PROJECT

ENTERPRISE NETWORK

DEVICES AND TECHNOLOGIES

The devices used in the configuration of the Enterprise Network are :

- *Router* – 3 routers are used in this network, where the first one is dedicated to network A & B, the second one to network C and the third one is used to route the whole Enterprise network together to the ISP router. Network D is attached to the third router. An additional ISP router is also shown in the network to denote the internet provided by ISP.
- *Switch* – 4 switches have been used in this network, where two are dedicated to establish the multi-switch VLAN networks A & B, one switch is used in network C and the last one is used in network D.
- *DHCP Server* – 2 DHCP servers are used, one for networks A & B and another in network C, for dynamic allocation of IP addresses in the said networks.
- *Web & FTP Server* – 1 combined Web & FTP server has been used in network D to allow HTTP access and FTP access to the whole network.
- *DNS Server* – 1 DNS server has been used in the whole network, in network D to allow naming of website instead of accessing the Web Server by IP address.

The technologies used in the configuration of the Enterprise Network are :

- *Variable Length Subnet Mask* – VLSM is applied here to distribute the provided IP address of 202.195.32.0/24 into varied number of hosts in various networks and links. The link between Enterprise Router and ISP Router is not included in this subnet scheme and a different IP has been used.
- *Virtual LAN* – VLAN has been used to create virtual network A & B. Subsequent Inter-VLAN Routing is done using 'Router-on-a-stick' inter-VLAN routing technique.
- *Dynamic Host Configuration Protocol* – DHCP has been employed for dynamic allocation of IP addresses in A, B & C networks. Network D uses static IP.
- *Open Shortest Path First* – OSPF has been used for dynamic routing within the enterprise network and ISP router is connected via default routing.
- *Domain Name System* – DNS server is used to configure DNS to allow naming of website instead of accessing using IP address.
- *Access Control List* – ACLs have been used in routers of network A, B & C to restrict the hosts of the respective networks in ways as directed in the project features.

PROJECT METHODOLOGY

The project has been accomplished in a step-by-step process, fulfilling requirements of the project one by one. Firstly, the variable length subnetting scheme is planned out before even placing the various devices in the logical layout. The variable length subnet mask is designed as such :

IP address range provided – 202.195.32.0/24

Network C – 60 hosts needed. So $\log_2 60$ bits are used in subnet, i.e. $5.9 \approx 6$.

IP addresses allotted : 202.195.32.00 000000/26

Hence *202.195.32.0 to 202.195.32.63*

Network A – 30 hosts needed. So $\log_2 30$ bits are used in subnet, i.e. $4.9 \approx 5$.

IP addresses allotted : 202.195.32.010 00000/27

Hence *202.195.32.64 to 202.195.32.95*

Network B – 30 hosts needed. So $\log_2 30$ bits are used in subnet, i.e. $4.9 \approx 5$.

IP addresses allotted : 202.195.32.011 00000/27

Hence *202.195.32.96 to 202.195.32.127*

Network D – 12 hosts needed. So $\log_2 12$ bits are used in subnet, i.e. $3.58 \approx 4$.

IP addresses allotted : 202.195.32.1000 0000/28

Hence *202.195.32.128 to 202.195.32.143*

Link SL_1 – 2 bits are used in subnet.

IP addresses allotted : 202.195.32.100100 00/30

Hence *202.195.32.144 to 202.195.32.147*

Link SL_2 – 2 bits are used in subnet.

IP addresses allotted : 202.195.32.100101 00/30

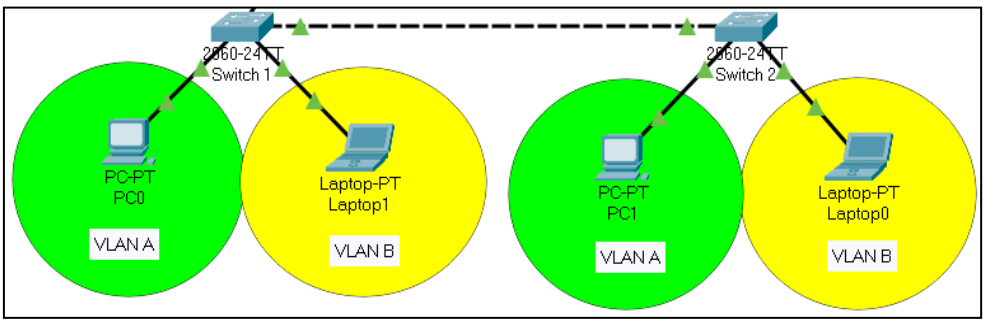
Hence *202.195.32.148 to 202.195.32.151*

Link SL_3 – 2 bits are used in subnet.

IP addresses allotted : 202.195.32.100110 00/30

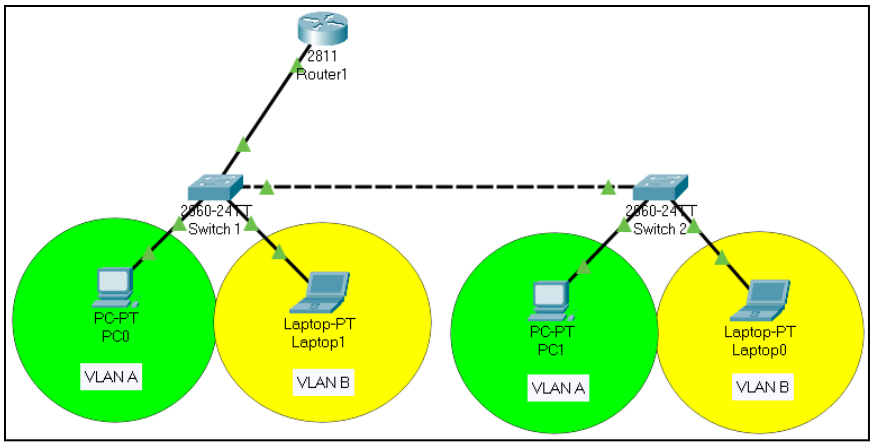
Hence *202.195.32.152 to 202.195.32.155*

After this scheme has been decided, all the networks are laid out one by one. Virtual LANs A and B are configured using Switches 1 and 2 and a trunk link for maintaining communication between VLANs distributed across the two switches.

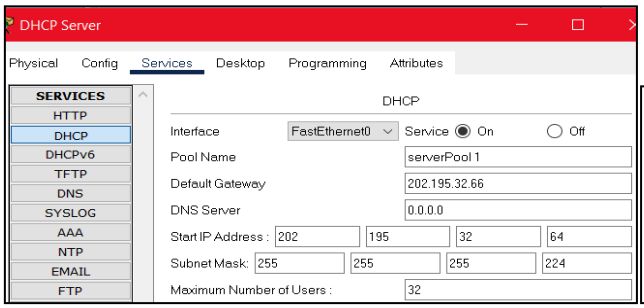


All the CLI commands used to configure VLAN A, VLAN B and the trunk links are provided in the appendix.

At this juncture, the VLANs A & B can communicate within themselves but the inter-VLAN communication is still not possible. It is setup using the 'Router-on-a-stick' inter-VLAN routing technique where a router is connected to one of the switches to create a common trunk link through which the router shall allow packets to pass from one VLAN to another.

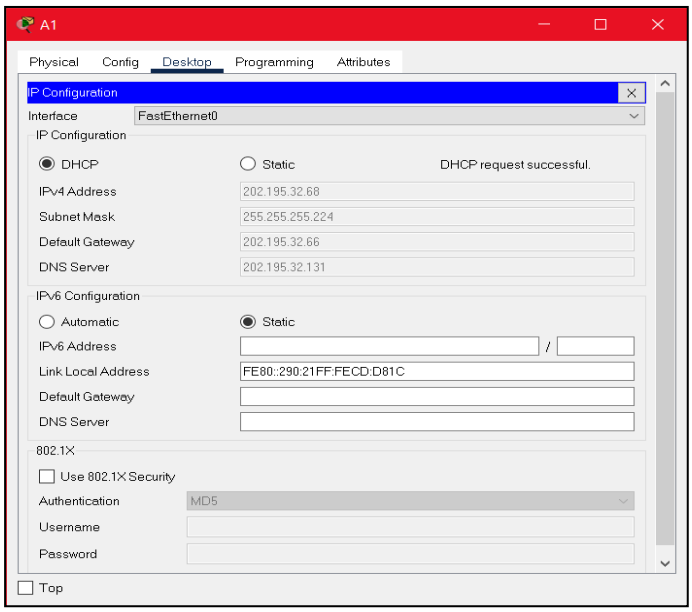


However, some CLI code needs to be configured on the concerned router to allow inter-VLAN routing, which has been provided in the appendix. After this step, DHCP Server is attached to switch 2 here and the dynamic allocation of IP addresses in networks A & B are configured as follows :

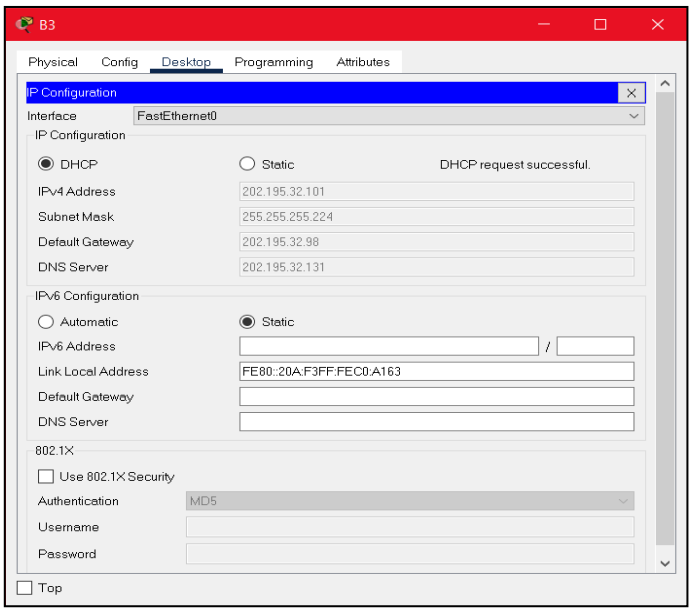


Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max User	TFTP Server	WLC Address
serverPool 2	202.195.32.98	0.0.0.0	202.195.32.96	255.255.255.224	32	0.0.0.0	0.0.0.0
serverPool 1	202.195.32.66	0.0.0.0	202.195.32.64	255.255.255.224	32	0.0.0.0	0.0.0.0
serverPool	0.0.0.0	0.0.0.0	202.195.32.64	255.255.255.224	255	0.0.0.0	0.0.0.0

The two serverpools, serverPool 1 with gateway *202.195.32.66* and serverPool 2 with gateway *202.195.32.98* created here serve the networks A & B respectively. The dynamic allocation of IP addresses is successful as shown in the IP configuration tab of these computers.

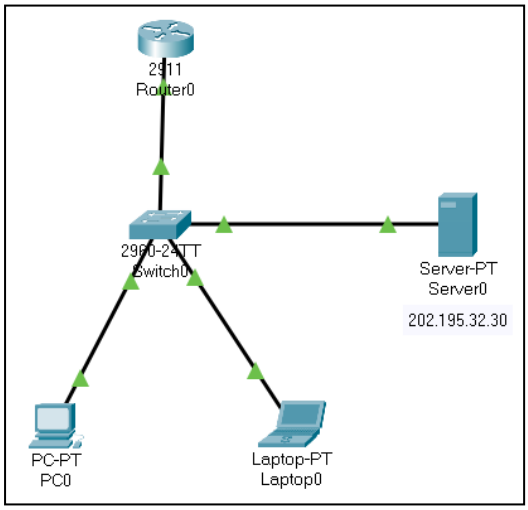


PC from Network A

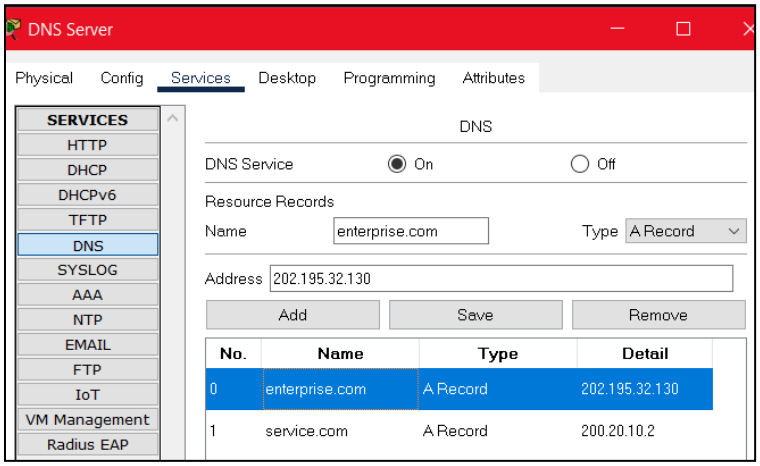


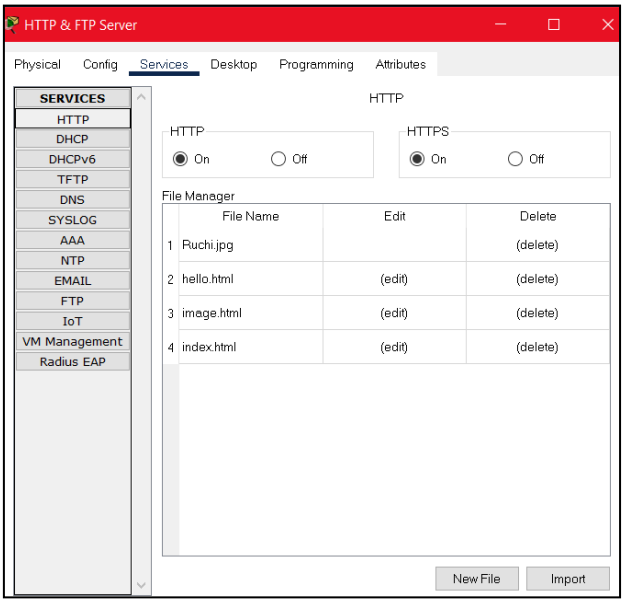
Laptop from Network B

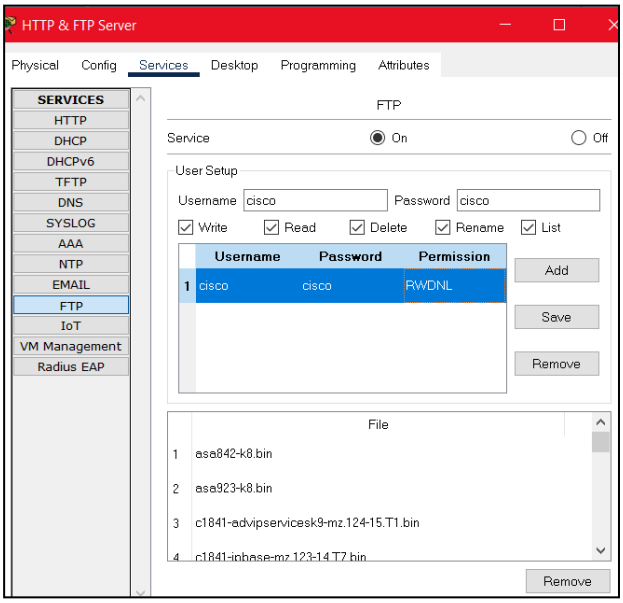
Now, network C which is a physical network, is created with a switch, a router, a PC, a laptop and a DHCP server. The router is used here to later connect to the router of networks A & B and the Enterprise router (configured later), and also to provide a default gateway to network C. Dynamic allocation of addresses is also required here and the DHCP server has been configured in the same way as in the previous networks. The network is formed as such :



Next, network D is constructed with the Enterprise router, a switch, two servers and a laptop. The servers are converted, one to a DNS server and another to a HTTP & FTP combined server. The configuration in each of them is easy and illustrated below :



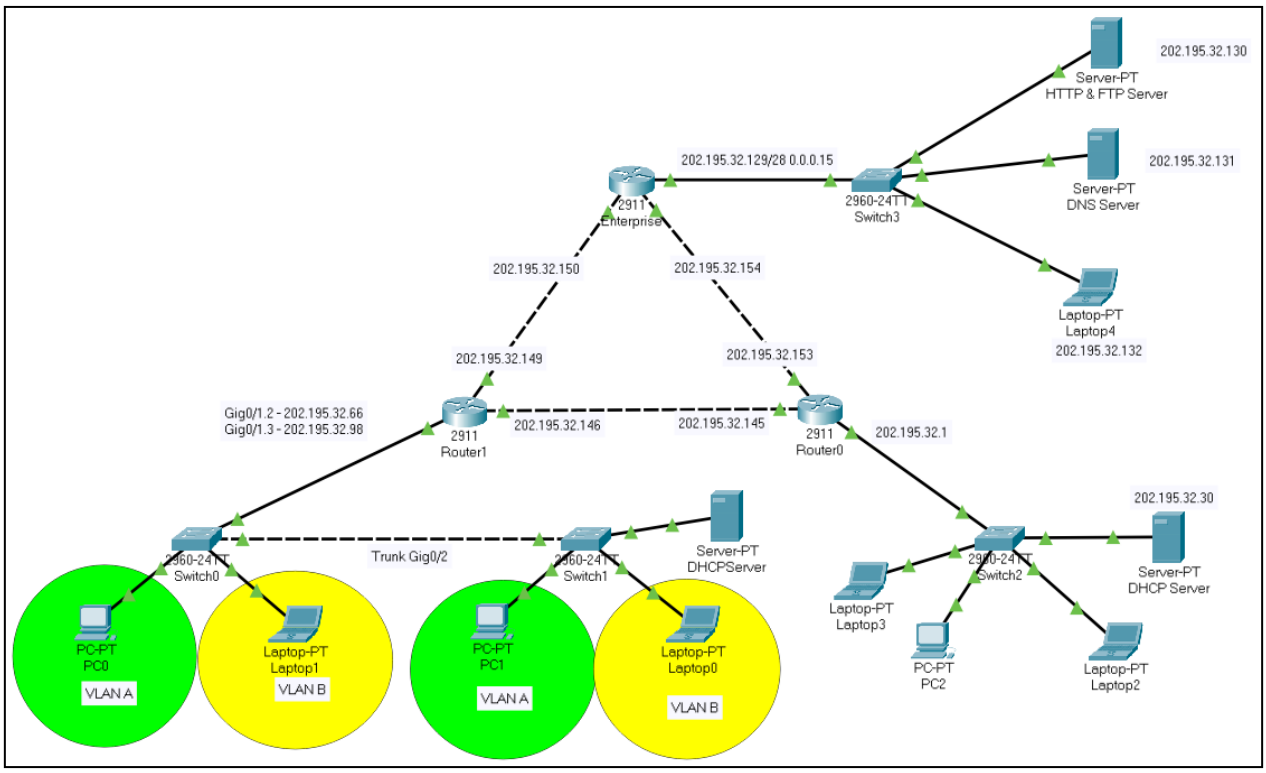




Here in network D, static IP addresses have been used unlike the previous three networks. This is done so because the IP addresses of the servers need to be static for accessing the HTTP & FTP server to access internet and share files. Also the DNS server is needed to resolve IP address of other servers into domain names.

Now, the four networks have to be routed together to share information (packets) with each other. The routers are connected to each other by the links SL_1, SL_2 & SL_3. The OSPF protocol is chosen for dynamic routing within the Enterprise Network and it is configured in the each of the routers some CLI commands, provided in the appendix.

Upto this point, the network had the logical layout as below, and all of the networks can send & receive packets from each other.



Finally, the network is connected to ISP router which has a web (HTTP) server connected to it. The ISP connection is made to the Enterprise Router using Serial link because the Ethernet ports had been used already to connect to all the previous networks. The Enterprise network is default routed to the ISP router to send all packets which are sent to IP addresses unavailable in the Enterprise Network.

Finally, the restrictions on the hosts of networks A, B & C are imposed through access control lists. The ACLs are configured to the interface of the routers these networks are connected to. In VLAN A, restricting it to its network might lead it to not even communicating with the DHCP server for dynamic IP allocation. As a result the ACL is tweaked to accommodate the DHCP server. All CLI commands relating to ACL configuration are given in the appendix.