EC4060

COMPUTER AND DATA NETWORK

SENARATHNA S.A.D.H.D.

2022/E/141

GROUP CG14

SEMESTER 4

2025.02.03

PROJECT DESCRIPTION

- This project aims to design and implement a structured network system for the Faculty of Engineering at the University of Jaffna. The goal is to ensure efficient communication, security, and scalability within the network. The network is segmented into multiple Virtual Local Area Networks (VLANs), each assigned to different departments and device types. This segmentation ensures logical separation and optimized traffic management.
- A Layer 3 core switch interconnects departmental Layer 3 switches to provide inter-VLAN routing. Each department has its own Layer 2 switch to manage local device connections. Both DHCP and static IP allocations have been configured to ensure effective address management.
- The Engineering Faculty consists of five academic departments (Civil, Mechanical, Electrical and Elec tronic Engineering (EEE), Computer Engineering, and Interdisciplinary Studies) along with an Admin istration Section, requiring a scalable and secure network. The design must accommodate unique subnet allocation, subnet information (subnet mask, usable host range, broadcast address), and scalability for at least 30% future growth.

OBJECTIVE

- To apply the principles of network design to create and simulate a functional network infrastructure for an institution with multiple branches.

SUBNET CALCULATION TABLE

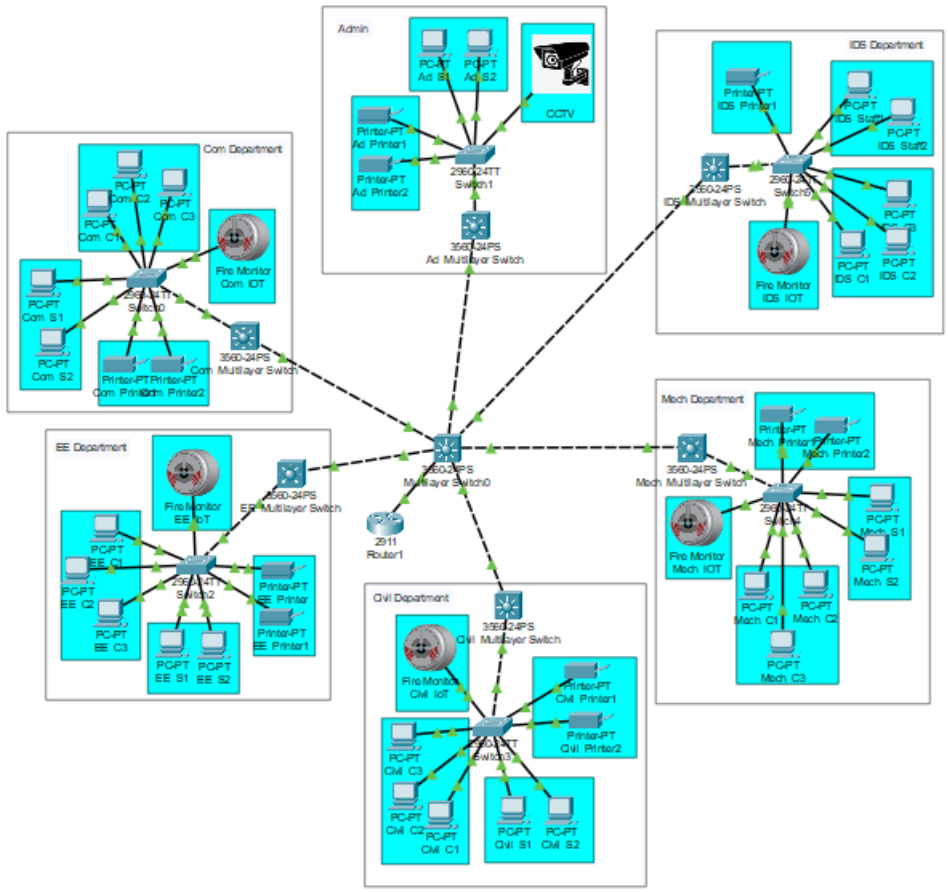
Section	Subnet Address	Network Address	Prefix	Broadcast Address	Usable Address Range
1. Common Section (Shared Resources)					
com	192.168.0.0/24	192.168.0.0	/24	192.168.0.255	192.168.0.1 – 192.168.0.254
ee	192.168.2.0/24	192.168.2.0	/24	192.168.2.255	192.168.2.1 – 192.168.2.254
civil	192.168.4.0/25	192.168.4.0	/25	192.168.4.127	192.168.4.1 – 192.168.4.126
mech	192.168.5.0/25	192.168.5.0	/25	192.168.5.127	192.168.5.1 – 192.168.5.126
IDS	192.168.6.0/27	192.168.6.0	/27	192.168.6.31	192.168.6.1 – 192.168.6.30
admin	192.168.7.0/30	192.168.7.0	/30	192.168.7.3	192.168.7.1 – 192.168.7.2
2. Staff Section (Staff Devices)					
com	192.168.0.64/26	192.168.0.64	/26	192.168.0.127	192.168.0.65 – 192.168.0.126
ee	192.168.2.64/26	192.168.2.64	/26	192.168.2.127	192.168.2.65 – 192.168.2.126
civil	192.168.4.64/26	192.168.4.64	/26	192.168.4.127	192.168.4.65 – 192.168.4.126

Section	Subnet Address	Network Address	Prefix	Broadcast Address	Usable Address Range
mech	192.168.5.64/26	192.168.5.64	/26	192.168.5.127	192.168.5.65 – 192.168.5.126
IDS	192.168.6.64/26	192.168.6.64	/26	192.168.6.127	192.168.6.65 – 192.168.6.126
admin	192.168.7.64/26	192.168.7.64	/26	192.168.7.127	192.168.7.65 – 192.168.7.126
3. Printers Section (Printer Devices)					
com	192.168.0.128/29	192.168.0.128	/29	192.168.0.135	192.168.0.129 – 192.168.0.134
ee	192.168.2.128/29	192.168.2.128	/29	192.168.2.135	192.168.2.129 – 192.168.2.134
civil	192.168.4.128/29	192.168.4.128	/29	192.168.4.135	192.168.4.129 – 192.168.4.134
mech	192.168.5.128/29	192.168.5.128	/29	192.168.5.135	192.168.5.129 – 192.168.5.134
IDS	192.168.6.128/29	192.168.6.128	/29	192.168.6.135	192.168.6.129 – 192.168.6.134
admin	192.168.7.128/28	192.168.7.128	/28	192.168.7.143	192.168.7.129 – 192.168.7.142
4. Other Devices Section (IoT, Miscellaneous)					
com	192.168.0.192/26	192.168.0.192	/26	192.168.0.255	192.168.0.193 – 192.168.0.254
ee	192.168.2.192/27	192.168.2.192	/27	192.168.2.223	192.168.2.193 – 192.168.2.222
civil	192.168.4.192/29	192.168.4.192	/29	192.168.4.199	192.168.4.193 – 192.168.4.198
mech	192.168.5.192/28	192.168.5.192	/28	192.168.5.207	192.168.5.193 – 192.168.5.206
IDS	192.168.6.192/29	192.168.6.192	/29	192.168.6.199	192.168.6.193 – 192.168.6.198
admin	192.168.7.192/28	192.168.7.192	/28	192.168.7.207	192.168.7.193 – 192.168.7.206

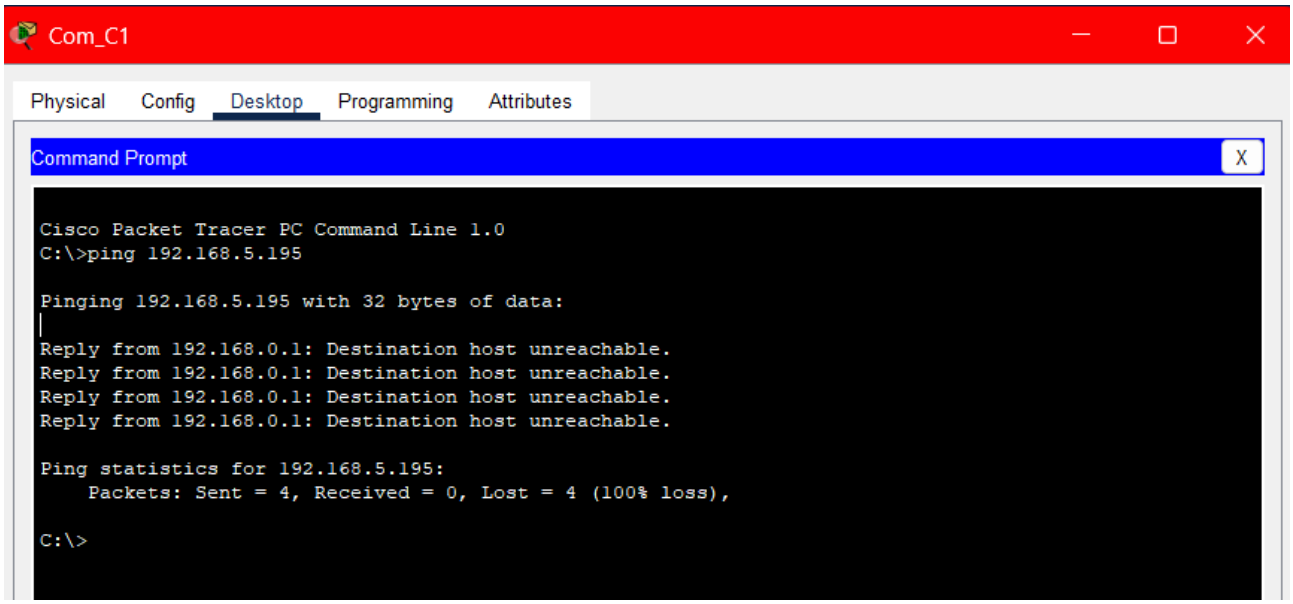
VLAN PLAN AND MAPPING TABLE

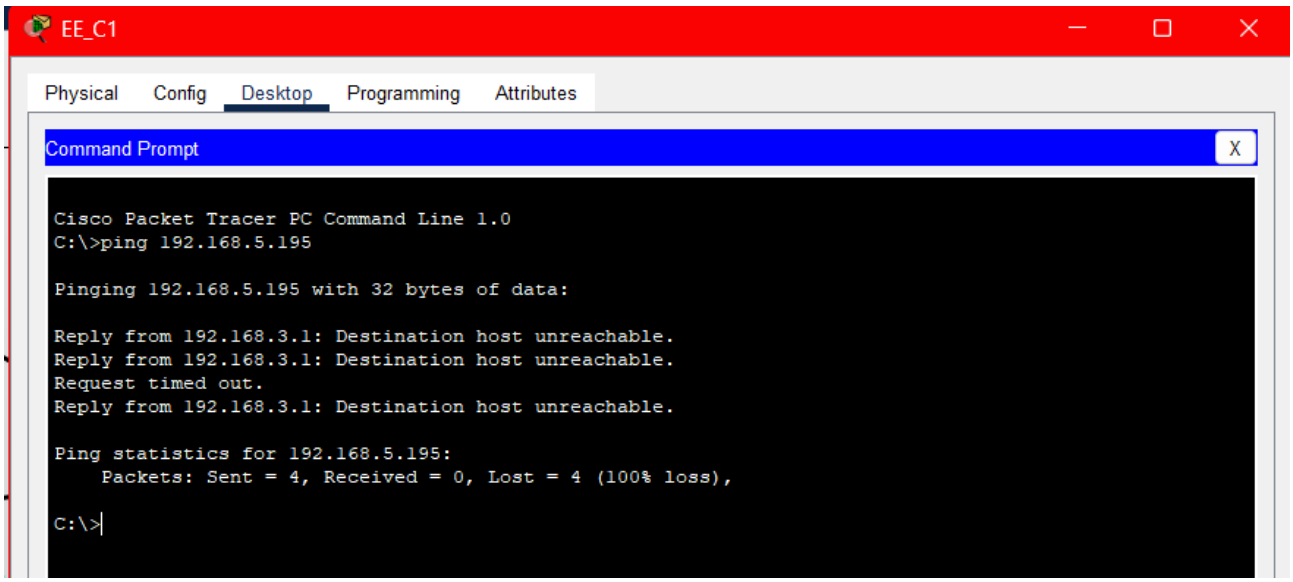
VLAN ID	Department	Section
VLAN 10	com	Common
VLAN 20	ee	Common
VLAN 30	civil	Common
VLAN 40	mech	Common
VLAN 50	IDS	Common
VLAN 11	com	Staff
VLAN 21	ee	Staff
VLAN 31	civil	Staff
VLAN 41	mech	Staff
VLAN 51	IDS	Staff
VLAN 61	admin	Staff
VLAN 12	com	Printers
VLAN 22	ee	Printers
VLAN 32	civil	Printers
VLAN 42	mech	Printers
VLAN 52	IDS	Printers
VLAN 61	admin	Printers
VLAN 13	com	Other Devices
VLAN 23	ee	Other Devices
VLAN 33	civil	Other Devices
VLAN 43	mech	Other Devices
VLAN 53	IDS	Other Devices
VLAN 62	admin	Other Devices

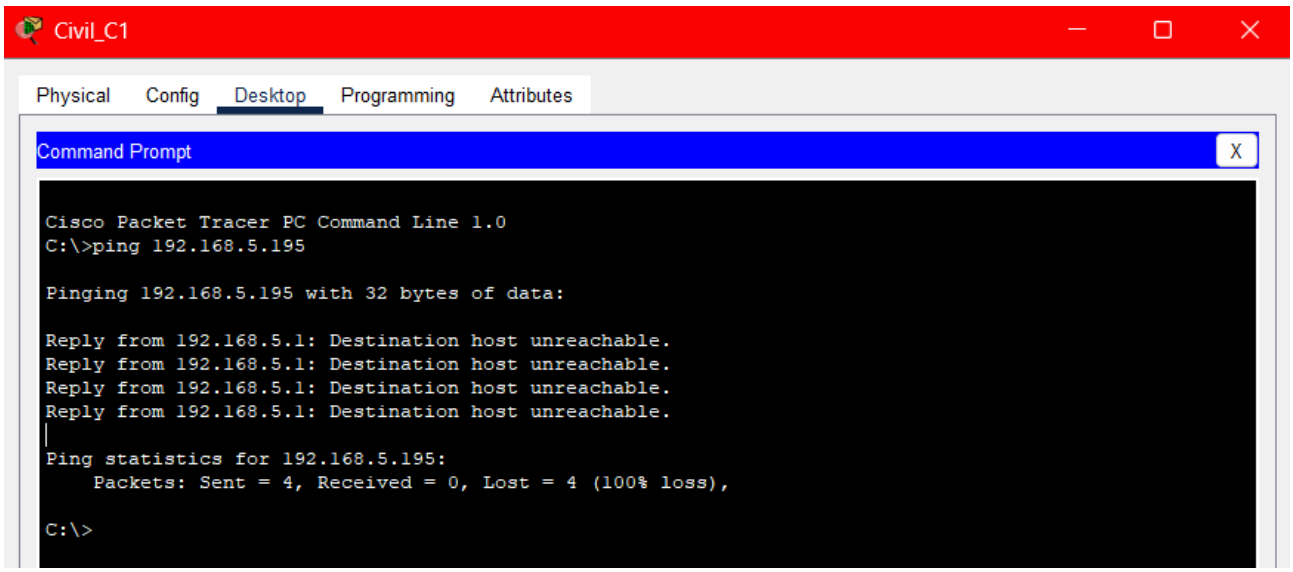
NETWORK DESIGN DIAGRAM

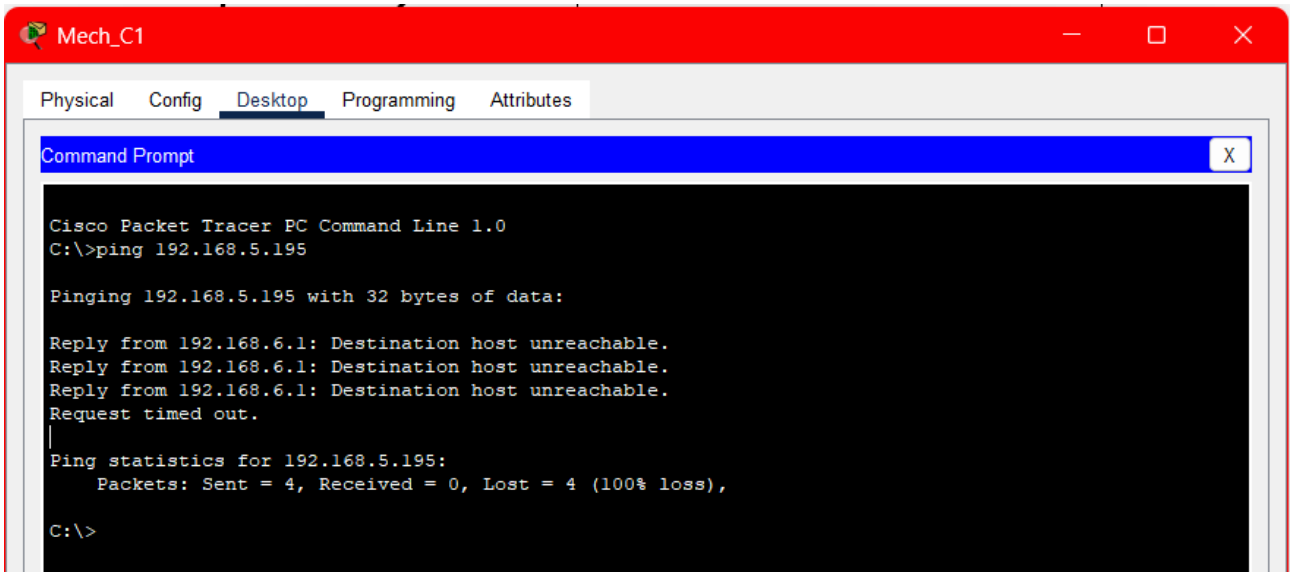


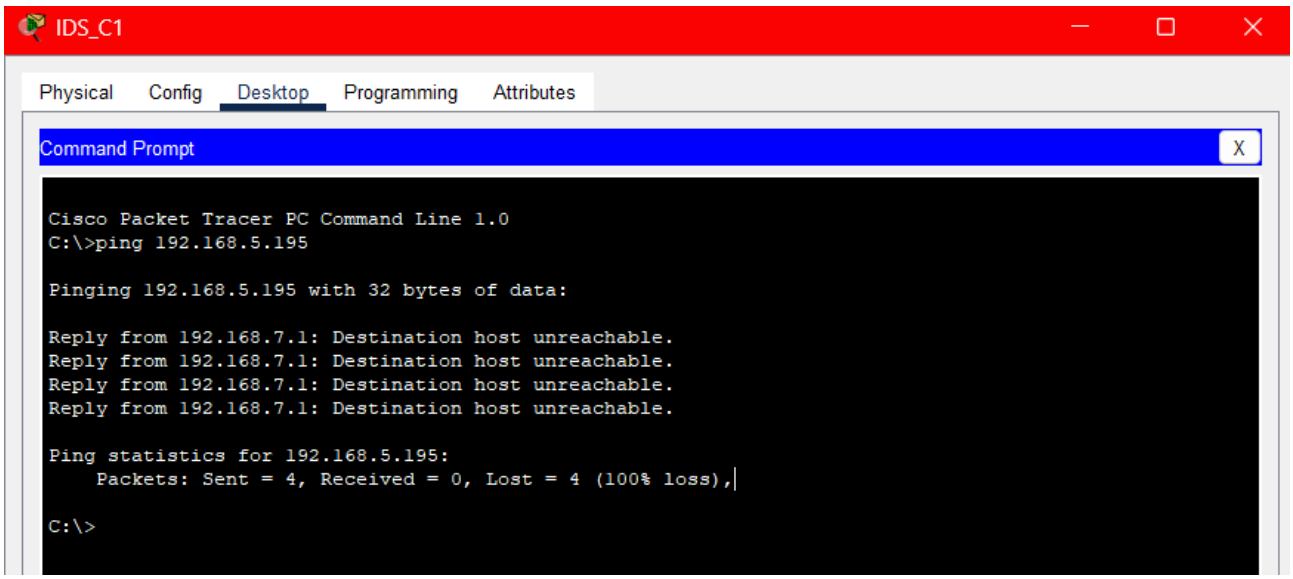
SIMULATION RESULTS



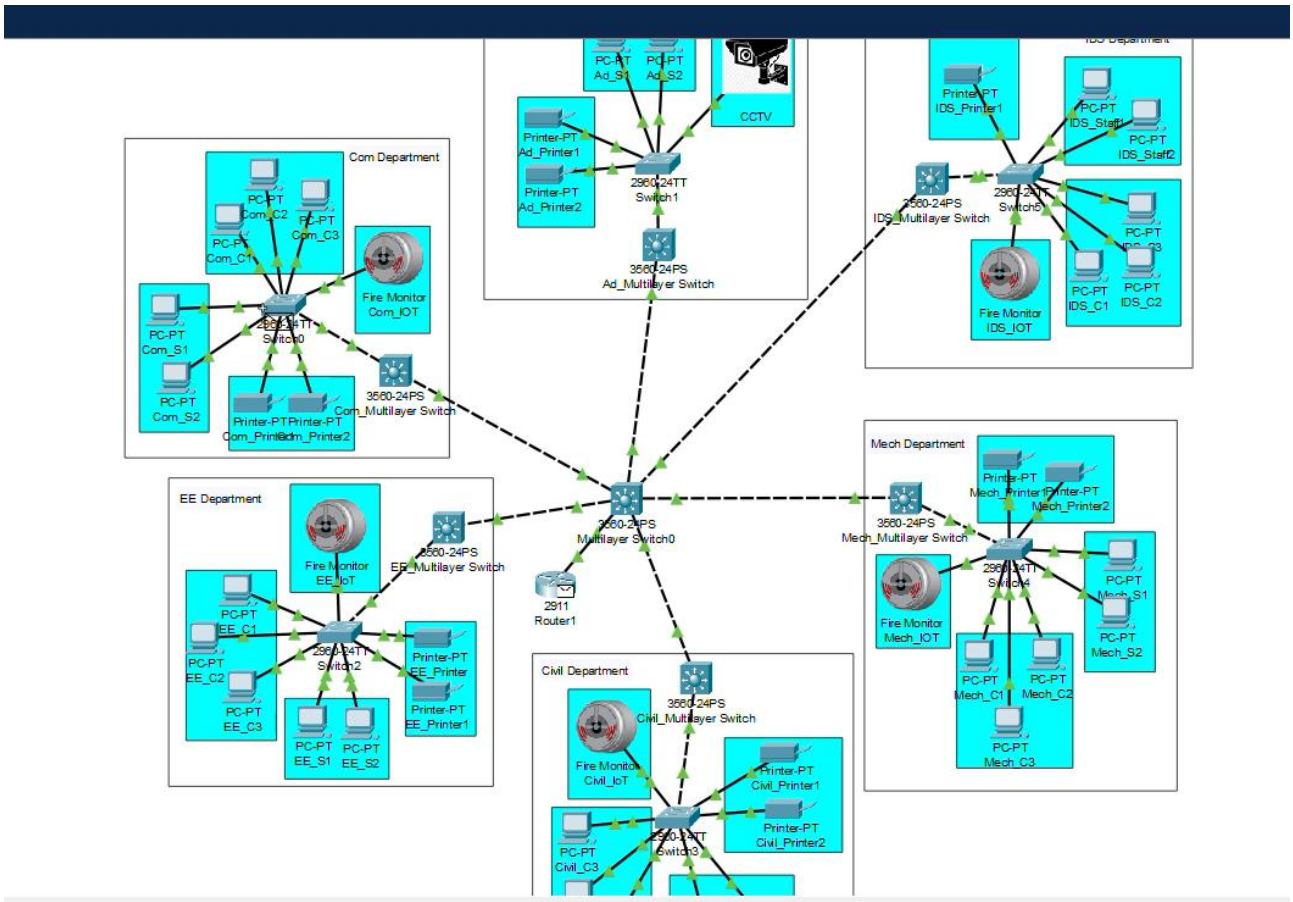

EE_C1
Physical
Config
Desktop
Programming
Attributes
Command Prompt
X
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.5.195
Pinging 192.168.5.195 with 32 bytes of data:
Reply from 192.168.3.1: Destination host unreachable.
Reply from 192.168.3.1: Destination host unreachable.
Request timed out.
Reply from 192.168.3.1: Destination host unreachable.
Ping statistics for 192.168.5.195:
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
C:\>

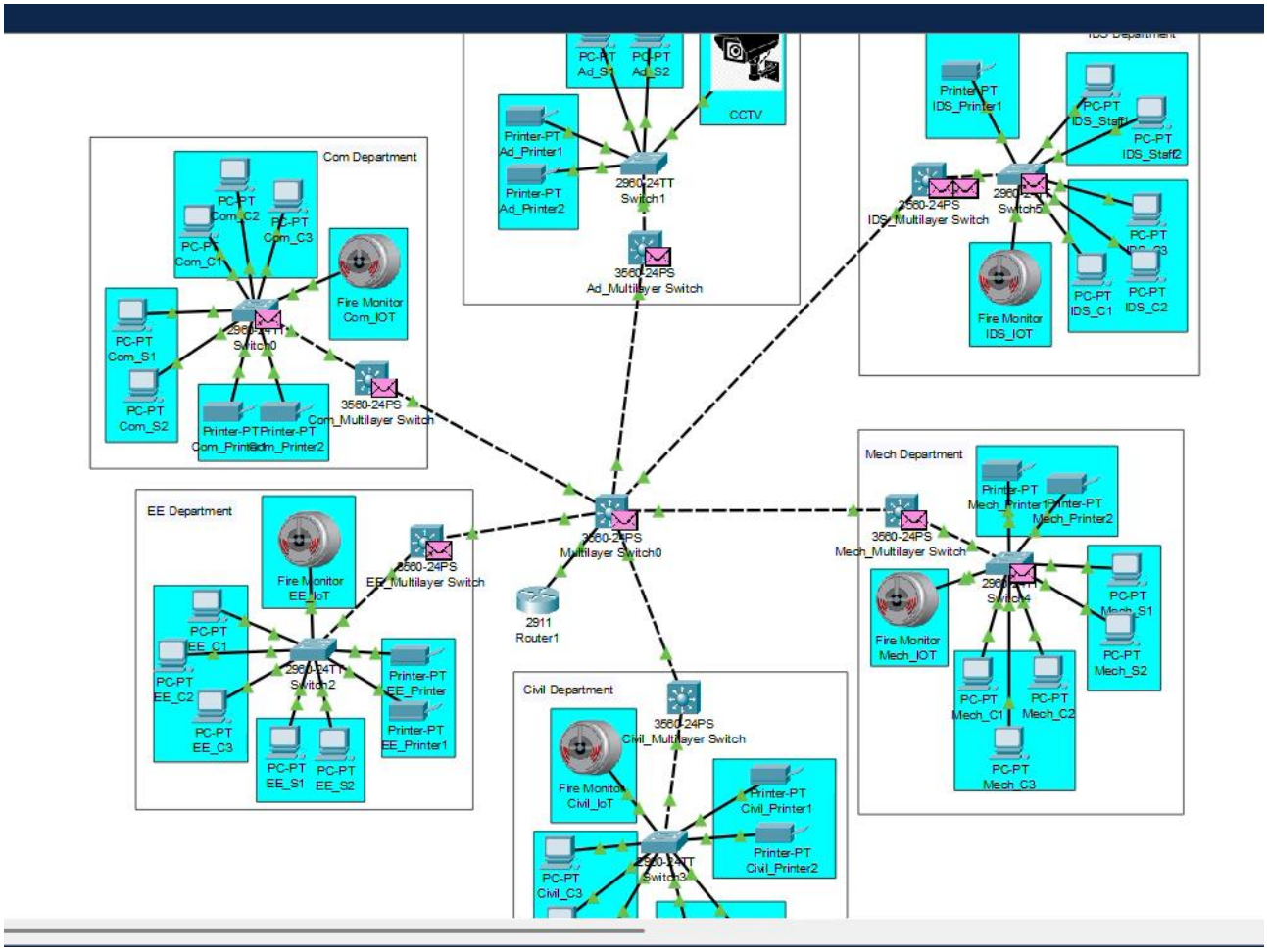

Civil_C1
Physical
Config
Desktop
Programming
Attributes
Command Prompt
X
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.5.195
Pinging 192.168.5.195 with 32 bytes of data:
Reply from 192.168.5.1: Destination host unreachable.
Reply from 192.168.5.1: Destination host unreachable.
Reply from 192.168.5.1: Destination host unreachable.
Reply from 192.168.5.1: Destination host unreachable.
Ping statistics for 192.168.5.195:
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
C:\>

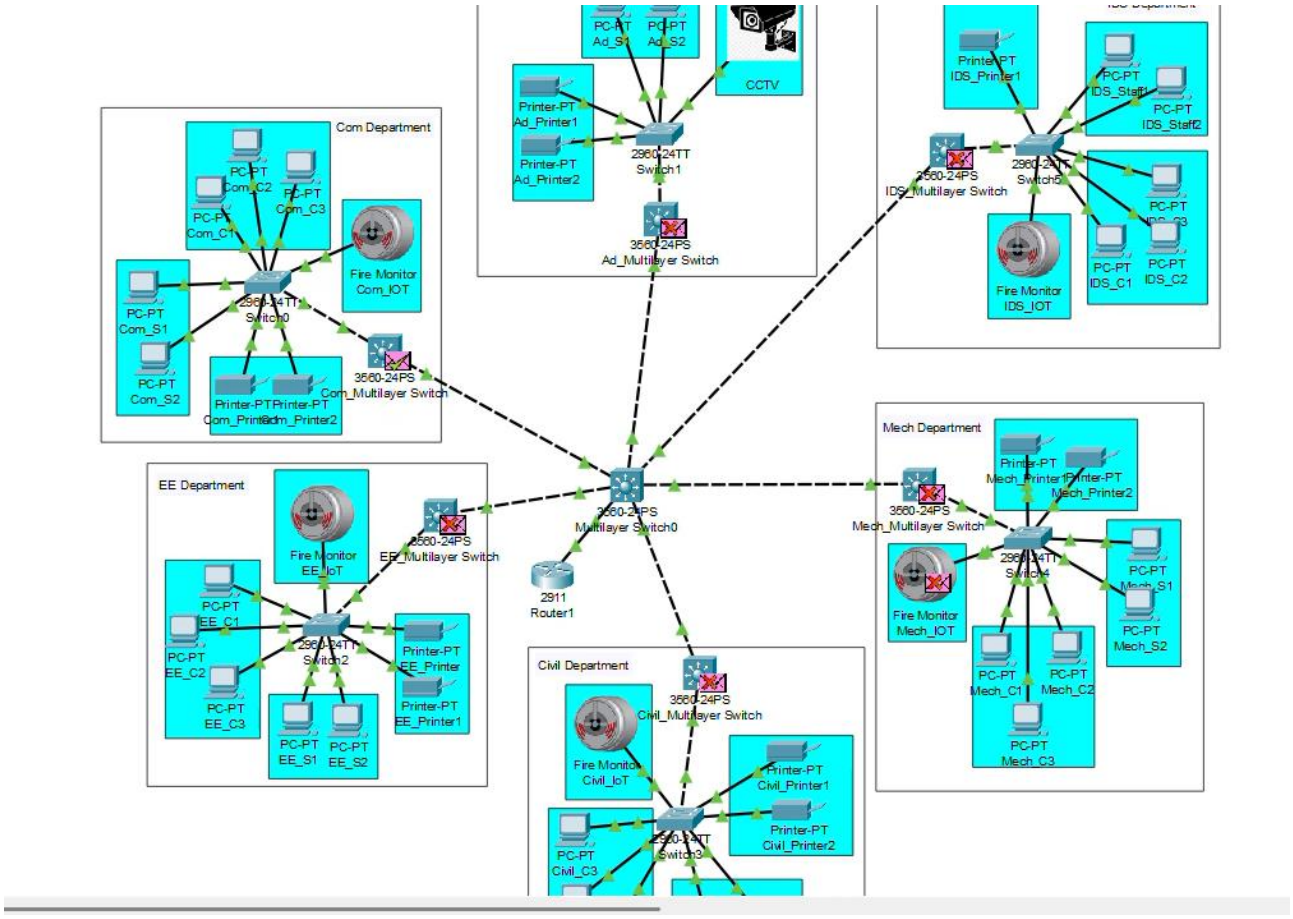

Mech_C1
Physical
Config
Desktop
Programming
Attributes
Command Prompt
X
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.5.195
Pinging 192.168.5.195 with 32 bytes of data:
Reply from 192.168.6.1: Destination host unreachable.
Reply from 192.168.6.1: Destination host unreachable.
Reply from 192.168.6.1: Destination host unreachable.
Request timed out.
Ping statistics for 192.168.5.195:
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
C:\>

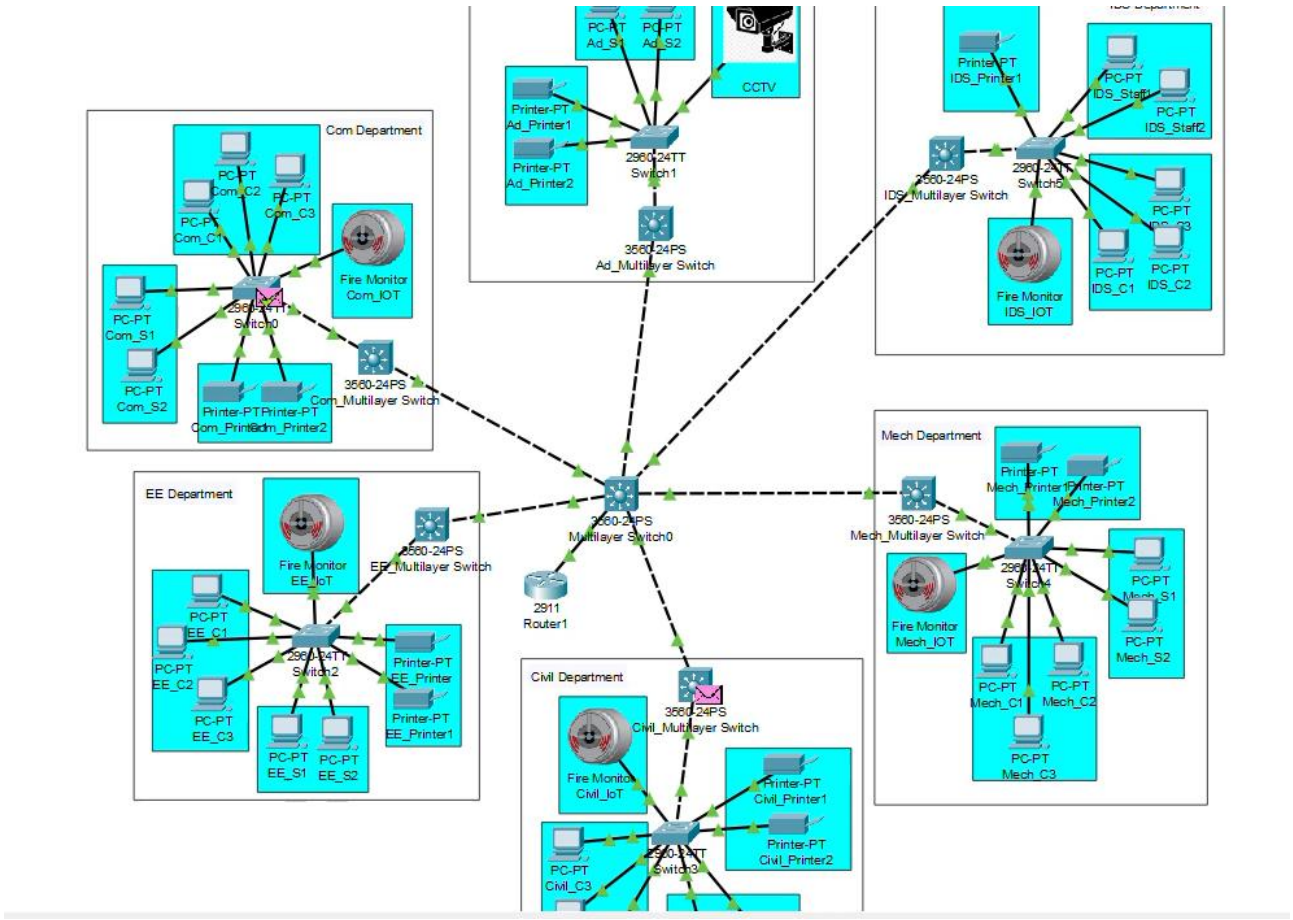

IDS_C1
Physical
Config
Desktop
Programming
Attributes
Command Prompt
X
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.5.195
Pinging 192.168.5.195 with 32 bytes of data:
Reply from 192.168.7.1: Destination host unreachable.
Reply from 192.168.7.1: Destination host unreachable.
Reply from 192.168.7.1: Destination host unreachable.
Reply from 192.168.7.1: Destination host unreachable.
Ping statistics for 192.168.5.195:
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
C:\>

TEST REPORT


Com Department
PC-PT Com_C1
PC-PT Com_C2
PC-PT Com_C3
Fire Monitor Com_IOT
PC-PT Com_S1
PC-PT Com_S2
3560-24PS Com_Multilayer Switch
Printer-PT Com_Printer1
Printer-PT Com_Printer2
CCTV
Printer-PT Ad_Printer1
Printer-PT Ad_Printer2
2960-24TT Switch1
3560-24PS Ad_Multilayer Switch
Printer-PT IDS_Printer1
PC-PT IDS_Staff1
PC-PT IDS_Staff2
3560-24PS IDS_Multilayer Switch
2960-24TT Switch5
Fire Monitor IDS_IOT
PC-PT IDS_C1
PC-PT IDS_C2
EE Department
Fire Monitor EE_IoT
3560-24PS EE_Multilayer Switch
PC-PT EE_C1
PC-PT EE_C2
PC-PT EE_C3
2960-24TT Switch2
Printer-PT EE_Printer
Printer-PT EE_Printer1
PC-PT EE_S1
PC-PT EE_S2
3560-24PS Multilayer Switch0
2911 Router1
Civil Department
3560-24PS Civil_Multilayer Switch
Fire Monitor Civil_IoT
Printer-PT Civil_Printer1
Printer-PT Civil_Printer2
PC-PT Civil_C3
2960-24TT Switch3
Mech Department
Printer-PT Mech_Printer1
Printer-PT Mech_Printer2
3560-24PS Mech_Multilayer Switch
2960-24TT Switch4
Fire Monitor Mech_IOT
PC-PT Mech_S1
PC-PT Mech_S2
PC-PT Mech_C1
PC-PT Mech_C2
PC-PT Mech_C3


Com Department
PC-PT Com_C2
PC-PT Com_C3
PC-PT Com_C1
Fire Monitor Com_IOT
2960-24TT Switch0
PC-PT Com_S1
PC-PT Com_S2
3560-24PS Com_Multilayer Switch
Printer-PT Com_Printer
Printer-PT Adm_Printer2
PC-PT Ad_S1
PC-PT Ad_S2
CCTV
Printer-PT Ad_Printer1
Printer-PT Ad_Printer2
2960-24TT Switch1
3560-24PS Ad_Multilayer Switch
Printer-PT IDS_Printer1
PC-PT IDS_Staff1
PC-PT IDS_Staff2
3560-24PS IDS_Multilayer Switch
2960-24TT Switch5
PC-PT IDS_C3
Fire Monitor IDS_IOT
PC-PT IDS_C1
PC-PT IDS_C2
EE Department
Fire Monitor EE_IoT
3560-24PS EE_Multilayer Switch
PC-PT EE_C1
PC-PT EE_C2
PC-PT EE_C3
2960-24TT Switch2
Printer-PT EE_Printer
Printer-PT EE_Printer1
PC-PT EE_S1
PC-PT EE_S2
3560-24PS Multilayer Switch0
2911 Router1
Mech Department
Printer-PT Mech_Printer1
Printer-PT Mech_Printer2
3560-24PS Mech_Multilayer Switch
2960-24TT Switch4
Fire Monitor Mech_IOT
PC-PT Mech_S1
PC-PT Mech_S2
PC-PT Mech_C1
PC-PT Mech_C2
PC-PT Mech_C3
Civil Department
3560-24PS Civil_Multilayer Switch
Fire Monitor Civil_IoT
Printer-PT Civil_Printer1
Printer-PT Civil_Printer2
2960-24TT Switch3
PC-PT Civil_C3


Com Department
PC-PT Com_C2
PC-PT Com_C3
PC-PT Com_C1
Fire Monitor Com_IOT
2960-24TT Switch0
PC-PT Com_S1
PC-PT Com_S2
3560-24PS Com_Multilayer Switch
Printer-PT Com_Printer
Printer-PT Adm_Printer2
PC-PT Ad_S1
PC-PT Ad_S2
CCTV
Printer-PT Ad_Printer1
Printer-PT Ad_Printer2
2960-24TT Switch1
3560-24PS Ad_Multilayer Switch
Printer-PT IDS_Printer1
PC-PT IDS_Staff1
PC-PT IDS_Staff2
3560-24PS IDS_Multilayer Switch
2960-24TT Switch5
PC-PT IDS_C3
Fire Monitor IDS_IOT
PC-PT IDS_C1
PC-PT IDS_C2
EE Department
Fire Monitor EE_IoT
3560-24PS EE_Multilayer Switch
PC-PT EE_C1
PC-PT EE_C2
PC-PT EE_C3
2960-24TT Switch2
Printer-PT EE_Printer
Printer-PT EE_Printer1
PC-PT EE_S1
PC-PT EE_S2
3560-24PS Multilayer Switch0
2911 Router1
Mech Department
Printer-PT Mech_Printer1
Printer-PT Mech_Printer2
3560-24PS Mech_Multilayer Switch
2960-24TT Switch4
Fire Monitor Mech_IOT
PC-PT Mech_S1
PC-PT Mech_S2
PC-PT Mech_C1
PC-PT Mech_C2
PC-PT Mech_C3
Civil Department
3560-24PS Civil_Multilayer Switch
Fire Monitor Civil_IoT
Printer-PT Civil_Printer1
Printer-PT Civil_Printer2
2960-24TT Switch3
PC-PT Civil_C3


Com Department
PC-PT Com_C2
PC-PT Com_C3
PC-PT Com_C1
Fire Monitor Com_IOT
PC-PT Com_S1
PC-PT Com_S2
2960-24TT Switch0
3560-24PS Com_Multilayer Switch
Printer-PT Com_Printer
Printer-PT Com_Printer2
Printer-PT Ad_Printer1
Printer-PT Ad_Printer2
2960-24TT Switch1
3560-24PS Ad_Multilayer Switch
CCTV
Printer-PT IDS_Printer1
PC-PT IDS_Staff1
PC-PT IDS_Staff2
3560-24PS IDS_Multilayer Switch
2960-24TT Switch5
Fire Monitor IDS_IOT
PC-PT IDS_C1
PC-PT IDS_C2
EE Department
Fire Monitor EE_IoT
3560-24PS EE_Multilayer Switch
PC-PT EE_C1
PC-PT EE_C2
PC-PT EE_C3
2960-24TT Switch2
Printer-PT EE_Printer
Printer-PT EE_Printer1
PC-PT EE_S1
PC-PT EE_S2
3560-24PS Multilayer Switch0
2911 Router1
Mech Department
Printer-PT Mech_Printer1
Printer-PT Mech_Printer2
3560-24PS Mech_Multilayer Switch
2960-24TT Switch4
Fire Monitor Mech_IOT
PC-PT Mech_S1
PC-PT Mech_S2
PC-PT Mech_C1
PC-PT Mech_C2
PC-PT Mech_C3
Civil Department
3560-24PS Civil_Multilayer Switch
Fire Monitor Civil_IoT
Printer-PT Civil_Printer1
Printer-PT Civil_Printer2
PC-PT Civil_C3
2960-24TT Switch3