.255.0	249
Finance	192.168.70.5 – 192.168.70.127	255.255.255.128	107
HR	192.168.71.5 – 192.168.71.127	255.255.255.128	107
DHCP	192.168.72.2	255.255.255.0	1
MUMBAI			
Technical	192.168.72.5 – 192.168.72.254	255.255.255.0	249
Finance	192.168.73.5 – 192.168.73.127	255.255.255.128	107
HR	192.168.74.5 – 192.168.74.127	255.255.255.128	107
DHCP	192.168.72.2	255.255.255.0	1
BEIJING			
Technical	192.168.75.2 – 192.168.75.254	255.255.255.0	253
HR	192.168.76.2 – 192.168.76.254	255.255.255.0	107
LONDON			
Technical	192.168.77.2 – 192.168.77.254	255.255.255.0	253
HR	192.168.78.2 – 192.168.78.254	255.255.255.0	253
NEWYORK			
Technical	192.168.79.2 – 192.168.79.254	255.255.255.0	253

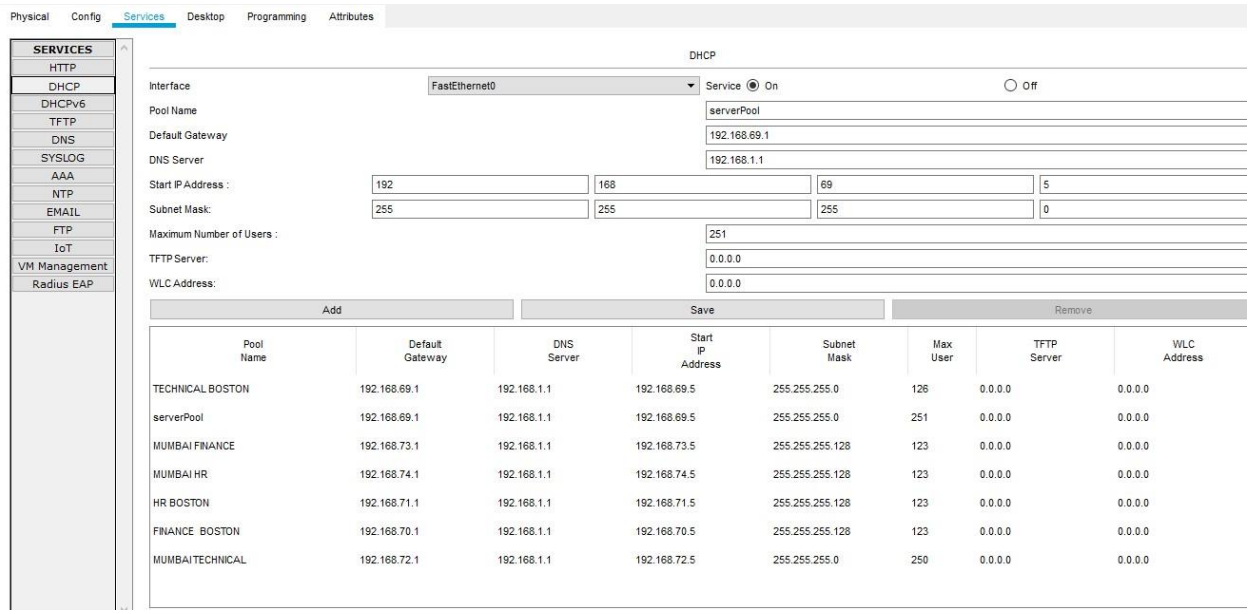
HR	192.168.80.2 – 192.168.80.254	255.255.255.0	253

Total Cost of the project:

S.no	Name of the network component	Quantity	Price/Quantity	Total price
1	Cisco 2960 switch	8	$ 150	$1200
2	Multilayer Switch	1	$ 200	$ 200
3	DHCP Server	2	$ 2000	$ 4000
4	Cisco Router 2811	9	$ 700	$ 6300
5	Copper straight cable	In ft	$ 1.5 / feet	1.5 * distance
6	Serial DCE	In ft	$ 3 / feet	3 * distance
			Total Price	$11700

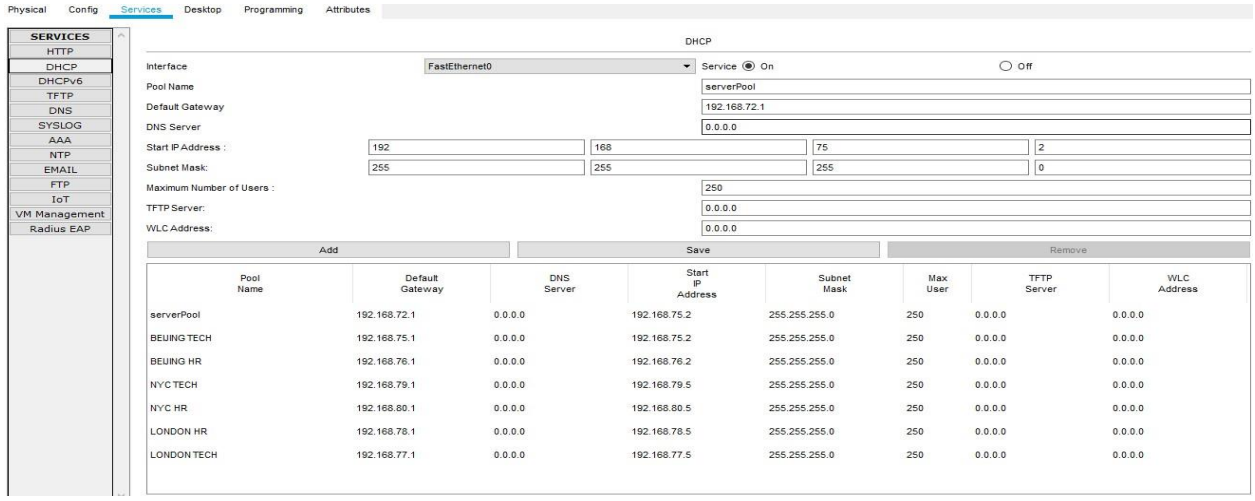
Cost optimization:

- VLAN'S for each department is configured on a single switch making the system cost efficient
- Limited utilization of DHCP servers (installed only at head quarter locations). HQ DHCP server used for assigning IP's to host at branch offices at London, Beijing & New York
- Multilayer switch erection leading to reduction in consumption of one additional router **Dynamic Host Allocation using Dynamic Host Configuration Protocol DCHP SERVER AT BOSTON:**
- Server at Boston location will assigning dynamic IP addresses to technical, finance & HR departments of Boston & Mumbai office's



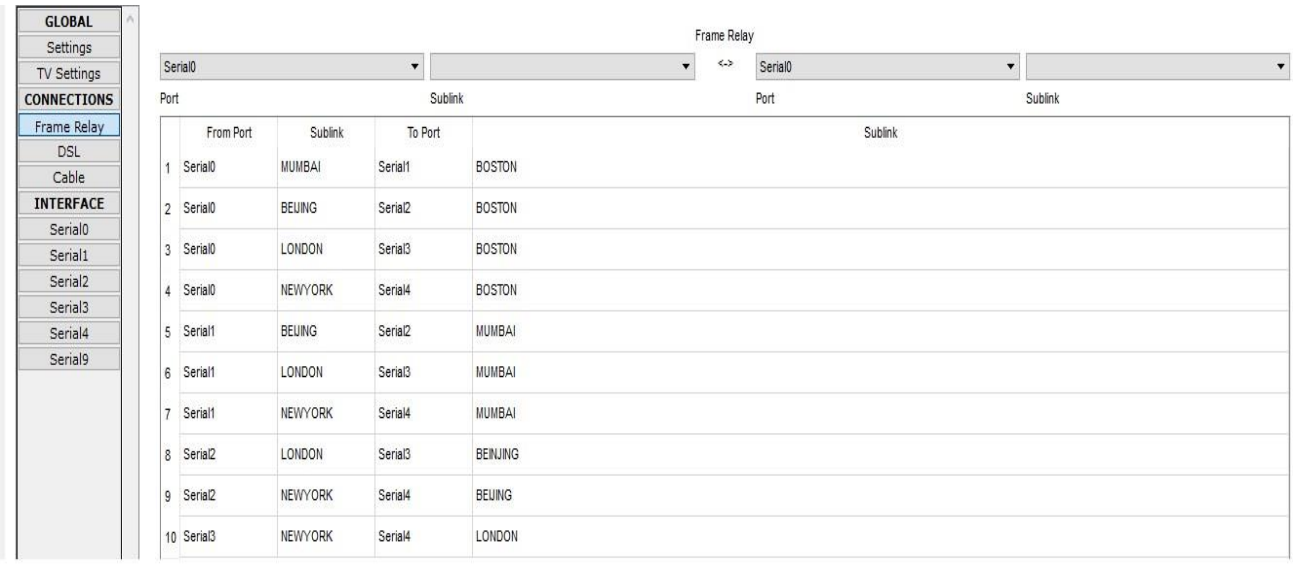
DCHP SERVER AT MUMBAI:

- Server at Mumbai will assign dynamic IP addresses to technical & HR departments of London, Beijing & New York office's



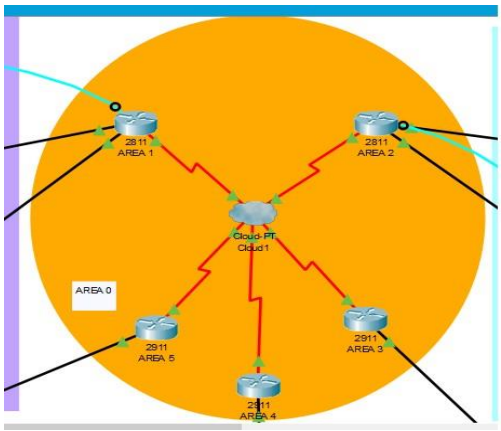
WAN Configuration

- All area borders are designated in area 0 as backbone network, whereas other routers used within location premises are given the following numbers ○ Area 1 - Boston ○ Area 2 - Mumbai ○ Area 3 - Beijing ○ Area 4 - London ○ Area 5 - New York
- Frame relay helps to connect inter networks improving data quality



	From Port	Sublink	To Port	Sublink
1	Serial0	MUMBAI	Serial1	BOSTON
2	Serial0	BEIJING	Serial2	BOSTON
3	Serial0	LONDON	Serial3	BOSTON
4	Serial0	NEWYORK	Serial4	BOSTON
5	Serial1	BEIJING	Serial2	MUMBAI
6	Serial1	LONDON	Serial3	MUMBAI
7	Serial1	NEWYORK	Serial4	MUMBAI
8	Serial2	LONDON	Serial3	BEIJING
9	Serial2	NEWYORK	Serial4	BEIJING
10	Serial3	NEWYORK	Serial4	LONDON

- Cloud 1 acting as ISP



VLAN:

- Different VLAN pools are created for each departments at all locations in following manner

Boston & Mumbai:

- VLAN - 10 - Technical Department
- VLAN - 20 - Finance Department
- VLAN - 30 - HR Department

Beijing, London & New York

- VLAN - 10 - Technical Department

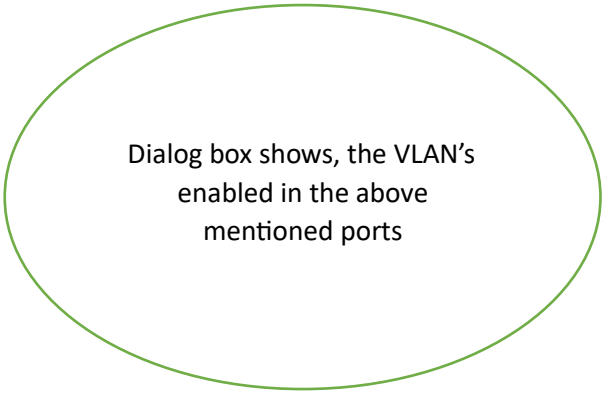
- VLAN - 20 - HR Department

VLAN Test plan:

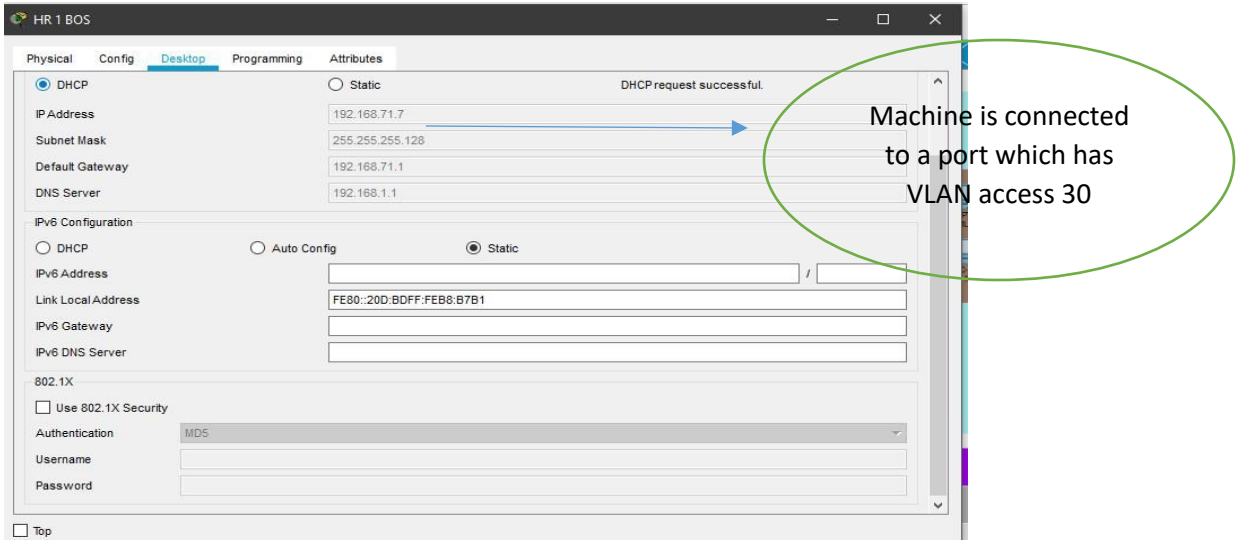
```
Switch>
Switch>en
Switch#show vlan
Switch#show vlan br
Switch#show vlan brief

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   TECH                             active    Fa0/1, Fa0/2, Fa0/3
20   fin                              active    Fa0/4, Fa0/5
30   hr                               active    Fa0/6, Fa0/7
1002 fddi-default                     active
1003 token-ring-default               active
1004 fddinet-default                  active
1005 trnet-default                    active
Switch#
```

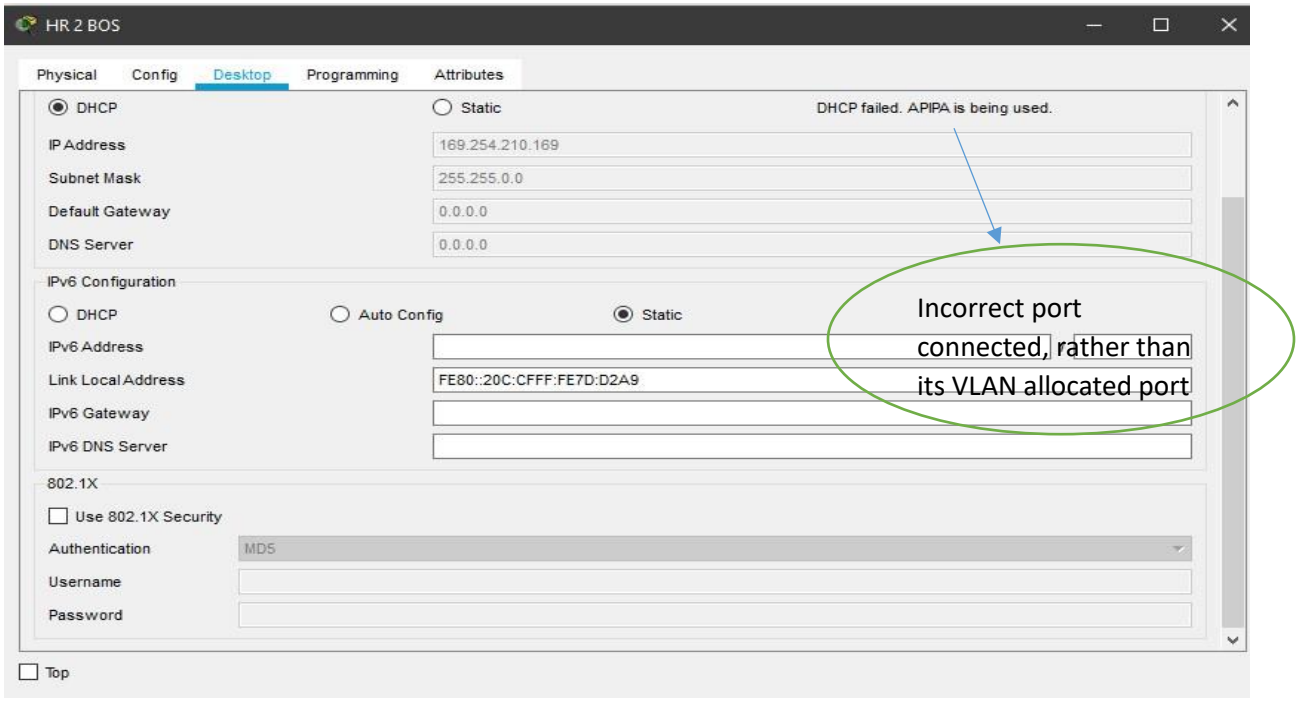
Ctrl+F6 to exit CLI focus



SUCCESSFUL DHCP ALLOCATION WHEN CONNECTED TO VLAN ALLOCATED SWITCH PORT

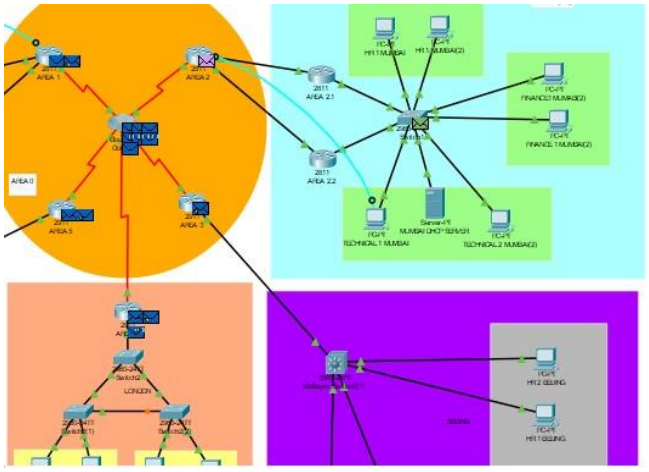


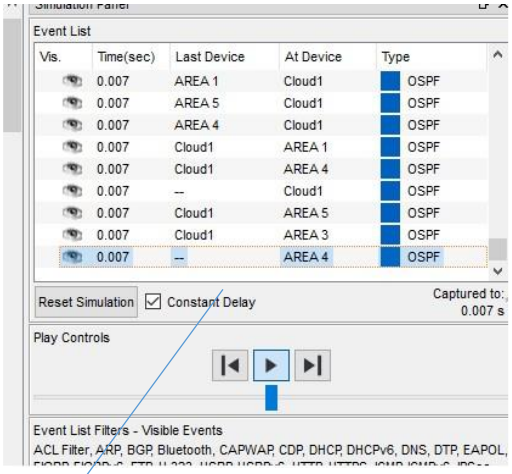
UNSUCCESSFUL DHCP ALLOCATION WHEN CONNECTED TO DIFFERENT SWITCH PORT



OSPF:

In order to communicate between PC'S on two different networks there must be a network protocol. Hence OSPF protocol is used here for this purpose. The following show the utilization of OSPF in project





"OSPF" mentioned while carrying out simulation between inter - network

Access-list (Security):

To provide access control or security for the organization, we used access control list to restrict access to finance department from HR & Technical department. Restriction to finance department is applicable to both Boston's & Mumbai's finance departments

Access list codes:

BOSTON
access-list 100 permit ip host 192.168.69.2 any
access-list 100 permit icmp any 192.168.70.0 0.0.0.127 echo-reply access-list 100 permit icmp any 192.168.73.0 0.0.0.127 echo-reply access-list 100 deny ip 193.168.69.0 0.0.0.255 192.168.70.0 0.0.0.127 access-list 100 deny ip 193.168.71.0 0.0.0.127 192.168.70.0 0.0.0.127 access-list 100 deny ip 193.168.69.0 0.0.0.255 192.168.73.0 0.0.0.127 access-list 100 deny ip 193.168.71.0 0.0.0.127 192.168.73.0 0.0.0.127 access-list 100 permit ip any any

MUMBAI
access-list 100 permit ip host 192.168.72.2 any
access-list 100 permit icmp any 192.168.70.0 0.0.0.127 echo-reply access-list 100 permit icmp any 192.168.73.0 0.0.0.127 echo-reply access-list 100 deny ip 192.168.72.0 0.0.0.255 192.168.70.0 0.0.0.127 access-list 100 deny ip

192.168.74.0 0.0.0.127 192.168.70.0 0.0.0.127 access-list 100 deny ip 192.168.72.0 0.0.0.255 192.168.73.0 0.0.0.127 access-list 100 deny ip 192.168.74.0 0.0.0.127 192.168.73.0 0.0.0.127 access-list 100 permit ip any any

BEIJING

access-list 100 permit ip host 192.168.72.2 any
access-list 100 permit icmp any 192.168.70.0 0.0.0.127 echo-reply access-list 100 permit icmp any 192.168.73.0 0.0.0.127 echo-reply access-list 100 deny ip 192.168.75.0 0.0.0.255 192.168.70.0 0.0.0.127 access-list 100 deny ip 192.168.76.0 0.0.0.255 192.168.70.0 0.0.0.127 access-list 100 deny ip 192.168.75.0 0.0.0.255 192.168.73.0 0.0.0.127 access-list 100 deny ip 192.168.76.0 0.0.0.255 192.168.73.0 0.0.0.127 access-list 100 permit ip any any

LONDON

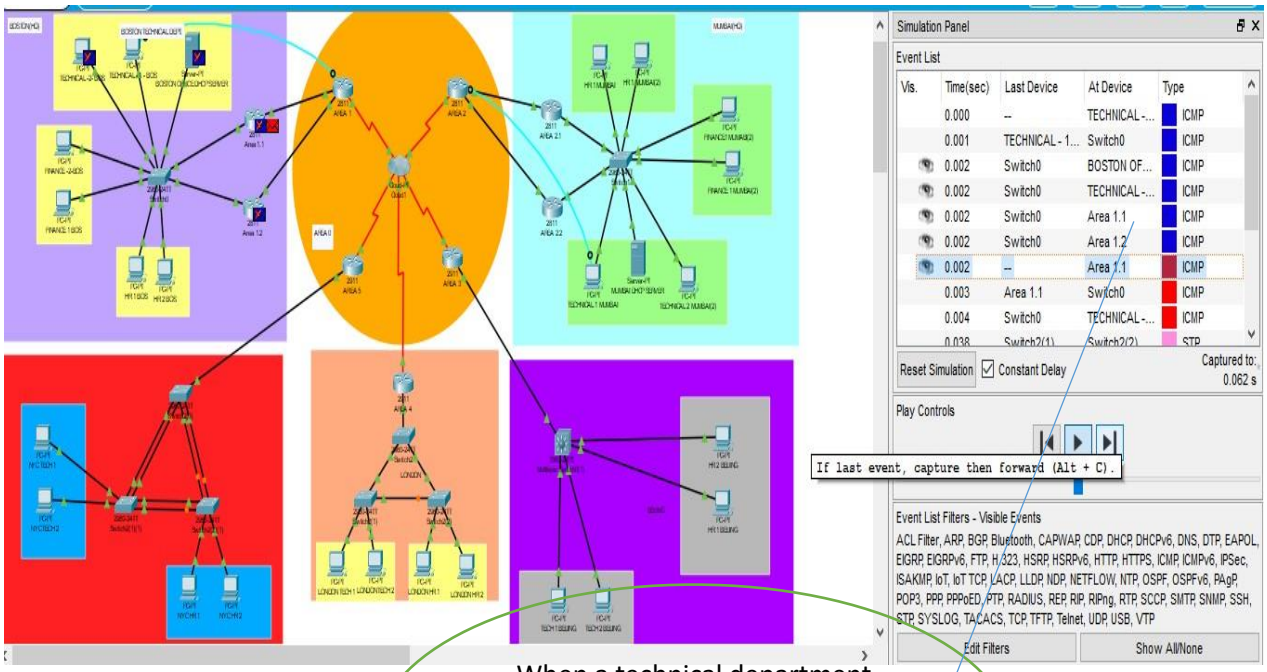
access-list 100 permit ip host 192.168.72.2 any
access-list 100 permit icmp any 192.168.70.0 0.0.0.127 echo-reply access-list 100 permit icmp any 192.168.73.0 0.0.0.127 echo-reply access-list 100 deny ip 192.168.77.0 0.0.0.255 192.168.70.0 0.0.0.127 access-list 100 deny ip 192.168.78.0 0.0.0.255 192.168.70.0 0.0.0.127 access-list 100 deny ip 192.168.77.0 0.0.0.255 192.168.73.0 0.0.0.127 access-list 100 deny ip 192.168.78.0 0.0.0.255 192.168.73.0 0.0.0.127 access-list 100 permit ip any any

NEWYORK

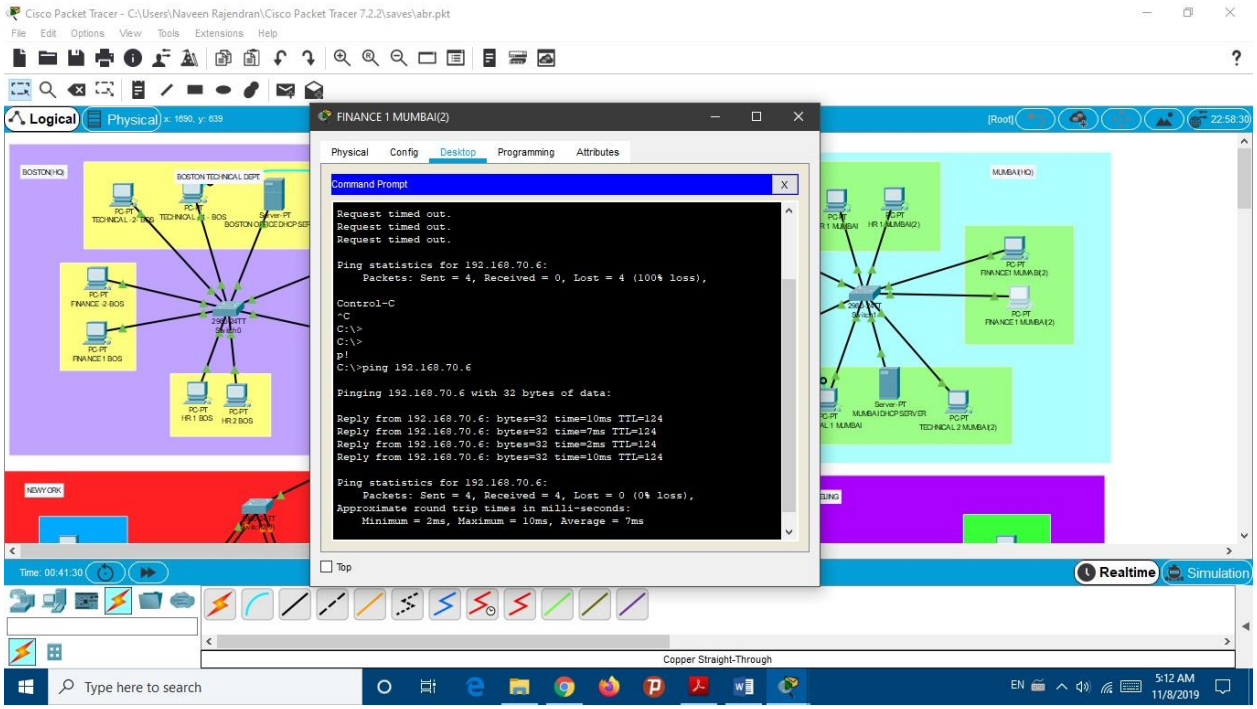
access-list 100 permit ip host 192.168.72.2 any
access-list 100 permit icmp any 192.168.70.0 0.0.0.127 echo-reply access-list 100 permit icmp any 192.168.73.0 0.0.0.127 echo-reply access-list 100 deny ip 192.168.79.0 0.0.0.255 192.168.70.0 0.0.0.127 access-list 100 deny ip 192.168.80.0 0.0.0.255 192.168.70.0 0.0.0.127 access-list 100 deny ip 192.168.79.0 0.0.0.255 192.168.73.0 0.0.0.127 access-list 100 deny ip 192.168.80.0 0.0.0.255 192.168.73.0 0.0.0.127 access-list 100 permit ip any any

Security Test Plan:

- Unable to ping finance department of Mumbai from Boston's technical department due to ACL restriction



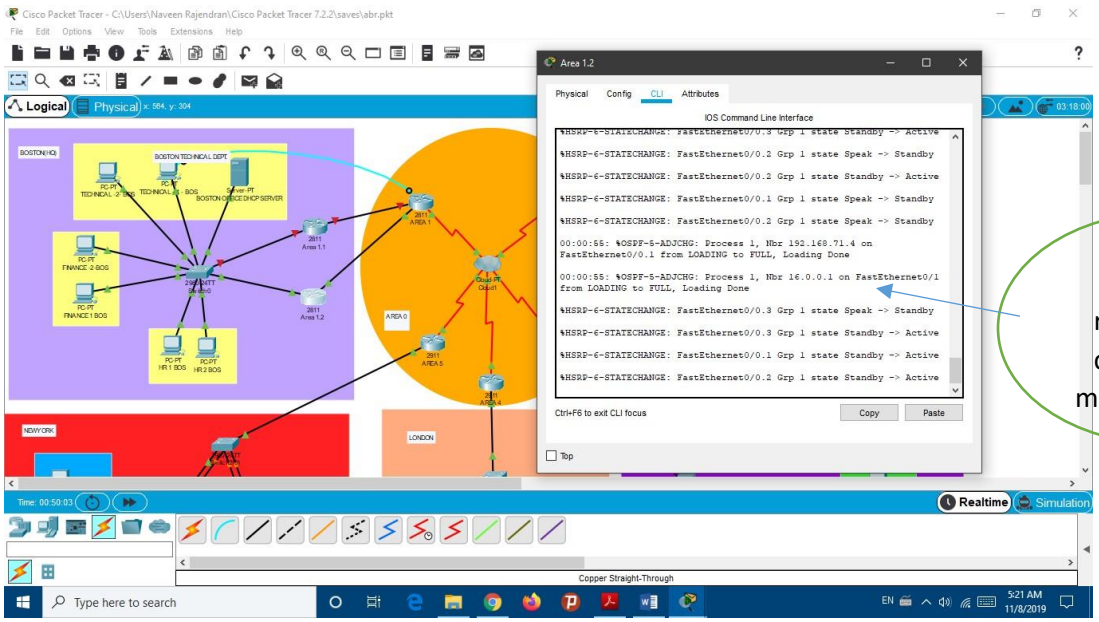
- The finance hosts are able to ping each other, since they were not restricted in access list



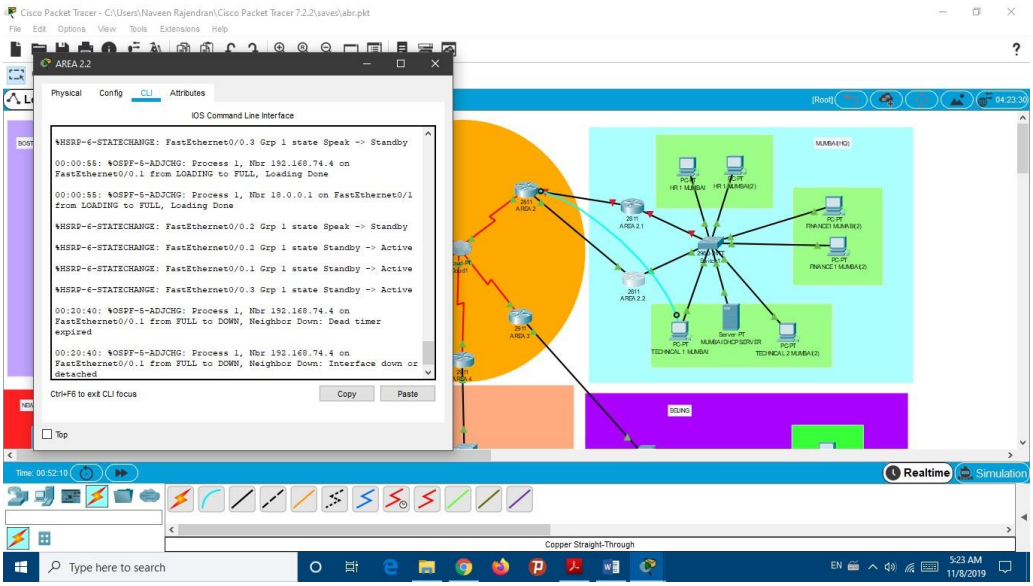
Redundancy Test plan:

For routers:
Hot standby routing protocol is executed at Boston & London location, so if the main router goes down standby gets activated. For testing, we are going to disable main routers at both the areas.

At Boston,



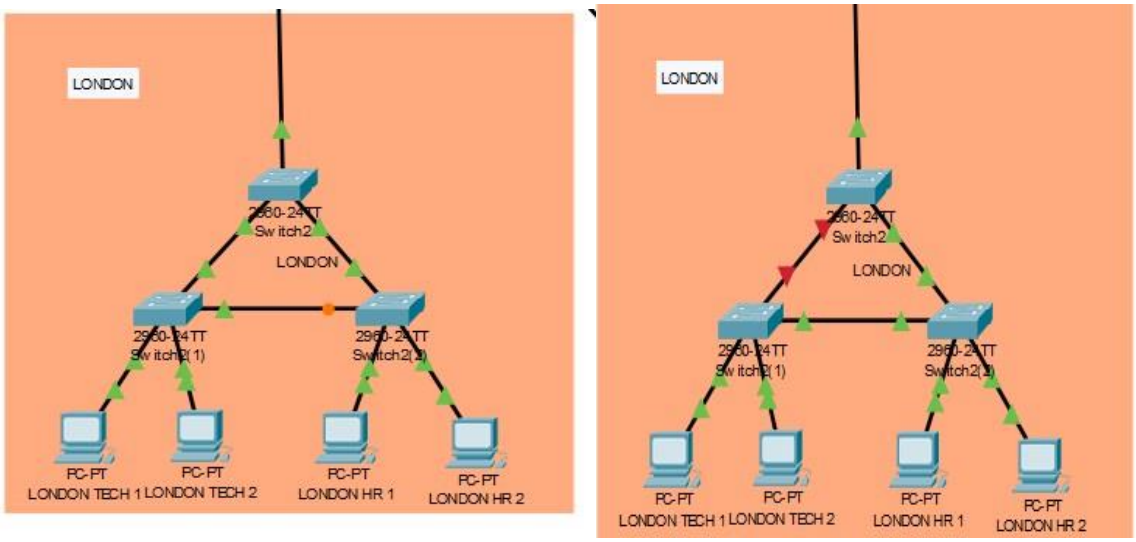
At Mumbai



Switch redundancy test plan:

When a trunk port is turned off, path A is blocked. Right now a redundant path which was at standby came into action instantly. Though the path is dropped, the VLAN's & network works fine due to redundant switch topology which is clearly adopted here.

BEFORE **AFTER**



Add-on testing:
Multilayer switch

A multilayer switch is capable of doing layer 3 roles, therefore it has the capability of doing inter VLAN routing. In this project, a multilayer switch was implemented at Beijing location which performs inter vlan routing.

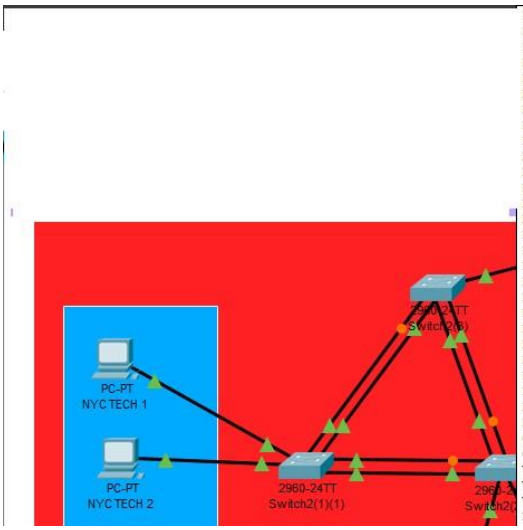
 When pinging HR department from technical department

When a ping request between two vlan's technical & hr department is initiated, the routing is done by multilayer switch, which acts as layer 3 network device

LaCP

Link aggregation & control protocol was implemented at New York office for increasing the speed of communication between channels. Two separate channels were created for this purpose.

Channel - 1 through ports – fa0/1-2-3 & Channel -2 through ports – fa0/4-5-6




```
Port                Link   VLAN   IP Address          M
Port-channel1       Up     --     <not set>           0
Port-channel2       Up     --     <not set>           0
FastEthernet0/1     Down   --     --                  0
FastEthernet0/2     Up     --     --                  0
FastEthernet0/3     Up     --     --                  0
FastEthernet0/4     Down   --     --                  0
FastEthernet0/5     Up     --     --                  0
FastEthernet0/6     Up     --     --                  0
FastEthernet0/7     Down   1      --                  0
FastEthernet0/8     Down   1      --                  0
FastEthernet0/9     Down   1      --                  0
FastEthernet0/10    Down   1      --                  0
FastEthernet0/11    Down   10     --                  0
FastEthernet0/12    Down   10     --                  0
FastEthernet0/13    Up     20     --                  0
FastEthernet0/14    Up     20     --                  0
FastEthernet0/15    Down   1      --                  0
FastEthernet0/16    Down   1      --                  0
FastEthernet0/17    Down   1      --                  0
FastEthernet0/18    Down   1      --                  0
FastEthernet0/19    Down   1      --                  0
FastEthernet0/20    Down   1      --                  0
FastEthernet0/21    Down   1      --                  0
FastEthernet0/22    Down   1      --                  0
FastEthernet0/23    Down   1      --                  0
FastEthernet0/24    Down   1      --                  0
GigabitEthernet0/1  Down   1      --                  0
GigabitEthernet0/2  Down   1      --                  0
Vlan1               Down   1      <not set>           0
Vlan10              Up     10     <not set>           0
Vlan20              Up     20     <not set>           0
Hostname: Switch
```

It can be seen LaCP enable in two different channels configured in New York location

Takeaway Questions

- OSPF is always better. It is better resourceful than RIP protocol which uses lot of memory & complications. Moreover OSPF is best suitable for larger networks due to its better convergence rate than RIP

- Area concept in OSPF is used by the routers to know which location they belong to. They are utilized to segment larger networks into smaller chunks in which router is assigned a area number & connected to backbone area '0'

- If there is no common area '0', it would be difficult for routers to communicate between each other. It should use a dedicated path for ex: 1-5,2-3,4-1 etc. This causes more confusion & congestion in designing the network. Hence backbone area '0' is used here

- There are 7 types of LSA's

1.) Router LSA

Router LAS is used to send the packets within the same area and won't leave the area

2.) Network LSA

Network LSA is used to flood the neighboring routers within the same area.

3.) Summary LSA

Summary LSA is used to flood the packets between routers in different areas and provide OSPF with a summary

4.) Summary ASBR LSA

ASBR Summary LSA gets the packet from one area and injects it into the area 0

5.) External LSA

ASBR external LSA packets are generated by to advertise external redistributed routes

6.) Multicast OSPF LSA

Multicast LSA is used to multicast routing through OSPF.

7.) Not so stubby area LSA (External)

This LSA allows limited amount of external routes to the stubby area

- Security plan is defined as the strategy for restricting the access between different hosts & redundancy plan is to place standby devices to avoid single point or device failure leading to shutdown of entire network
- If 2 switches are connected without STP, then the switches will infinitely duplicate the initial broadcast packet because nothing at the layer 2 to stop. Whereas, the STP helps in avoiding the loopback.

- STP gives a loop-free tree inconsistent topology of switches. It enables users to set the preferred location of root and determines the cost.

- PSTP is the Cisco proprietary protocol which is almost like STP, but the only difference is that PSTP allows each VLAN to run their own STP.

- RSTP provides a fast convergence rate when compared to the previous versions

Concepts learned during this project:

- Various network terminologies

- CLI Commands

- IP addressing & Sub netting

- Configuring switches & routers

- DHCP Configuration

- Network protocols (OSPF)

- Redundancy topologies

- Spanning tree & Rapid spanning tree protocols

- Frame relay implementation

- MAC flooding

BOSTON SWITCH CONFIGURATION

```
Switch>
Switch>
Switch>en
Switch#show run
Switch#show running-config
Building configuration...

Current configuration : 2621 bytes
!
version 12.2 no service timestamps log datetime msec no service timestamps debug datetime msec no service password-encryption
!
hostname Switch
!
!
!
!
!
spanning-tree mode pvst spanning-tree extend system-id
!
interface FastEthernet0/1 switchport access vlan 10 switchport mode access spanning-tree portfast spanning-tree bpduguard enable
!
interface FastEthernet0/2 switchport access vlan 10 switchport mode access switchport port-security maximum 5 switchport port-security mac-address sticky  spanning-tree portfast spanning-tree bpduguard enable
!
interface FastEthernet0/3 switchport access vlan 10 switchport mode access switchport port-security maximum 5 switchport port-security mac-address sticky  spanning-tree portfast spanning-tree bpduguard enable
!
interface FastEthernet0/4 switchport access vlan 20 switchport mode access switchport port-security maximum 5 switchport port-security mac-address sticky  spanning-tree portfast spanning-tree bpduguard enable
!
interface FastEthernet0/5 switchport access vlan 20 switchport mode access switchport port-security maximum 5 switchport port-security mac-address sticky  spanning-tree portfast spanning-tree bpduguard enable
!
interface FastEthernet0/6 switchport access vlan 30 switchport mode access switchport port-security maximum 5 switchport port-security mac-address sticky  spanning-tree portfast spanning-tree bpduguard enable
!
interface FastEthernet0/7 switchport access vlan 30 switchport mode access switchport port-security maximum 5 switchport port-security mac-address sticky  spanning-tree portfast spanning-tree bpduguard enable
!
interface FastEthernet0/8 switchport trunk native vlan 30 switchport trunk allowed vlan 2-1001 switchport mode trunk
!
interface FastEthernet0/9 switchport trunk native vlan 30 switchport trunk allowed vlan 2-1001 switchport mode trunk
```

```
!
interface FastEthernet0/10
!
interface FastEthernet0/11
!
interface FastEthernet0/12
!
interface FastEthernet0/13
!
interface FastEthernet0/14
!
interface FastEthernet0/15
!
interface FastEthernet0/16
!
interface FastEthernet0/17
!
interface FastEthernet0/18
!
interface FastEthernet0/19
!
interface FastEthernet0/20
!
interface FastEthernet0/21
!
interface FastEthernet0/22
!
interface FastEthernet0/23
!
interface FastEthernet0/24
!
end
```

MUMABI SWITCH CONFIGURATION

```
Switch>
Switch>
Switch>EN
Switch#SHOW RUN
Switch#SHOW RUNning-config
Building configuration...

Current configuration : 2555 bytes
!
version 12.2 no service timestamps log
 interface GigabitEthernet0/1      datetime
 !                                msec      no
 interface GigabitEthernet0/2      service
 !                                 timestamps
 interface Vlan1 no                      debug
 ip address                        datetime
 !                                msec      no
 interface Vlan10                        service
 mac-address 0090.0c2b.b501      password-
 no ip address                    encryption
 !                                !
 interface Vlan20                    hostname
 mac-address 0090.0c2b.b502       Switch
 no ip address                    !
 !                                !
 !                                !
 !                                !
 !                                !
 line con 0
 !
 line vty 0 4
 login line
 vty 5 15
 login
 !
 !
 !
 !

spanning-tree mode pvst spanning-tree
extend system-id
!
interface          FastEthernet0/1
switchport   access   vlan   10
switchport      mode      access
spanning-tree portfast spanning-
tree bpduguard enable !
interface FastEthernet0/2 switchport
access vlan 10 switchport mode access
switchport port-security maximum 5
switchport port-security mac-address
```

sticky spanning-tree portfast spanning-tree bpduguard enable
!
interface FastEthernet0/3 switchport access vlan 10 switchport mode access switchport port-security maximum 5 switchport port-security mac-address sticky spanning-tree portfast spanning-tree bpduguard enable
!
interface FastEthernet0/4 switchport access vlan 20 switchport mode access switchport port-security maximum 5 switchport port-security mac-address sticky spanning-tree portfast spanning-tree bpduguard enable
!
interface FastEthernet0/5 switchport access vlan 20 switchport mode access switchport port-security maximum 5 switchport port-security mac-address sticky spanning-tree portfast spanning-tree bpduguard enable
!
interface FastEthernet0/6 switchport access vlan 30 switchport mode access switchport port-security maximum 5 switchport port-security mac-address sticky spanning-tree portfast spanning-tree bpduguard enable
!
interface FastEthernet0/7 switchport access vlan 30 switchport mode access switchport port-security maximum 5 switchport port-security mac-address sticky spanning-tree portfast spanning-tree bpduguard enable
!
interface FastEthernet0/8 switchport trunk native vlan 30 switchport mode trunk
!
interface FastEthernet0/9 switchport trunk native vlan 30 switchport mode trunk
!
interface FastEthernet0/10
!
interface FastEthernet0/11
!
interface FastEthernet0/12
!
interface FastEthernet0/13
!
interface FastEthernet0/14
!
interface FastEthernet0/15
!
interface FastEthernet0/16
!
interface FastEthernet0/17
!
interface FastEthernet0/18
!
interface FastEthernet0/19
!
interface FastEthernet0/20
!
interface FastEthernet0/21
!
interface FastEthernet0/22
!
interface FastEthernet0/23
!
interface FastEthernet0/24
!
interface GigabitEthernet0/1
!
interface GigabitEthernet0/2
!
interface Vlan1

no ip address shutdown
!
interface Vlan10
mac-address 00d0.d31e.ec01
no ip address
!
interface Vlan20
mac-address 00d0.d31e.ec02
no ip address
!
!
!

BEIJING SWITCH CONFIGURATION

Switch>
Switch>
Switch>EN
Switch#SHOW RUN
Switch#SHOW RUNning-config
Building configuration...

Current configuration : 1702 bytes
!
version 12.2(37)SE1 no service timestamps log datetime msec no service timestamps debug datetime msec no service password-encryption
!
hostname Switch
!
!
!
!
!
!
ip routing
!
!
interface FastEthernet0/7
!
interface FastEthernet0/8
!
line con 0
!
line vty 0 4
login line
vty 5 15
login
!
!
!
!
end

!
!
!
spanning-tree mode pvst
!
!
!
!
!
interface FastEthernet0/1 switchport trunk native vlan 20 switchport trunk encapsulation dot1q switchport mode trunk
!
interface FastEthernet0/2 switchport access vlan 10
!
interface FastEthernet0/3 switchport access vlan 10
!
interface FastEthernet0/4 switchport access vlan 20
!
interface FastEthernet0/5 switchport access vlan 20
!
interface FastEthernet0/6
!
no ip address
shutdown
!

```
!
interface FastEthernet0/9
!
interface FastEthernet0/10
!
interface FastEthernet0/11
!
interface FastEthernet0/12
!
interface FastEthernet0/13
!
interface FastEthernet0/14
!
interface FastEthernet0/15
!
interface FastEthernet0/16
!
interface FastEthernet0/17
!
interface FastEthernet0/18
!
interface FastEthernet0/19
!
interface FastEthernet0/20
!
interface FastEthernet0/21
!
interface FastEthernet0/22
interface Vlan10
mac-address 0001.63a1.5d01
ip address 192.168.75.1 255.255.255.0
ip helper-address 192.168.72.2
!
interface Vlan20
mac-address 0001.63a1.5d02
ip address 192.168.76.1 255.255.255.0
ip helper-address 192.168.72.2
!
router ospf 1
log-adjacency-changes
network 192.168.75.0 0.0.0.255 area 3
network 192.168.76.0 0.0.0.255 area 3
!
ip classless
!
ip flow-export version 9
!
!
!
!
!
!
!
!
line con 0
!
```

!

interface FastEthernet0/23

!

interface FastEthernet0/24

!

interface GigabitEthernet0/1

!

interface GigabitEthernet0/2

!

interface Vlan1

line aux 0

!

line vty 0 4

login

!

!

!

!

end

Switch#show running-config Building configuration...

Current configuration : 1772 bytes
!
version 12.2 no service timestamps log datetime msec no service timestamps debug datetime msec no service password-encryption
!
hostname Switch
!
!
!
!
!
spanning-tree mode rapid-pvst spanning-tree extend system-id
!
interface FastEthernet0/1 switchport trunk native vlan 20 switchport mode trunk
!

interface FastEthernet0/2 switchport trunk native vlan 20 switchport mode trunk spanning-tree link-type point-to-point
!
interface FastEthernet0/3 switchport trunk native vlan 20 switchport mode trunk spanning-tree link-type point-to-point
!
interface FastEthernet0/4
!
interface FastEthernet0/5
!
interface FastEthernet0/6
!
interface FastEthernet0/7
!
interface FastEthernet0/8
!
interface FastEthernet0/9

```
!
interface FastEthernet0/10
!
no ip address shutdown
!
interface Vlan10
mac-address 00d0.d323.6601
no ip address
!
interface Vlan20
mac-address 00d0.d323.6602
no ip address
!
!

interface FastEthernet0/11
switchport access vlan 10
switchport mode access
!
interface FastEthernet0/12
switchport access vlan 10
switchport mode access
!
interface FastEthernet0/13 switchport access vlan 20 switchport mode access spanning-tree portfast spanning-tree bpduguard enable
!
interface FastEthernet0/14 switchport access vlan 20 switchport mode access spanning-tree portfast spanning-tree bpduguard enable
!
interface FastEthernet0/15
!
interface FastEthernet0/16
!
interface FastEthernet0/17
!
interface FastEthernet0/18
!
interface FastEthernet0/19
!
interface FastEthernet0/20
!
interface FastEthernet0/21
!
!                    interface FastEthernet0/22
!                    !
line con 0           interface FastEthernet0/23
!                    !
line vty 0 4         interface FastEthernet0/24
login line           !
vty 5 15             interface GigabitEthernet0/1
login                !
!                    interface GigabitEthernet0/2
!                    !
!                    interface Vlan1
!
e
n
d
```

BOSTON ROUTER CONFIGURATION

```
Router#show run
Router#show running-
config  Building
configuration...

Current configuration : 2151 bytes
!
version 12.4 no service timestamps log datetime msec no service timestamps debug datetime msec no service password-encryption
!
hostname Router
!
!
!
!
!
!
!
!
! ip
cef
```

```
no ipv6 cef
!
!
!
!
!
!
!
!
!
!
!
spanning-tree mode pvst
!
!
!
!
!
!
interface FastEthernet0/0 no ip
address duplex auto speed auto
!
interface FastEthernet0/0.1 encapsulation
dot1Q 10 ip address 192.168.69.4
255.255.255.0 ip helper-address 192.168.69.2
ip access-group 100 in standby 1 ip
192.168.69.1 standby 1 priority 105 standby 1
preempt standby preempt standby 0 timers 2 6
!
interface FastEthernet0/0.2 encapsulation dot1Q
20 ip address 192.168.70.4 255.255.255.128 ip
helper-address 192.168.69.2 ip access-group
100 in standby 1 ip 192.168.70.1 standby 1
priority 105 standby 1 preempt standby preempt
standby 0 timers 2 6
!
interface FastEthernet0/0.3 encapsulation dot1Q
30 native ip address 192.168.71.4
255.255.255.128 ip helper-address 192.168.69.2
ip access-group 100 in standby 1 ip 192.168.71.1
standby 1 priority 105 standby 1 preempt standby
preempt standby 0 timers 2 6
!
interface FastEthernet0/1 ip
address 15.0.0.2
255.255.255.0 duplex auto
speed auto
!
interface
Serial0/2/0 no
ip address
clock rate
2000000
shutdown
!
interface
Serial0/3/0 no
ip address
clock rate
2000000
!
interface
Vlan1 no
ip address
shutdown
!
router ospf 1 log-adjacency-
changes network 192.168.69.0
0.0.0.255 area 1 network
192.168.70.0 0.0.0.127 area 1
network 192.168.71.0
0.0.0.127 area 1 network
15.0.0.0 0.0.0.255 area 0
! ip
class
less
!
ip flow-export version 9
!
!
access-list 100 permit ip host
192.168.69.2 any access-list 100
permit icmp any 192.168.70.0
0.0.0.127 echo-reply access-list 100
permit icmp any 192.168.73.0
0.0.0.127 echo-reply access-list 100
deny ip 192.168.69.0 0.0.0.255
192.168.70.0 0.0.0.127 access-list
```

100 deny ip 192.168.71.0 0.0.0.127 192.168.70.0 0.0.0.127 access-list 100 deny ip 192.168.69.0 0.0.0.255 192.168.73.0 0.0.0.127 access-list 100 deny ip 192.168.71.0 0.0.0.127 192.168.73.0 0.0.0.127
access-list 100 permit ip any any

line con 0
!
line aux 0
!
line vty 0 4 login
!
!
!
end

BOSTON AREA BORDER ROUTER CONFIGURATION

Router>
Router>EN
Router#sho run Router#sho running-config Building configuration...

Current configuration : 2028 bytes
!
version 12.4 no service timestamps log datetime msec no service timestamps debug datetime msec no service password-encryption
!
hostname Router
!
!
!
!
!
!
!
!
!
no ip cef no ipv6 cef
!
!
!
!
!
!
!
!
!
!
!
spanning-tree mode pvst
!
!
!
!
!
!
interface FastEthernet0/0
ip address 15.0.0.1 255.255.255.0 duplex auto speed auto
!
interface FastEthernet0/1
ip address 16.0.0.1 255.255.255.0 duplex auto speed auto
!
interface Ethernet0/2/0 no ip address duplex auto speed auto shutdown
!
interface Ethernet0/3/0 no ip address duplex auto speed auto shutdown
!
interface Serial1/0
no ip address

encapsulation frame-relay
!
interface Serial1/0.102 point-to-point
bandwidth 64 ip address 10.0.0.1
255.255.255.0 frame-relay interface-dlci
102 clock rate 2000000
!
interface Serial1/0.103 point-to-point
bandwidth 64 ip address 10.0.1.1
255.255.255.0 frame-relay interface-dlci
103 clock rate 2000000
!
interface Serial1/0.104 point-to-point
bandwidth 64 ip address 10.0.2.1
255.255.255.0 frame-relay interface-dlci
104 clock rate 2000000
!
interface Serial1/0.105 point-to-point bandwidth
64 ip address 10.0.3.1 255.255.255.0 frame-
relay interface-dlci 105 clock rate 2000000
!
interface Serial1/1 no ip
address clock rate 2000000
shutdown
!
interface Serial1/2 no ip
address clock rate 2000000
shutdown
!
interface Serial1/3 no ip
address clock rate 2000000
!
interface Serial1/4 no ip
address clock rate 2000000
!
interface Serial1/5 no ip
address clock rate 2000000
!
interface Serial1/6 no ip
address clock rate 2000000
!
interface Serial1/7 no ip
address clock rate 2000000
. !
interface
Vlan1 no
ip
address
shutdow
n
!
router ospf 1 log-
adjacency-changes
network 10.0.0.0 0.0.0.255
area 0 network 10.0.1.0
0.0.0.255 area 0 network
10.0.2.0 0.0.0.255 area 0
network 10.0.3.0 0.0.0.255
area 0 network 15.0.0.0
0.0.0.255 area 0 network
16.0.0.0 0.0.0.255 area 0
! ip
class
less
!
ip flow-export version 9
!
!
!
!
!
!
!
!
!
line con 0
!
line aux 0
!
line
vty
0 4
logi
n
!
!
!
end

MUMBAI ABR CONFIGURATION

Router>
Router>en
Router#show run Router#show running-config Building configuration...

Current configuration : 1570 bytes
!
version 12.4 no service timestamps log datetime msec no service timestamps debug datetime msec no service password-encryption
!
hostname Router
!
!
!
!
!
!
!
!
no ip cef no ipv6 cef
!
!
!
!
!
!
!
!
!
!
!
!
!
spanning-tree mode pvst
!
!
!
!
!
interface FastEthernet0/0
ip address 17.0.0.1 255.255.255.0 duplex auto speed auto
!
interface FastEthernet0/1 ip address 18.0.0.1 255.255.255.0 duplex auto speed auto
!
interface Serial0/0/0 bandwidth 64 no ip address encapsulation frame-relay clock rate 2000000
!
interface Serial0/0/0.201 point-to-point bandwidth 64 ip address 10.0.0.2 255.255.255.0 frame-relay interface-dlci 201 clock rate 2000000
!
interface Serial0/0/0.203 point-to-point bandwidth 64 ip address 11.0.0.1 255.255.255.0 frame-relay interface-dlci 203 clock rate 2000000
!
interface Serial0/0/0.204 point-to-point bandwidth 64 ip address 11.0.1.1 255.255.255.0 frame-relay interface-dlci 204 clock rate 2000000
!
interface Serial0/0/0.205 point-to-point bandwidth 64 ip address 11.0.2.1 255.255.255.0 frame-relay interface-dlci 205 clock rate 2000000
!

!

interface Serial0/0/1
no ip address clock rate
2000000 shutdown
interface Vlan1
no ip address
shutdown
!
router ospf 1 log-adjacency-
changes network 10.0.0.0 0.0.0.255
area 0 network 11.0.0.0 0.0.0.255
area 0 network 11.0.1.0 0.0.0.255
area 0 network 11.0.2.0 0.0.0.255
area 0 network 17.0.0.0 0.0.0.255
area 0 network 18.0.0.0 0.0.0.255
area 0
!

MUMBAI AREA ROUTER CONF

Router>
Router>en
Router#copy
Router#copy run Router#copy
running-config % Incomplete
command.
Router#copy running-config sta Router#copy
running-config startup-config Destination
filename [startup-config]?
Building configuration...
[OK]
Router#

Router con0 is now available

Press RETURN to get started.

Router>
Router>EN
Router#sho
Router#show run
Router#show running-config
Building configuration...

Current configuration : 1975 bytes
!
version 12.4 no service timestamps log
datetime msec no service timestamps
debug datetime msec no service
password-encryption
!
hostname Router
!
!
!
!
!
!
!

!

```
! ip cef no
ipv6 cef
!
!
!
!
!
!
!
!
!
!
!
spanning-tree mode pvst
!
!
!
!
!
!
!
interface FastEthernet0/0 no ip
address duplex auto speed auto
!
interface FastEthernet0/0.1 encapsulation
dot1Q 10 ip address 192.168.72.4
255.255.255.0 ip helper-address 192.168.69.2
ip access-group 100 in standby 1 ip
192.168.72.1 standby 1 priority 115 standby 1
preempt standby preempt standby 0 timers 2 6
!
interface FastEthernet0/0.2 encapsulation
dot1Q 20 ip address 192.168.73.4
255.255.255.0 ip helper-address 192.168.69.2
ip access-group 100 in standby 1 ip
192.168.73.1 standby 1 priority 115 standby 1
preempt standby preempt
!
interface FastEthernet0/0.3 encapsulation
dot1Q 30 native ip address 192.168.74.4
255.255.255.0 ip helper-address 192.168.69.2
ip access-group 100 in standby 1 ip
192.168.74.1 standby 1 priority 115
standby 1 preempt standby preempt
!
interface FastEthernet0/1 ip
address 17.0.0.2 255.255.255.0
duplex auto speed auto
!
interface
Vlan1 no ip
address
shutdown
!
router ospf 1 log-adjacency-changes
network 192.168.72.0 0.0.0.255
area 2 network 192.168.73.0
0.0.0.127 area 2 network
192.168.74.0 0.0.0.127 area 2
network 17.0.0.0 0.0.0.255 area 0
! ip
classless
!
ip flow-export version 9
!
!
access-list 100 permit ip host
192.168.72.2
any access-list 100 permit icmp
any 192.168.70.0 0.0.0.127 echo-
reply access-list 100 permit icmp
any 192.168.73.0 0.0.0.127 echo-
reply access-list 100 deny ip
192.168.72.0 0.0.0.255
192.168.70.0 0.0.0.127 access-list
100 deny ip 192.168.74.0
0.0.0.127 192.168.70.0 0.0.0.127
access-list 100 deny ip
192.168.72.0 0.0.0.255
192.168.73.0 0.0.0.127 access-list
100 deny ip 192.168.74.0
0.0.0.127 192.168.73.0 0.0.0.127
access-list 100 permit ip any any
!
!
!
!
```

!
!
!
line con 0
!
line aux 0

!

line vty 0 4 login
!
!
!
end

BEIJING ROUTER CONF

Current configuration : 2032 bytes
!
version 15.1 no service timestamps log datetime msec no service timestamps debug datetime msec no service password-encryption
!
hostname Router
!
!
!
!
!
!
!
!
no ip cef no
ipv6 cef
!
!
!
!
license udi pid CISCO2911/K9 sn FTX15243294-
!
!
!
!
!
!
!
!
!
!
!
!
spanning-tree mode pvst
!
!
!
!
!
!
interface GigabitEthernet0/0
no ip address ip helper-address 192.168.72.2 duplex auto speed auto
!
interface GigabitEthernet0/0.1
encapsulation dot1Q 10 ip address 192.168.75.1 255.255.255.0 ip helper-address 192.168.72.2
!
interface GigabitEthernet0/0.2
encapsulation dot1Q 20 native ip address 192.168.76.1 255.255.255.0
ip helper-address 192.168.72.2
!
interface GigabitEthernet0/1 no ip address duplex auto speed auto
!
interface GigabitEthernet0/2 no ip address duplex auto speed auto
!
interface GigabitEthernet0/0/0 no ip address shutdown
!
interface Serial0/1/0 bandwidth 64 no ip address encapsulation frame-relay clock rate 2000000
!

interface Serial0/1/0.301 point-to-point bandwidth 64 ip address 10.0.1.2 255.255.255.0 frame-relay interface-dlci 301
clock rate 2000000
!
interface Serial0/1/0.302 point-to-point bandwidth 64 ip address 11.0.0.2 255.255.255.0 frame-relay interface-dlci 302
clock rate 2000000
!
interface Serial0/1/0.304 point-to-point bandwidth 64 ip address 12.0.0.1 255.255.255.0 frame-relay interface-dlci 304
clock rate 2000000
!
interface Serial0/1/0.305 point-to-point bandwidth 64 ip address 12.0.1.1 255.255.255.0 frame-relay interface-dlci 305
clock rate 2000000
!
interface Serial0/1/1 no ip address clock rate 2000000
shutdown
!
interface Vlan1 no ip address shutdown
!
router ospf 1 log-adjacency-changes network 10.0.1.0 0.0.0.255 area 0 network 11.0.0.0 0.0.0.255 area 0 network 12.0.0.0 0.0.0.255 area 0 network 12.0.1.0 0.0.0.255 area 0 network 192.168.75.0 0.0.0.255 area 3 network 192.168.76.0 0.0.0.255 area 3
! ip classless !
ip flow-export version 9
!
!
!
no cdp run
!
!
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
login
!
!
!
en
d

LONDON ROUTER CONFIGURATION

Router>
Router>
Router>EN
Router#SHOW RUN
Router#SHOW RUNning-config
Building configuration...

Current configuration : 2481 bytes
!
version 15.1 no service timestamps log datetime msec no service timestamps debug datetime msec no service password-encryption
!
hostname Router
!
!
!
!
!
!
!
!
no ip cef
no ipv6 cef
!
!
!

```
!
license udi pid CISCO2911/K9 sn FTX152435AI-
!
!
!
!
!
!
!
!
!
!
!
spanning-tree mode pvst
!
!
!
!
!
!
interface GigabitEthernet0/0 no ip address duplex auto speed auto
!
interface GigabitEthernet0/0.1 encapsulation dot1Q 10 ip address 192.168.77.1 255.255.255.0 ip helper-address 192.168.72.2 ip access-group 100 in
!
interface GigabitEthernet0/0.2 encapsulation dot1Q 20 native ip address 192.168.78.1 255.255.255.0 ip helper-address 192.168.72.2 ip access-group 100 in
!
interface GigabitEthernet0/1 no ip address duplex auto speed auto
!
interface GigabitEthernet0/2 no ip address duplex auto speed auto shutdown
!
interface Serial0/0/0 bandwidth 64 no ip address encapsulation frame-relay clock rate 2000000
!
interface Serial0/0/0.401 point-to-point bandwidth 64 ip address 10.0.2.2 255.255.255.0 frame-relay interface-dlci 401 clock rate 2000000
!
interface Serial0/0/0.402 point-to-point bandwidth 64 ip address 11.0.1.2 255.255.255.0 frame-relay interface-dlci 402 clock rate 2000000
!
interface Serial0/0/0.403 point-to-point bandwidth 64 ip address 12.0.0.2 255.255.255.0 frame-relay interface-dlci 403 clock rate 2000000
!
interface Serial0/0/0.405 point-to-point bandwidth 64 ip address 13.0.0.1 255.255.255.0 frame-relay interface-dlci 405 clock rate 2000000
!
interface Serial0/0/1 no ip address clock rate 2000000 shutdown
!
interface Vlan1 no ip address shutdown
!
router ospf 1 log-adjacency-changes network 192.168.77.0 0.0.0.255 area 4 network 192.168.78.0 0.0.0.255 area 4
network 13.0.0.0 0.0.0.255 area 0
network 10.0.2.0 0.0.0.255 area 0
```

```
network 11.0.1.0 0.0.0.255 area 0
network 12.0.0.0 0.0.0.255 area 0
! ip classless !
ip flow-export version 9
!
!
access-list 100 permit ip host 192.168.72.2
any access-list 100 permit icmp any
192.168.70.0 0.0.0.127 echo-reply
access-list 100 permit icmp any
192.168.73.0 0.0.0.127 echo-reply
access-list 100 deny ip 192.168.77.0
0.0.0.255 192.168.70.0 0.0.0.127
access-list 100 deny ip 192.168.78.0
0.0.0.255 192.168.70.0 0.0.0.127
access-list 100 deny ip 192.168.77.0
0.0.0.255 192.168.73.0 0.0.0.127
access-list 100 deny ip 192.168.78.0
0.0.0.255 192.168.73.0 0.0.0.127
access-list 100 permit ip any any
!
!
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
login
!
!
!
en
d
```

Conclusion

Thus an enterprise network was built successfully with cisco packet tracer implementing various network protocols and output was tested successfully

References:

- https://www.youtube.com/user/danscourses
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- https://www.youtube.com/watch?v=lLnilT_WOmI
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