CAMPUS NETWORK DESIGN

A large University consists of two campuses situated 20 miles apart. The university's students and staff are distributed in 4 faculties; these include the faculties of Health and Sciences, Business, Engineering/Computing and Art/Design. Each member of staff has a PC and students have access to PCs in the labs.

Requirements:

(1). Create a network topology with the main components to support the following:

- Main Campus:
    - Building A: Administrative Staff in the departments of management, HR and finance. The admin staff PCs are distributed in the building offices and it is expected that they will share some networking equipment. The Faculty of Business is also situated in this building.
    - Building B: Faculty of Engineering and COmputing and Faculty of Art and Design.
    - Building C: Students' labs and IT department. The IT department hosts the University Web server and other servers.
    - There is also an email server hosted externally on the cloud.
- Branch Campus:
    - Faculty of Health and Sciences (staff and students' labs are situated on separate floors.)

(2). We are expected to configure the core devices and a few end devices to provide end-to-end connectivity and access to the internal servers and the external server.

- Each department/faculty is expected to be on its own separate IP network.
- The switches should be configured with appropriate VLANs and security settings.
- RIPv2 will be used to provide routing for the routers in the internal network and static routing for the external server.
- The devices in building A will be expected to acquire dynamic IP addresses from a router-based DHCP server.

Design

(1).The Hierarchical network design model has been employed for designing the required network. It consists of the Access Layer, the Distribution Layer and the Core Layer.

(2). Taking into consideration the two campuses, the number of buildings in each campus and the total number of departments in each building, we plan our network design following the hierarchical network design model.

(3). The Main Campus consists of 3 buildings - A, B and C.
Building A consists of 4 departments:

(1). Administrator dept.
(2). HR.
(3). Finance and
(4). Business.

(1). Therefore, in order to implement the four departments in this particular building, we would define 4 subnetworks, representing the respective departments.

(2). At maximum, let us assume that the maximum number of hosts that would be required to be accommodated within a particular subnetwork (department) is 254 hosts.
Having this assumption, we may easily choose to go with a class C network having the network prefix length of 24 bits or 254 total possible host addresses. Each Layer 2 Switch can accommodate 24 end hosts at their FastEthernet interfaces. Multiple Layer 2 switches may be employed in order to accommodate a greater number of host devices.

(3). The same process applies to almost every network across all buildings. The end devices connect to the Layer 2 switches, which in turn connect to Layer 3 switches or Multilayer switches. This Multilayer switch then connects to the Main Campus Router, which in turn establishes connectivity to the Branch Campus Router and the Cloud.
We would require the departments to be separated at Layer 2 logically, therefore, the configuration of every subnetwork into a VLAN is necessary. Otherwise, the traffic originating from a particular department would reach its respective Layer 2 Switch, which would forward the unknown unicast and the broadcast frames out of all interfaces. Ultimately, the frame might end up reaching the L3 switch, which in turn would forward the frame out all interfaces, thereby causing unnecessary network congestion.

Therefore, every subnetwork has been configured as a VLAN and the links between the Layer 3 Switch to the Layer 2 Switches have also been configured to be the access ports so that they do not transmit traffic to different VLANS. All the interfaces from fa0/1-24 are configured to be the access ports belonging to a particular VLAN.

The link between the L3 Switch and the Campus Router is configured as a trunk port in order for it to be able to forward traffic belonging to all the VLANS that are connected in the Access Layer.

MAIN CAMPUS BUILDING:
Building A:

(1). Admin Department - VLAN 10 - Network address 192.168.1.0/24
(2). HR - VLAN 20 - Network address 192.168.2.0/24
(3). FINANCE - VLAN 30 - Network address 192.168.3.0/24
(4). BUSINESS - VLAN 40 - Network address 192.168.4.0/24

Building B:

(5). E&C - VLAN 50 - Network address 192.168.5.0/24
(6). A&D - VLAN 60 - Network address 192.168.6.0/24

Building C:

(7). LAB - VLAN 70 - Network address 192.168.7.0/24

(8). IT DEPT - VLAN 80 - Network address 192.168.8.0/24

The Layer 3 Switch connects to the Main Campus Router. Subinterfaces have been configured on the G0/0 physical interface of the Router as G0/0.10 through G0/0.80

The Router performs inter-VLAN routing and receives traffic from all VLANS across the Main Campus Building. The Router on a Stick concept is being used here (ROAS).
This Router is connected with the Branch Campus Building Router, at the Core layer, which is in turn connected with the Layer 3 Switch in the Distribution Layer, for the Branch Campus.

This L3 switch connects to the Layer 2 switches in the Access Layer providing connections to the end devices in their respective subnetworks/VLANs - the Student Lab and the Staff.

BRANCH CAMPUS:

(1). Staff Department - VLAN 90 - Network address - 192.168.9.0/24

(2). Student LAB - VLAN 100 - Network address - 192.168.10.0/24

The two Campus routers connect using the network 10.10.10.0/30 subnet which provides connectivity for only 2 hosts, and therefore, the two Serial interfaces of the respective Campus routers.

The Branch Campus Router connects to the Router in the Cloud using the network 10.10.10.4/30.

The Routers have been enabled with RIPv2 for providing Dynamic routing services at the Network Layer.
