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Computer Communication and Networks

[BECE401L] - C1+TC1 - Dr. Markkandan S

Digital Assignment 1

Cisco Packet Tracer Based Applications

#3 - Multi-Branch Office Connectivity

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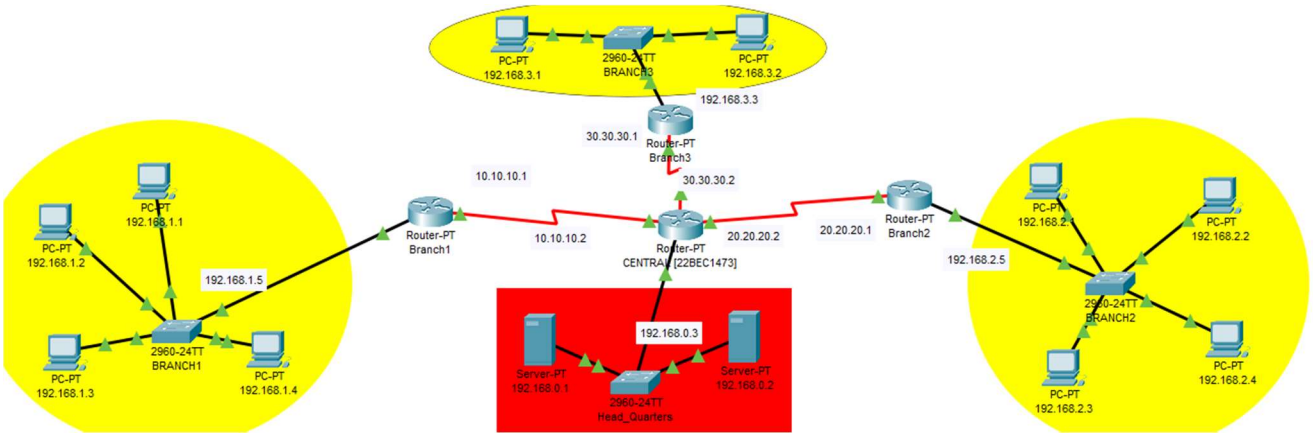
NETWORK TOPOLOGY



NETWORK REQUIREMENTS:

- Layer Two Switches
- Routers with Serial Ports [adjustable clock speed] and Ethernet
- Front End devices at each branch
- Servers at Head Quarters
- Ethernet and Serial Connection
- Open Shortest Path Routing (OSPF) for routing across branches

DESIGN DECISIONS:

- The “Router on a Stick” design practice has been adopted for inter VLAN routing instead of legacy Inter VLAN routing which requires additional links to be established.
- Using single wild area (OSPF area ie: area 0) for all the branches enables simplified configuration and management, no requirement for inter-area summarization and faster coverage over all branch with trade off to decrease in Isolation between branches.

IMPLEMENTATION DETAILS

1. Number of Departments : 2 [Production and Marketing]
2. Number of Branches :3
   Containing
   - A layer 2 switch
   - A router
   - End Devices
3. A head office containing servers for each department with central router connected with all branches in Start Topology
4. Subnets for each branch as well as each router-router Interface.

CLI COMMANDS

General command for router configuration

```
Router>enable
Router#configure terminal
```

BRANCH 1

```
Router(config)#router ospf 1
Router(config-router)#network 192.168.1.0 0.0.0.255 area 0
Router(config-router)#network 10.10.10.0 0.255.255.255 area 0
```

BRANCH 2

```
Router(config)#router ospf 2
Router(config-router)#network 192.168.2.0 0.0.0.255 area 0
Router(config-router)#network 20.20.20.0 0.255.255.255 area 0
```

BRANCH 3

```
Router(config)#router ospf 3
Router(config-router)#network 192.168.3.0 0.0.0.255 area 0
Router(config-router)#network 30.30.30.0 0.255.255.255 area 0
```

HQ

```
Router(config)#router ospf 4
Router(config-router)#network 192.168.0.0 0.0.0.255 area 0
Router(config-router)#network 10.10.10.0 0.255.255.255 area 0
Router(config-router)#network 20.20.20.0 0.255.255.255 area 0
Router(config-router)#network 30.30.30.0 0.255.255.255 area 0
```

FINISHING OSPF

```
Router(config-router)#end
```

SAVING AS STARTUP CONFIG

```
Router#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
```

VLANs

---PRODUCTION: 20

---MARKETTING: 30

VLAN Configuration in each switch

```
Switch(config-if)#int fa 0/1
Switch (config-if)#description ###Connected-To-PC1-VLAN20###
Switch (config-if)#switchport mode access
Switch (config-if)#switchport access vlan 20


Switch(config-if)#int fa 0/2
Switch (config-if)#description ###Connected-To-PC3-VLAN20###
Switch (config-if)#switchport mode access
Switch (config-if)#switchport access vlan 20


Switch(config-if)#int fa 0/3
Switch (config-if)#description ###Connected-To-PC3-VLAN30###
Switch (config-if)#switchport mode access
Switch (config-if)#switchport access vlan 30


Switch(config-if)#int fa 0/4
Switch (config-if)#description ###Connected-To-PC4-VLAN30###
Switch (config-if)#switchport mode access
Switch (config-if)#switchport access vlan 30


Switch(config-if)#int fa 0/5
Switch (config-if)#switchport mode trunk
```

The access ports are confined to VLAN whereas the trunk ports could allow access of all VLANs that has been trunked. The trunked ports allow Inter-VLAN Routing.

RESULTS:

OSPF config

Branch: 1

```
Router#show ip route ospf
O    20.0.0.0 [110/128] via 10.10.10.2, 00:28:20, Serial2/0
O    30.0.0.0 [110/128] via 10.10.10.2, 00:28:02, Serial2/0
O    192.168.0.0 [110/65] via 10.10.10.2, 00:27:30, Serial2/0
O    192.168.2.0 [110/129] via 10.10.10.2, 00:28:20, Serial2/0
O    192.168.3.0 [110/129] via 10.10.10.2, 00:27:52, Serial2/0
```

Branch: 2

```
Router#show ip route ospf
O    10.0.0.0 [110/128] via 20.20.20.2, 00:29:20, Serial2/0
O    30.0.0.0 [110/128] via 20.20.20.2, 00:28:56, Serial2/0
O    192.168.0.0 [110/65] via 20.20.20.2, 00:28:24, Serial2/0
O    192.168.1.0 [110/129] via 20.20.20.2, 00:29:20, Serial2/0
O    192.168.3.0 [110/129] via 20.20.20.2, 00:28:46, Serial2/0
```

Branch: 3

```
Router#show ip route ospf
O    10.0.0.0 [110/128] via 30.30.30.2, 00:29:26, Serial2/0
O    20.0.0.0 [110/128] via 30.30.30.2, 00:29:26, Serial2/0
O    192.168.0.0 [110/65] via 30.30.30.2, 00:29:03, Serial2/0
O    192.168.1.0 [110/129] via 30.30.30.2, 00:29:26, Serial2/0
O    192.168.2.0 [110/129] via 30.30.30.2, 00:29:26, Serial2/0
```

HQ

```
Router#show ip route ospf
O    192.168.1.0 [110/65] via 10.10.10.1, 00:31:28, Serial2/0
O    192.168.2.0 [110/65] via 20.20.20.1, 00:30:55, Serial3/0
O    192.168.3.0 [110/65] via 30.30.30.1, 00:30:22, Serial6/0
```

VLAN config

```
Switch#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
20   PRODUCTION                       active    Fa0/1, Fa0/2
30   MARKETTING                       active    Fa0/3, Fa0/4
1002 fddi-default                     active
1003 token-ring-default               active
1004 fddinet-default                  active
1005 trnet-default                    active
```

Trunked ports

```
Switch#show interfaces trunk
Port        Mode         Encapsulation  Status        Native vlan
Fa0/5       on           802.1q         trunking      1

Port        Vlans allowed on trunk
Fa0/5       1-1005

Port        Vlans allowed and active in management domain
Fa0/5       1,20,30

Port        Vlans in spanning tree forwarding state and not pruned
Fa0/5       1,20,30
```

CONNECTIVITY TEST using “ping”:

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.0.1

Pinging 192.168.0.1 with 32 bytes of data:

Reply from 192.168.0.1: bytes=32 time=1ms TTL=126
Reply from 192.168.0.1: bytes=32 time=1ms TTL=126
Reply from 192.168.0.1: bytes=32 time=1ms TTL=126
Reply from 192.168.0.1: bytes=32 time=14ms TTL=126

Ping statistics for 192.168.0.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 14ms, Average = 4ms
```

Pinging HQ from branch

```
Cisco Packet Tracer SERVER Command Line 1.0
C:\>ping 192.168.1.1

Pinging 192.168.1.1 with 32 bytes of data:

Reply from 192.168.1.1: bytes=32 time=1ms TTL=126
Reply from 192.168.1.1: bytes=32 time=2ms TTL=126
Reply from 192.168.1.1: bytes=32 time=13ms TTL=126
Reply from 192.168.1.1: bytes=32 time=1ms TTL=126

Ping statistics for 192.168.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 13ms, Average = 4ms
```

Pinging Branch from HQ

PDU TEST for DIFFERENT LINKS ACROSS BRANCHES

PDU List Window

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num
	Successful	192.168.1.1	192.168.0.1	ICMP		0.000	N	0
	Successful	192.168.3.1	192.168.0.1	ICMP		0.000	N	1
	Successful	192.168.2.1	192.168.0.2	ICMP		0.000	N	2
	Successful	192.168.0.1	192.168.1.1	ICMP		0.000	N	3
	Successful	192.168.0.1	192.168.2.1	ICMP		0.000	N	4
	Successful	192.168.0.2	192.168.3.2	ICMP		0.000	N	5