DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

UNIVERSITY OF MORATUWA

EN2150 - Communication Network Engineering

Network Routing Simulation – OSPF

Group DirectNetz

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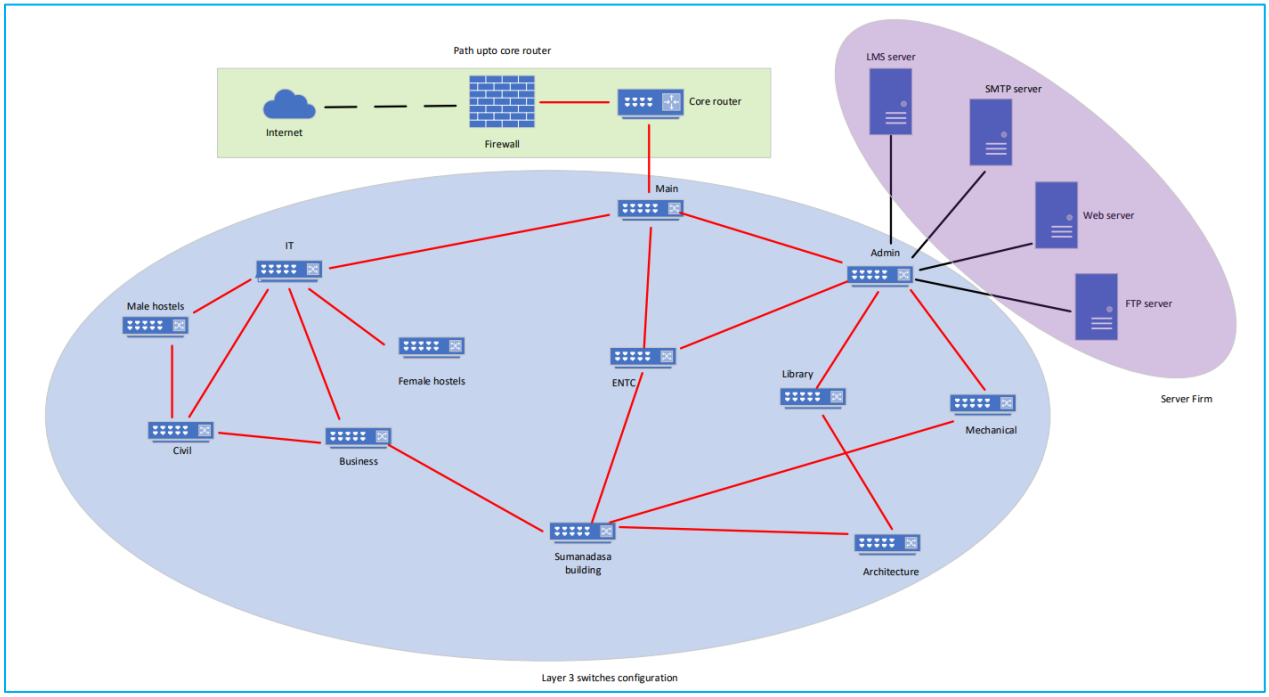
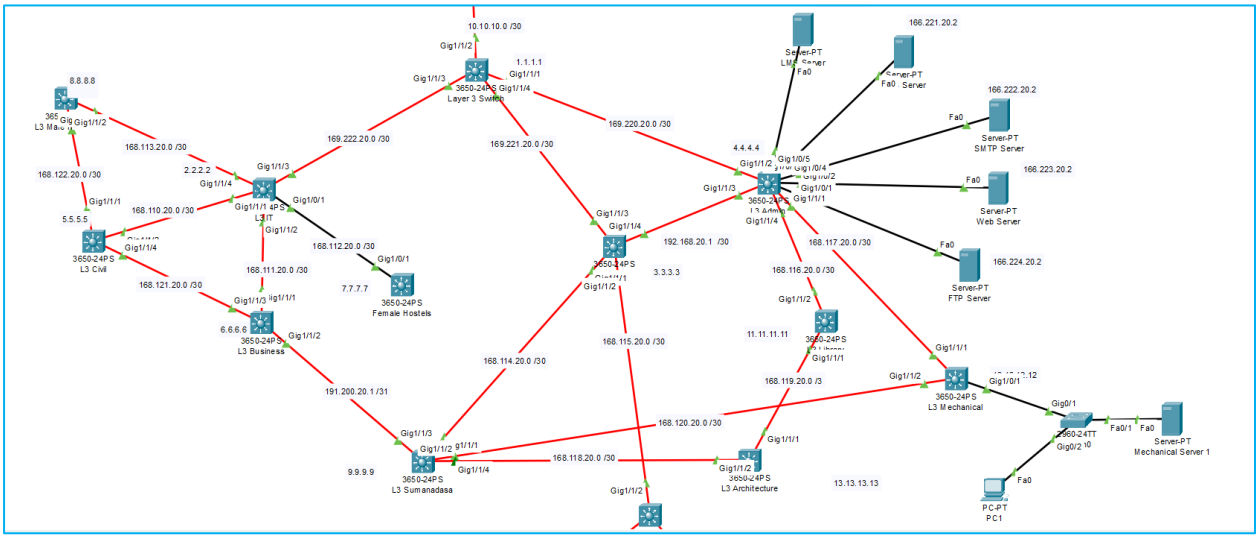
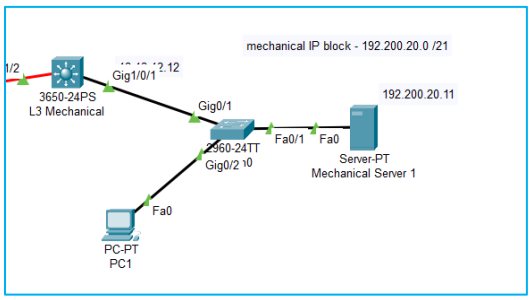
Network Topology for the University of Moratuwa Backbone Network



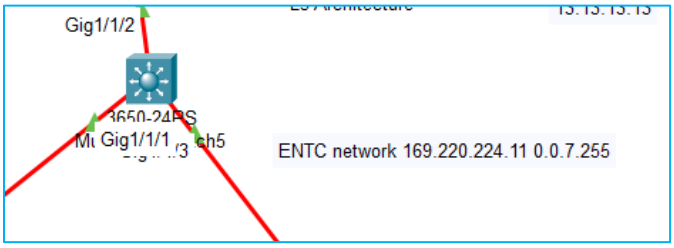
- **Backbone Network:** The backbone network consists of 13 nodes. These nodes form the core infrastructure and are crucial for connecting all departments and other locations where network coverage is required.
- **Topology:** The backbone network uses a combination of star and ring topologies. The star topology might be used for connecting the departments to the backbone, while the ring topology provides redundancy and alternative paths in case of link failures.
- **Redundancy:** Each node in the backbone network has redundancy. This means that even if a link fails between two nodes or other nodes, there are alternative paths available to maintain connectivity and avoid disruptions in the network.
- **Layer 3 Switches:** The backbone nodes are layer 3 switches. Layer 3 switches are capable of performing routing functions, which is essential for allocating subnets and managing traffic efficiently in a large network.
- **Subnet Allocation:** The backbone nodes are responsible for allocating subnets. Subnets are logical divisions of IP address ranges, and each department/division is connected to the backbone through a separate layer 3 switch, which helps manage IP address assignments within each department.
- **Department Connectivity:** All departments and divisions in the organization are connected to the backbone network. Some smaller departments with fewer IP allocations may share the same backbone layer 3 switch for connectivity.

Backbone Network Implementation on Packet Tracer

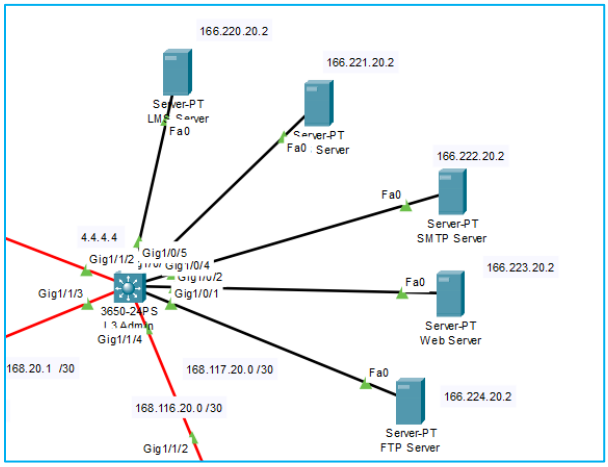




Department of Mechanical Engineering



ENTC Network



Server Firm

OSPF Configuration

```
00:00:45: %OSPF-5-ADJCHG: Process 1, Nbr 9.9.9.9 on GigabitEthernet1/1/1 from LOADING to FULL, Loading Done

00:00:45: %OSPF-5-ADJCHG: Process 1, Nbr 4.4.4.4 on GigabitEthernet1/1/4 from LOADING to FULL, Loading Done

00:00:45: %OSPF-5-ADJCHG: Process 1, Nbr 1.1.1.1 on GigabitEthernet1/1/3 from LOADING to FULL, Loading Done

00:00:45: %OSPF-5-ADJCHG: Process 1, Nbr 10.10.10.10 on GigabitEthernet1/1/2 from LOADING to FULL, Loading Done
```

ENTC Routing Table

```
Gateway of last resort is not set

     166.220.0.0/30 is subnetted, 1 subnets
O       166.220.20.0 [110/2] via 192.168.20.2, 00:45:14, GigabitEthernet1/1/4
     166.221.0.0/30 is subnetted, 1 subnets
O       166.221.20.0 [110/2] via 192.168.20.2, 00:45:14, GigabitEthernet1/1/4
     166.222.0.0/30 is subnetted, 1 subnets
O       166.222.20.0 [110/2] via 192.168.20.2, 00:45:14, GigabitEthernet1/1/4
     166.223.0.0/30 is subnetted, 1 subnets
O       166.223.20.0 [110/2] via 192.168.20.2, 00:45:14, GigabitEthernet1/1/4
     166.224.0.0/30 is subnetted, 1 subnets
O       166.224.20.0 [110/2] via 192.168.20.2, 00:45:14, GigabitEthernet1/1/4
     168.110.0.0/30 is subnetted, 1 subnets
O       168.110.20.0 [110/3] via 169.221.20.1, 00:45:14, GigabitEthernet1/1/3
     168.111.0.0/30 is subnetted, 1 subnets
O       168.111.20.0 [110/3] via 168.114.20.2, 00:45:14, GigabitEthernet1/1/1
                     [110/3] via 169.221.20.1, 00:45:14, GigabitEthernet1/1/3
     168.112.0.0/30 is subnetted, 1 subnets
O       168.112.20.0 [110/3] via 169.221.20.1, 00:45:14, GigabitEthernet1/1/3
     168.113.0.0/30 is subnetted, 1 subnets
O       168.113.20.0 [110/3] via 169.221.20.1, 00:45:14, GigabitEthernet1/1/3
     168.114.0.0/30 is subnetted, 1 subnets
C       168.114.20.0 is directly connected, GigabitEthernet1/1/1
     168.115.0.0/30 is subnetted, 1 subnets
C       168.115.20.0 is directly connected, GigabitEthernet1/1/2
     168.116.0.0/30 is subnetted, 1 subnets
O       168.116.20.0 [110/2] via 192.168.20.2, 00:45:14, GigabitEthernet1/1/4
     168.118.0.0/30 is subnetted, 1 subnets
O       168.118.20.0 [110/2] via 168.114.20.2, 00:45:14, GigabitEthernet1/1/1
     168.119.0.0/30 is subnetted, 1 subnets
O       168.119.20.0 [110/3] via 168.114.20.2, 00:45:14, GigabitEthernet1/1/1
                     [110/3] via 192.168.20.2, 00:45:14, GigabitEthernet1/1/4
     168.120.0.0/30 is subnetted, 1 subnets
O       168.120.20.0 [110/2] via 168.114.20.2, 00:45:14, GigabitEthernet1/1/1
     168.121.0.0/30 is subnetted, 1 subnets
O       168.121.20.0 [110/3] via 168.114.20.2, 00:45:14, GigabitEthernet1/1/1
     168.122.0.0/30 is subnetted, 1 subnets
O       168.122.20.0 [110/4] via 168.114.20.2, 00:45:14, GigabitEthernet1/1/1
                     [110/4] via 169.221.20.1, 00:45:14, GigabitEthernet1/1/3
     169.220.0.0/30 is subnetted, 1 subnets
O       169.220.20.0 [110/2] via 169.221.20.1, 00:45:14, GigabitEthernet1/1/3
                     [110/2] via 192.168.20.2, 00:45:14, GigabitEthernet1/1/4
     169.221.0.0/30 is subnetted, 1 subnets
C       169.221.20.0 is directly connected, GigabitEthernet1/1/3
     169.222.0.0/30 is subnetted, 1 subnets
O       169.222.20.0 [110/2] via 169.221.20.1, 00:45:14, GigabitEthernet1/1/3
     190.200.0.0/21 is subnetted, 1 subnets
O       190.200.16.0 [110/2] via 168.115.20.2, 00:45:14, GigabitEthernet1/1/2
     190.201.0.0/21 is subnetted, 1 subnets
O       190.201.16.0 [110/2] via 168.115.20.2, 00:45:14, GigabitEthernet1/1/2
     191.200.0.0/30 is subnetted, 1 subnets
O       191.200.20.0 [110/2] via 168.114.20.2, 00:45:14, GigabitEthernet1/1/1
     192.168.20.0/30 is subnetted, 1 subnets
C       192.168.20.0 is directly connected, GigabitEthernet1/1/4
```

Simulation Results

Traceroute was executed in each situation to display the route taken by the network session.

a) Tracing the Network Session: ENTC Student Accessing LMS Servers in the University Data Center

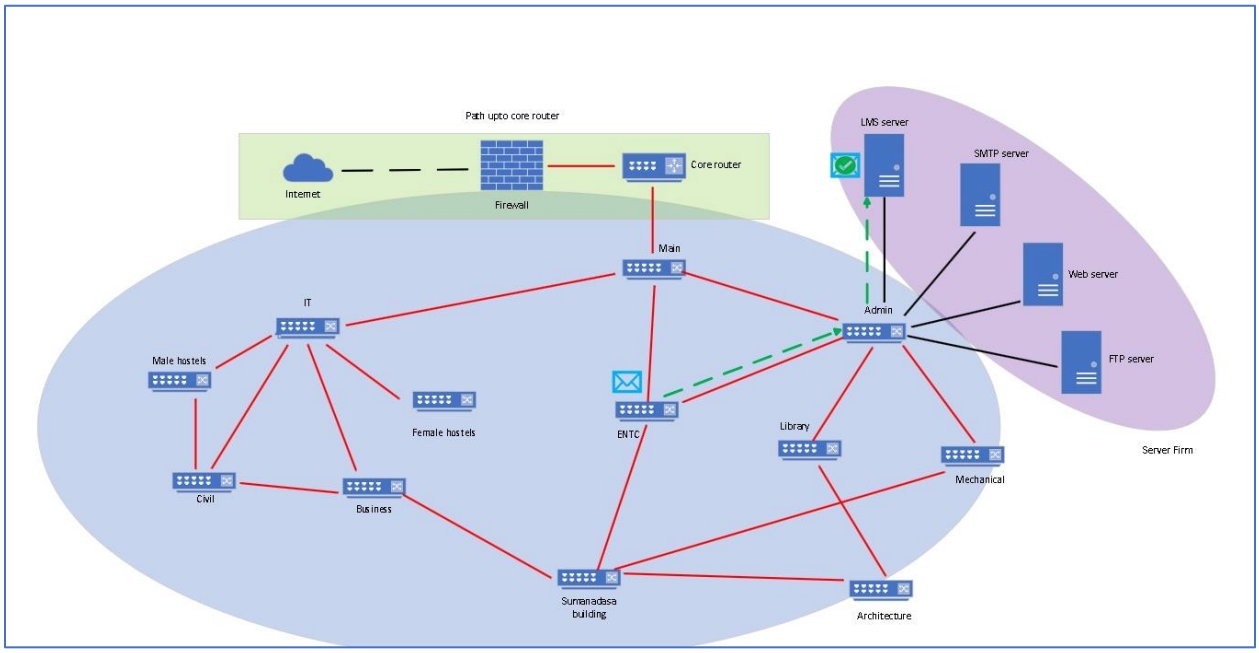
```
C:\>tracert 166.220.20.2

Tracing route to 166.220.20.2 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      190.200.20.1
  2    0 ms      0 ms      0 ms      168.115.20.1
  3    0 ms      0 ms      0 ms      192.168.20.2
  4    0 ms      0 ms      0 ms      166.220.20.2

Trace complete.
```

Routing Path



b) Tracing Disrupted Routing Path: ENTC Student Accessing LMS Servers as Backbone Link to Data Center Breaks

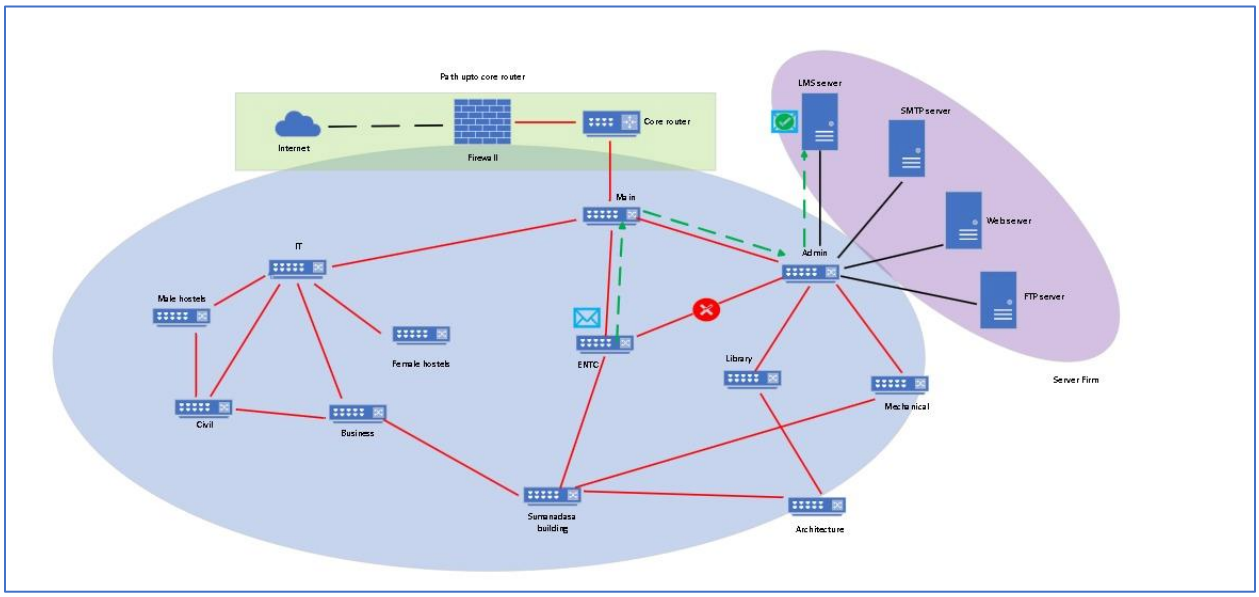
```
C:\>tracert 166.220.20.2

Tracing route to 166.220.20.2 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      190.200.20.1
  2    0 ms      0 ms      0 ms      168.115.20.1
  3    0 ms      0 ms      0 ms      169.221.20.1
  4    0 ms      0 ms      0 ms      169.220.20.2
  5    0 ms      0 ms      0 ms      166.220.20.2

Trace complete.
```

Routing Path



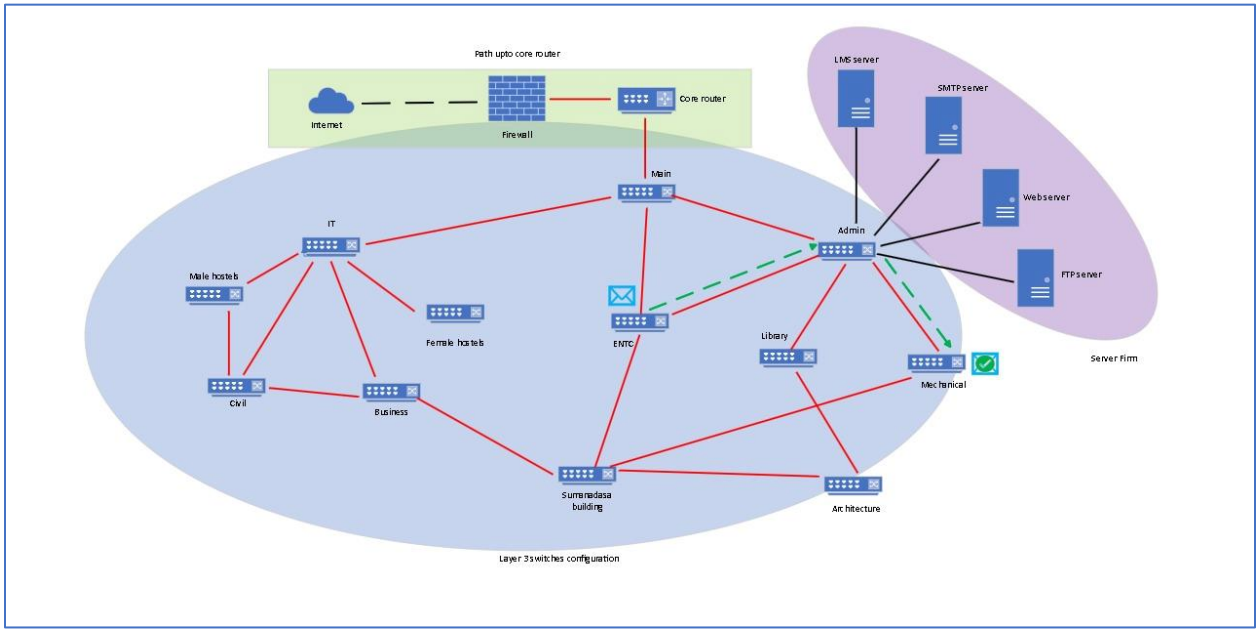
c) Tracing the Routing Path: Collaborative ENTC and Mechanical Research Project Accessing the Mechanical Department Server

```
Tracing route to 192.200.20.11 over a maximum of 30
hops:

  1    0 ms      0 ms      0 ms      190.200.20.1
  2    0 ms      0 ms      0 ms      168.115.20.1
  3    0 ms      0 ms      0 ms      168.114.20.2
  4    1 ms      0 ms      0 ms      168.117.20.2
  5    *         10 ms     0 ms      192.200.20.11

Trace complete.
```

Routing Path



d) Tracing the Routing Path: Collaborative ENTC and Mechanical Research Project Accessing the Mechanical Department Server

```
C:\>tracert 192.200.20.11

Tracing route to 192.200.20.11 over a maximum of 30
hops:

  1    0 ms      0 ms      0 ms      190.200.20.1
  2    0 ms      0 ms      8 ms      168.115.20.1
  3    0 ms      0 ms      0 ms      168.114.20.2
  4    0 ms      0 ms      0 ms      168.120.20.2
  5    0 ms      0 ms      0 ms      192.200.20.11

Trace complete.
```

Routing Path