

Enterprise *Network & Design* Project

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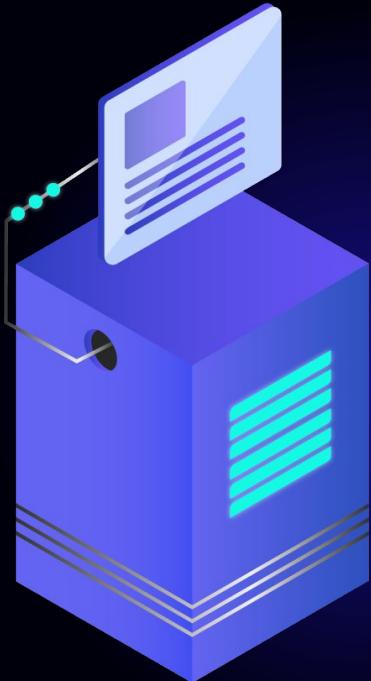
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INTRODUCTION

Aim: Present a comprehensive network design project for the school, addressing the requirements and constraints of the enterprise network to ensure

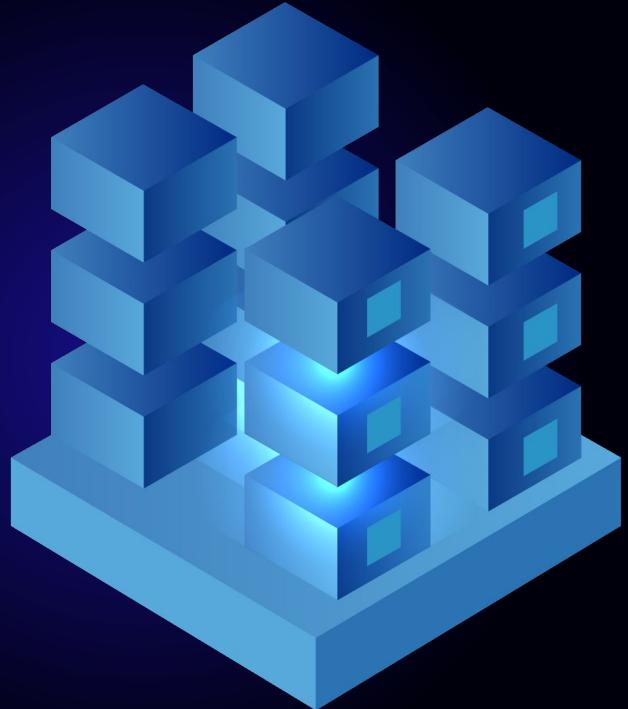
- seamless communication
- resource sharing
- remote networking capabilities

REQUIREMENTS

- Enable interworking, file sharing, printer access, and remote networking for the School of EEE's new buildings, S2.1 and S2.2.
- Accommodate four user groups: Acad, Admin, RS and Lab while ensuring access to shared resources and workgroup functionality.
- Implement a secure and optimized IP addressing scheme using variable length subnet mask (VLSM)
- Ensure that all users have access to shared printers within their respective rooms and dedicated printers for each workgroup when different user groups share the same room.
- Adhere to the specific access restrictions for different user groups
- Incorporate efficient network services such as DHCP and dynamic routing
- Design the network based on the TCP/IP protocol

01

Top-Down Approach



Top Down Approach



**Identify business objectives
and requirements**



Perform a needs analysis



**Develop a high-level network
architecture**



Plan Network Security

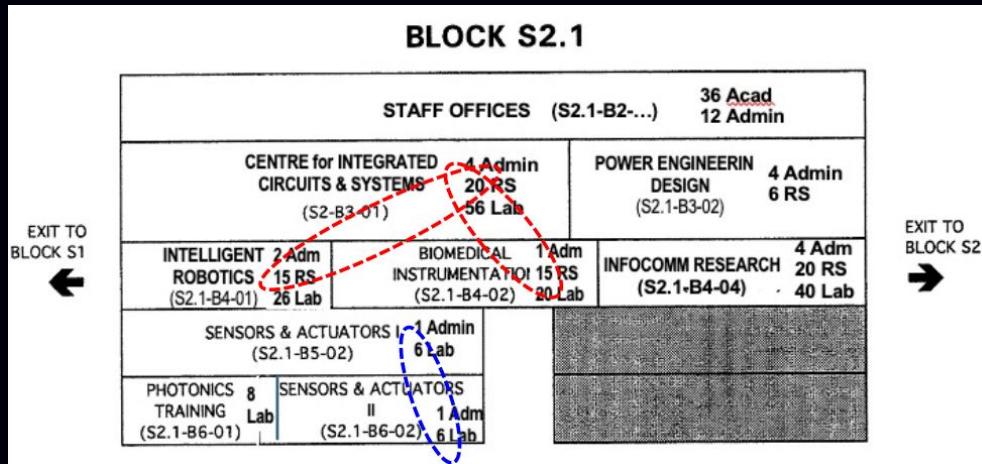


Implementation & Testing

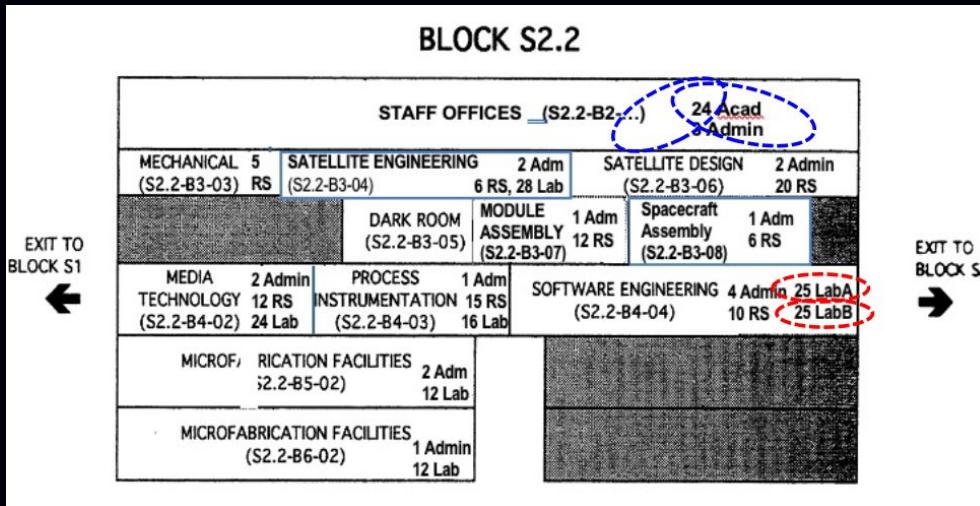


Monitor & Optimize

Block S2.1 Layout



Block S2.2 Layout



02

Bottom-Up Approach



Bottom Up Approach



Define basic requirements



Network devices & Physical layout



Implement data link layer



Configure



Deploy Security Measures



Monitor & Optimize

Network Layer Protocol

Total Number of Hosts

Location	Acad		Admin		RS		Lab			
	Block S2.1	Host	Net#Subnet Bits	Total Number						
S2.1-b2		36			12					
S2.1-b3-01					4		20		56	
S2.1-b3-02					4		6			
S2.1-b4-01					2		15		26	
S2.1-b4-02					1		15		20	
S2.1-b4-04					4		20		40	
S2.1-b5-02					1				6	
S2.1-b6-01									8	
S2.1-b6-02					1				6	
Total Hosts		36			29		76		162	303

Block S2.2	Host	Net#Subnet Bits	Total Number						
S2.2-b2		24		3					
S2.2-b3-03						5			
S2.2-b3-04				2		6		28	
S2.2-b3-05				2		20			
S2.2-b3-06									
S2.2-b3-07				1		12			
S2.2-b3-08				1		6			
S2.2-b4-02				2		12		24	
S2.2-b4-03				1		15		16	
S2.2-b4-04				4		10		50	
S2.2-b5-02				2				12	
S2.2-b6-02				1				12	
Total Hosts		24		19		86		142	271

IPu4 Classes

Class	No. of Host IDs	No. of hosts a network address can support
A	24	$2^{24} - 2 = 16 \text{ million}$
B	16	$2^{16} - 2 = 65534$
C	8	$2^8 - 2 = 254$

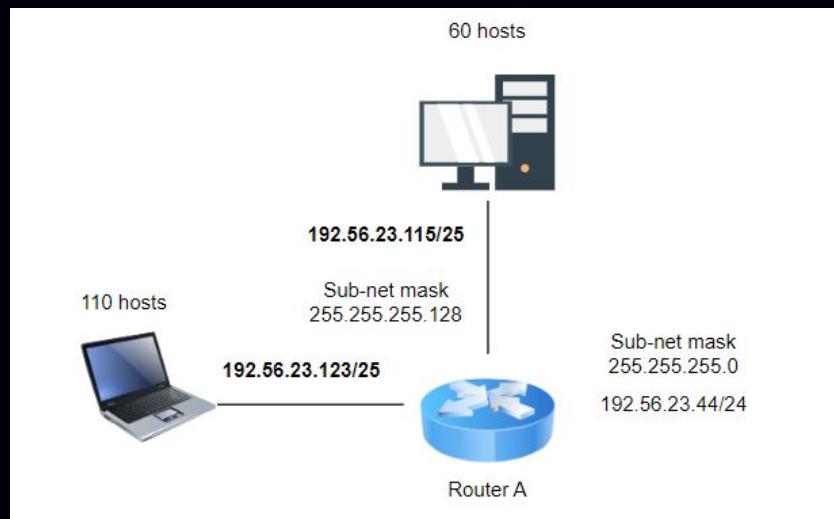
- Total number of hosts needed is a lot less than what an individual Class B network address can provide which is 65534 - Wastage of Host-IDs
- Single Class C network is not sufficient - only support up to 254 hosts
- Using a few Class C network addresses, one for each logical network, is a preferable alternative.

Supernet Address Assignment

User Group	Supernet	
	Block S2.1	Block S2.2
Acad + Admin	200.10.10.0 / 25	200.10.10.128 / 25
RS	200.10.11.128 / 25	200.10.11.0 / 25
Lab	200.10.12.0 / 23	200.10.14.0 / 24

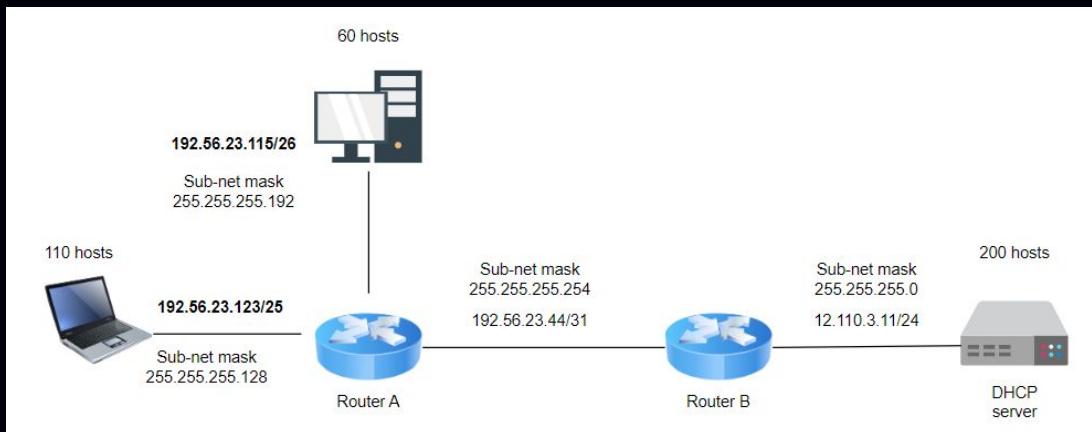
FLSM

A fixed-length subnet mask (FLSM) refers to a type of enterprise or provider networking where a block of IP addresses is divided into multiple subnets of equal length. (i.e. an equal number of IP addresses)



VLSM

Variable-length subnet mask (VLSM) describes a technique that enables all subnetworks to have variable sizes. In order to partition an IP address space into subnets of different lengths and allocate them according to the specifications of the network, network administrators can utilize VLSM subnetting.



FLSM vs VLSM

Attributes	FLSM	VLSM
Subnet size	Equal	Variable
Subnet mask	Same	Different
Number of Hosts	Equal	Variable
Configuration	Easy and simple	Complex
IP addresses wastage	More	Less
Efficiency	Less	More
Routing Protocols	Supports classful and classless	Supports classless
Applications	Suitable for private IP addresses	Suitable for public IP addresses

While VLSM is more appropriate for public IP addresses, FLSM is a better option for private IP addresses. FLSM frequently wastes IP addresses by using more of them than are required. VLSM utilizes a specific IP address range more effectively, resulting in less waste.

VLSM Requirements

- Additional IP addresses for assignment to printers for all user groups
- Additional IP addresses for assignment to server for each lab
- Additional IP addresses for assignment to file server for RS, Acad and Admin respectively
- Additional IP addresses for assignment to group email server, accessed by Acad and Admin, and its router interfaces
- Additional IP addresses for assignment to router interfaces for all user groups within Access layer
- Additional IP addresses for router interfaces within Core layer

Subnet Assignment

Location									
Department	Block S2.1	Net#Subnet Bits	Binary Rep	Subnet Mask	Router Address	First Host	Last Host	Printer	DHCP Server
Acad	S2.1-b2	200.10.10.96/27	200.10.10.011/27	255.255.255.224	200.10.10.97	200.10.10.98	200.10.10.125	200.10.10.126	
Acad	S2.1-b2	200.10.10.64/28	200.10.10.0100/28	255.255.255.240	200.10.10.65	200.10.10.66	200.10.10.73	200.10.10.74	200.10.10.78
Admin	S2.1-b2	200.10.10.48/28	200.10.10.0011/28	255.255.255.240	200.10.10.49	200.10.10.50	200.10.10.55	200.10.10.56	200.10.10.62
	S2.1-b3-01					200.10.10.57	200.10.10.60	200.10.10.61	
Admin	S2.1-b2	200.10.10.32/28	200.10.10.0010/28	255.255.255.240	200.10.10.33	200.10.10.34	200.10.10.39	200.10.10.40	200.10.10.46
	S2.1-b3-02					200.10.10.41	200.10.10.44	200.10.10.45	
Admin	S2.1-b4-01	200.10.10.24/29	200.10.10.00011/29	255.255.255.248	200.10.10.25	200.10.10.26	200.10.10.27	200.10.10.28	
	S2.1-b4-02						200.10.10.29	200.10.10.30	
Admin	S2.1-b4-04	200.10.10.16/29	200.10.10.00010/29	255.255.255.248	200.10.10.17	200.10.10.18	200.10.10.21	200.10.10.22	
	S2.1-b5-02	200.10.10.8/29	200.10.10.00001/29	255.255.255.248	200.10.10.9	200.10.10.10		200.10.10.11	200.10.10.14
	S2.1-b6-02						200.10.10.12	200.10.10.13	

Subnet assignment for supernet 200.10.10.0/25

Department	Block S2.2	Net#Subnet Bits	Binary Rep	Subnet Mask	Router Address	First Host	Last Host	Printer	DHCP Server
Acad	S2.2-b2	200.10.10.208/28	200.10.10.1101/28	255.255.255.240	200.10.10.209	200.10.10.210	200.10.10.221	200.10.10.222	
Acad	S2.2-b2	200.10.10.192/28	200.10.10.1100/28	255.255.255.240	200.10.10.193	200.10.10.194	200.10.10.205	200.10.10.206	
Admin	S2.2-b2	200.10.10.168/29	200.10.10.10101/29	255.255.255.248	200.10.10.169	200.10.10.170	200.10.10.172	200.10.10.173	200.10.10.174
Admin	S2.2-b3-04 S2.2-b3-07	200.10.10.160/29	200.10.10.10100/29	255.255.255.248	200.10.10.161	200.10.10.162	200.10.10.163	200.10.10.164	
Admin	S2.2-b3-06 S2.2-b3-08	200.10.10.152/29	200.10.10.10011/29	255.255.255.248	200.10.10.153	200.10.10.154	200.10.10.155	200.10.10.156	
Admin	S2.2-b4-02 S2.2-b4-03	200.10.10.144/29	200.10.10.10010/29	255.255.255.248	200.10.10.145	200.10.10.146	200.10.10.147	200.10.10.148	
Admin	S2.2-b4-04	200.10.10.136/29	200.10.10.10001/29	255.255.255.248	200.10.10.137	200.10.10.138	200.10.10.141	200.10.10.142	
Admin	S2.2-b5-02 S2.2-b6-02	200.10.10.128/29	200.10.10.10000/29	255.255.255.248	200.10.10.129	200.10.10.130	200.10.10.131	200.10.10.132	
							200.10.10.133	200.10.10.134	

Subnet assignment for supernet 200.10.10.128/25

Location	RS	Network: 200.10.11							
Block S2.1	Net#Subnet Bits	Binary Rep	Subnet Mask	Router Address	First Host	Last Host	Printer	DHCP Server	
S2.1-b3-01	200.10.11.128/27	200.10.11.100/27	255.255.255.224	200.10.11.129	200.10.11.130	200.10.11.139	200.10.11.140	200.10.11.158	
S2.1-b4-01					200.10.11.141	200.10.11.155	200.10.11.156		
S2.1-b3-01	200.10.11.160/27	200.10.11.101/27	255.255.255.224	200.10.11.161	200.10.11.162	200.10.11.171	200.10.11.172	200.10.11.190	
S2.1-b4-02					200.10.11.173	200.10.11.187	200.10.11.188		
S2.1-b3-02	200.10.11.192/27	200.10.11.110/27	255.255.255.224	200.10.11.193	200.10.11.194	200.10.11.199	200.10.11.200	200.10.11.222	
S2.1-b4-04					200.10.11.201	200.10.11.220	200.10.11.221		

Subnet assignment for supernet 200.10.11.128/25

Block S2.2	Net#Subnet Bits	Binary Rep	Subnet Mask	Router Address	First Host	Last Host	Printer	DHCP Server
S2.2-b3-03	200.10.11.16/28	200.10.11.0001/28	255.255.255.240	200.10.11.17	200.10.11.18	200.10.11.22	200.10.11.23	
S2.2-b3-04					200.10.11.24	200.10.11.29	200.10.11.30	
S2.2-b3-07	200.10.11.32/28	200.10.11.0010/28	255.255.255.240	200.10.11.33	200.10.11.34	200.10.11.45	200.10.11.46	
S2.2-b4-02	200.10.11.48/28	200.10.11.0011/28	255.255.255.240	200.10.11.49	200.10.11.50	200.10.11.61	200.10.11.62	
S2.2-b3-06	200.10.11.64/27	200.10.11.010/27	255.255.255.224	200.10.11.65	200.10.11.66	200.10.11.85	200.10.11.86	200.10.11.94
S2.2-b3-08					200.10.11.87	200.10.11.92	200.10.11.93	
S2.2-b4-03	200.10.11.96/27	200.10.11.011/27	255.255.255.224	200.10.11.97	200.10.11.98	200.10.11.112	200.10.11.113	200.10.11.126
S2.2-b4-04					200.10.11.114	200.10.11.123	200.10.11.124	

Subnet assignment for supernet 200.10.11.0/25

Lab Name	Block S2.1	Net#Subnet Bits	Binary Rep	Subnet Mask	Router Address	First Host	Last Host	Printer	Server	Supernet
Integrated Circuits & Systems	S2.1-b3-01	200.10.12.128/27	200.10.12.100/27	255.255.255.224	200.10.12.129	200.10.12.130	200.10.12.157	200.10.12.158		200.10.12.128 / 26
		200.10.12.160/27	200.10.12.101/27	255.255.255.224	200.10.12.161	200.10.12.162	200.10.12.189	200.10.12.190		
Intelligent Robotics	S2.1-b4-01	200.10.12.96/27	200.10.12.011/27	255.255.255.224	200.10.12.97	200.10.12.98	200.10.12.123	200.10.12.125	200.10.12.126	200.10.12.96 / 27
Biomedical Instrumentation	S2.1-b4-02	200.10.12.64/28	200.10.12.0100/28	255.255.255.240	200.10.12.65	200.10.12.66	200.10.12.75	200.10.12.78		200.10.12.64 / 27
Infocomm Research	S2.1-b4-04	200.10.12.192/27	200.10.12.110/27	255.255.255.224	200.10.12.193	200.10.12.194	200.10.12.221	200.10.12.222		200.10.12.192 / 26
Sensors & Actuators I	S2.1-b5-02	200.10.12.16/28	200.10.12.0001/28	255.255.255.240	200.10.12.17	200.10.12.18	200.10.12.23	200.10.12.30		200.10.12.0 / 26
Photronics Training	S2.1-b6-01	200.10.12.48/28	200.10.12.0011/28	255.255.255.240	200.10.12.49	200.10.12.50	200.10.12.57	200.10.12.61	200.10.12.62	200.10.12.48 / 28

Subnet assignment for supernet 200.10.12.0/23

Lab Name	Block S2.2	Net#Subnet Bits	Binary Rep	Subnet Mask	Router Address	First Host	Last Host	Printer	Server	Supernet
Satellite Engineering	S2.2-b3-04	200.10.14.192/27	200.10.14.110/27	255.255.255.224	200.10.14.193	200.10.14.194	200.10.14.221	200.10.14.222		200.10.14.192 / 27
	Local Server	200.10.14.8/30	200.10.14.000010/30	255.255.255.252	200.10.14.9				200.10.14.10	
Media Technology	S2.2-b4-02	200.10.14.160/27	200.10.14.101/27	255.255.255.224	200.10.14.161	200.10.14.162	200.10.14.185	200.10.14.189	200.10.14.190	200.10.14.160 / 27
Process Instrumentation	S2.2-b4-03	200.10.14.32/28	200.10.14.0010/28	255.255.255.240	200.10.14.33	200.10.14.34	200.10.14.45	200.10.14.46		
		200.10.14.16/29	200.10.14.00010/29	255.255.255.248	200.10.14.17	200.10.14.18	200.10.14.21	200.10.14.22		200.10.14.0 / 26
	Local Server	200.10.14.12/30	200.10.14.000011/30	255.255.255.252	200.10.14.13				200.10.14.14	
Software Engineering A	S2.2-b4-04	200.10.14.128/27	200.10.14.100/27	255.255.255.224	200.10.14.129	200.10.14.130	200.10.14.154	200.10.14.157	200.10.14.158	200.10.14.128 / 27
Software Engineering B	S2.2-b4-04	200.10.14.96/27	200.10.14.011/27	255.255.255.224	200.10.14.97	200.10.14.98	200.10.14.122	200.10.14.125	200.10.14.126	200.10.14.96 / 27
Microfabrication Facilities	S2.2-b5-02	200.10.14.64/28	200.10.14.0100/28	255.255.255.240	200.10.14.65	200.10.14.66	200.10.14.77	200.10.14.78		
Microfabrication Facilities	S2.2-b6-02	200.10.14.48/28	200.10.14.0011/28	255.255.255.240	200.10.14.49	200.10.14.50	200.10.14.61	200.10.14.62		200.10.14.0 / 25
	Local Server	200.10.14.4/30	200.10.14.000001/30	255.255.255.252	200.10.14.5				200.10.14.6	

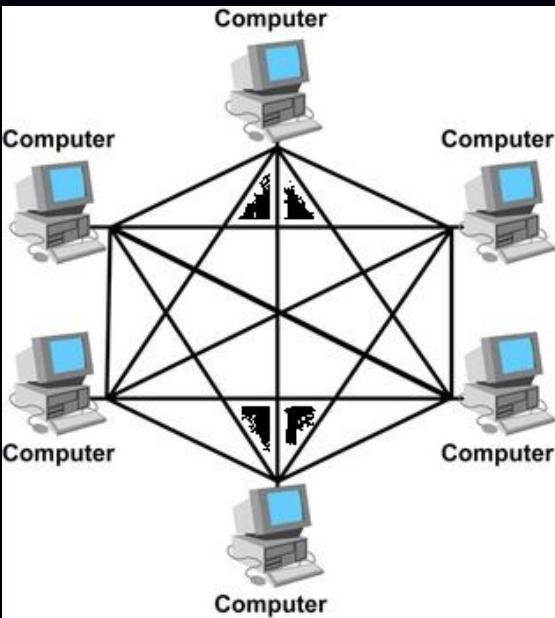
Subnet assignment for supernet 200.10.14.0/24



03

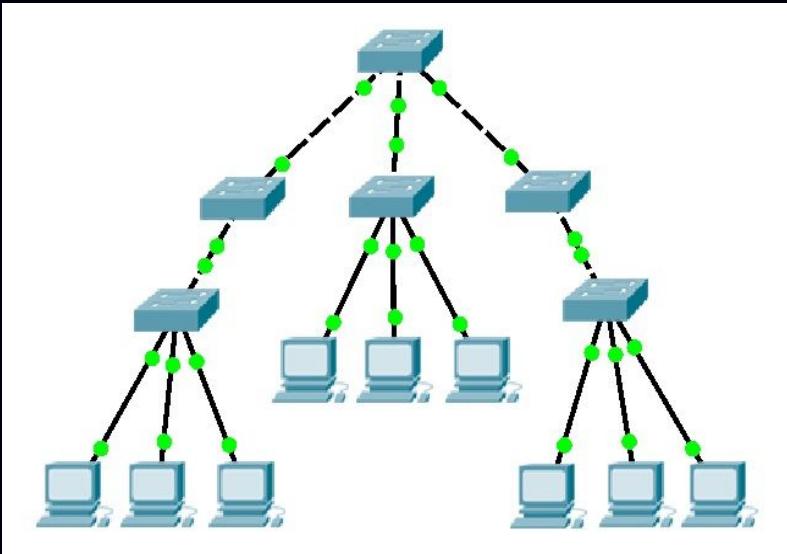
Network Topology

Mesh Topology

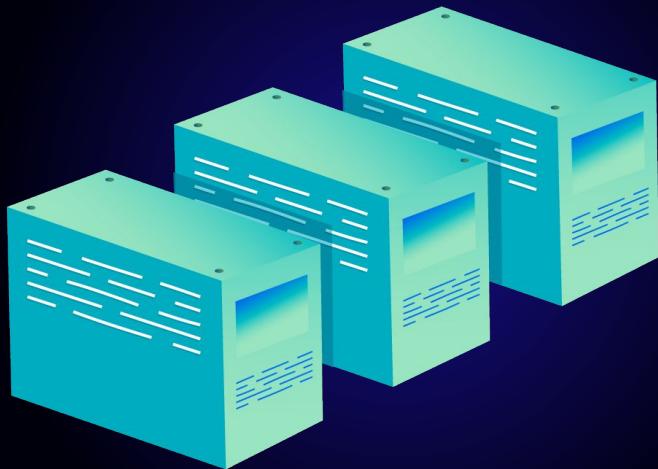


- Each node relays data for the network and the idea of routes is crucial
- Cheap option that offers redundancy in the event of a physical failure
- Redundancy boosts the network's robustness and reliability
- Core layer is the highest level, it should have more redundancy than a lower level layer in order to reduce the effects of a physical failure

Tree Topology



- Physical failure would prevent the child node from contacting its parent node or nodes if one or more were involved
- Allows for network expansion in the future due to its straightforward implementation



04

Multi-Layered Design

3 LAYERS



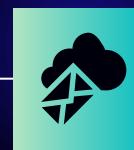
CORE

Focuses network traffic for remote access and access control



DISTRIBUTION

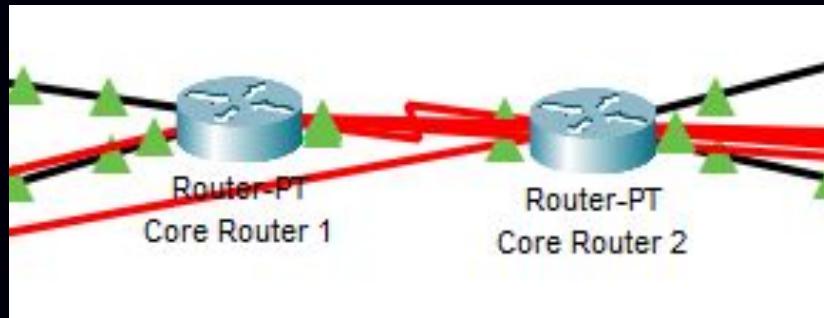
Distributes traffic from the Access layer equitably among local network segments



ACCESS

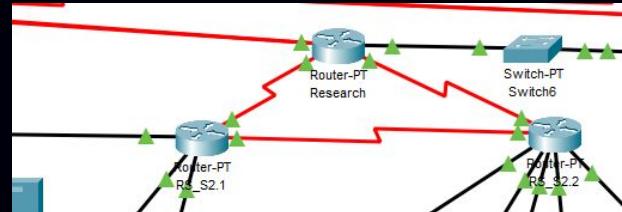
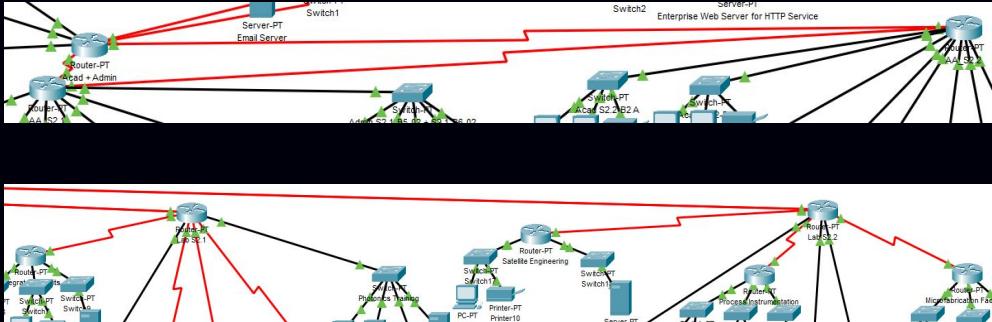
Expands the requirements for local network segments and end-user physical locations

CORE



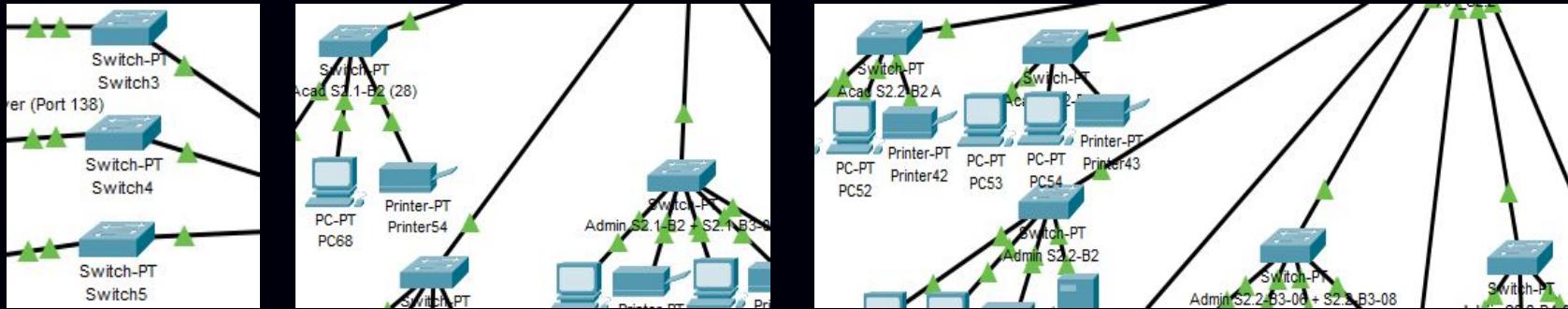
- Dual core router design
- Provides redundancy, load balancing and scalability
- Cost Effective solution

DISTRIBUTION



- Different distribution layer design for different workgroups
- Ensure redundancy while keeping the cost low
- Ensure security for Lab users

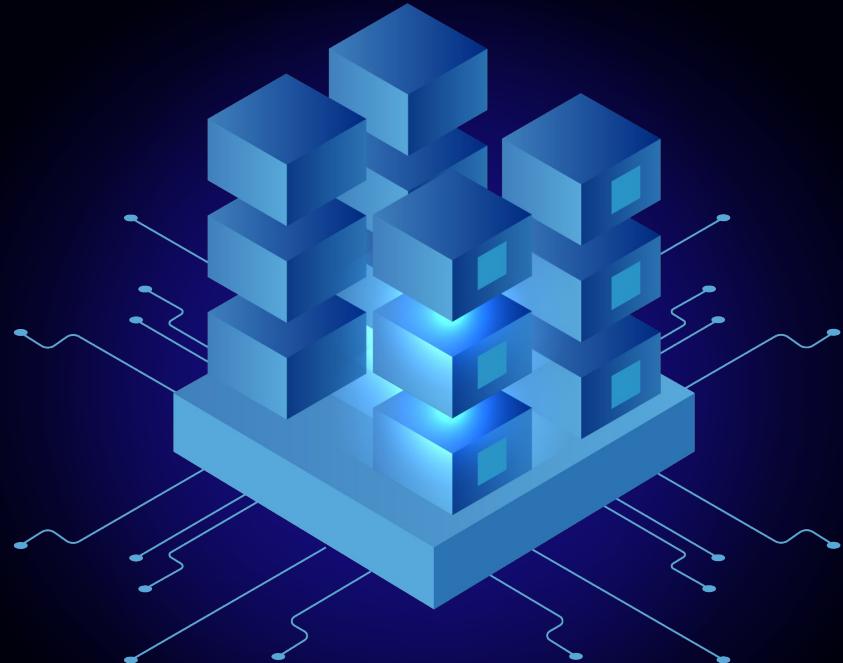
ACCESS



- Switches are assigned to different subnet groups and servers to provide network access.
- 55 switches are used

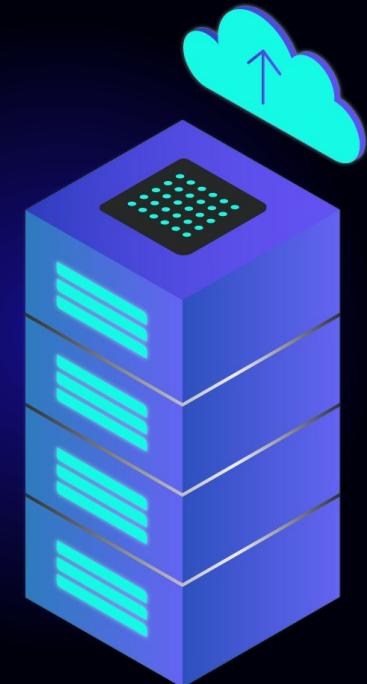
05

Server Placement

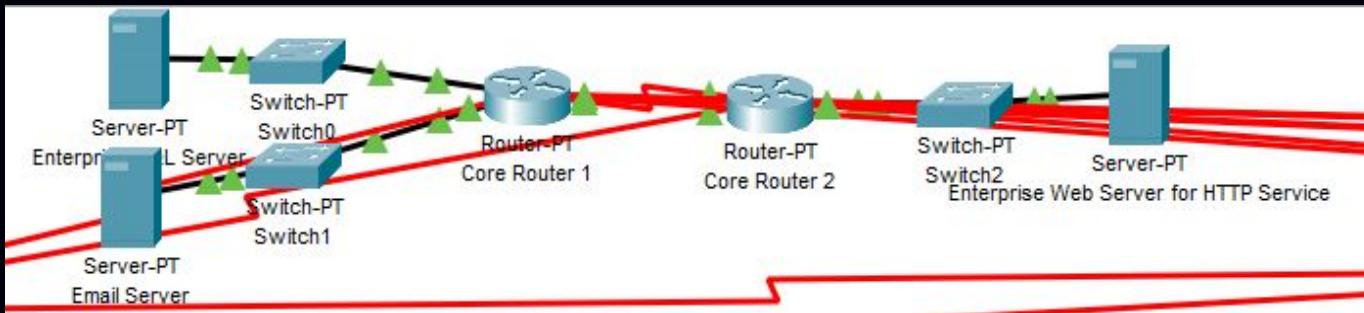


Server Placement

- Campus Wide Services
- Workgroup Specific Servers
- DHCP Servers
- Lab Servers

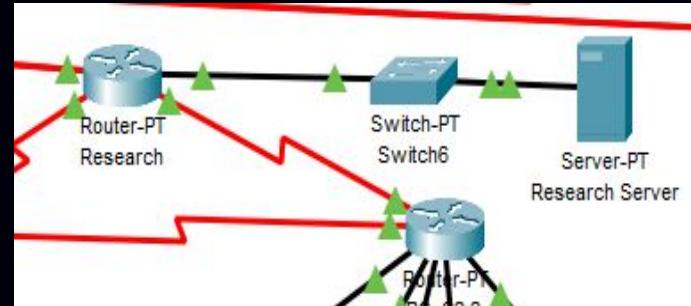
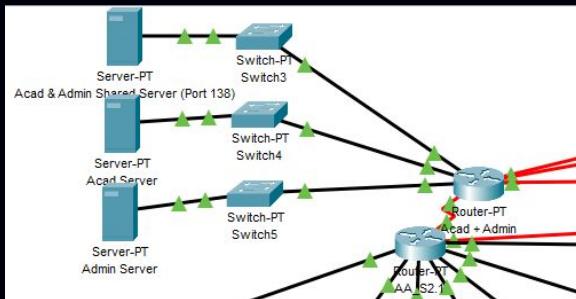


Campus Wide Services



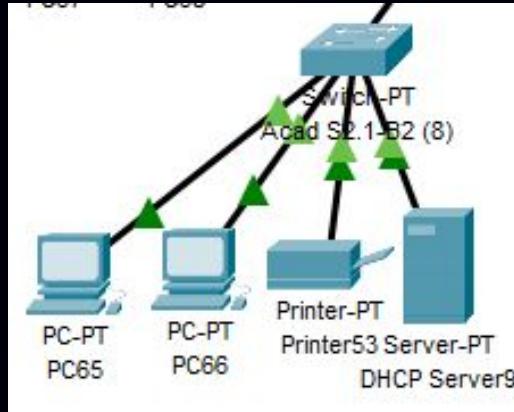
- 3 core campus network servers (SQL, Email, and HTTP) provide essential campus wide services
- Servers are connected directly to the two core routers via a switch
- This placement reduces redundant network traffic and ensures efficient and reliable access to critical services

Workgroup Servers



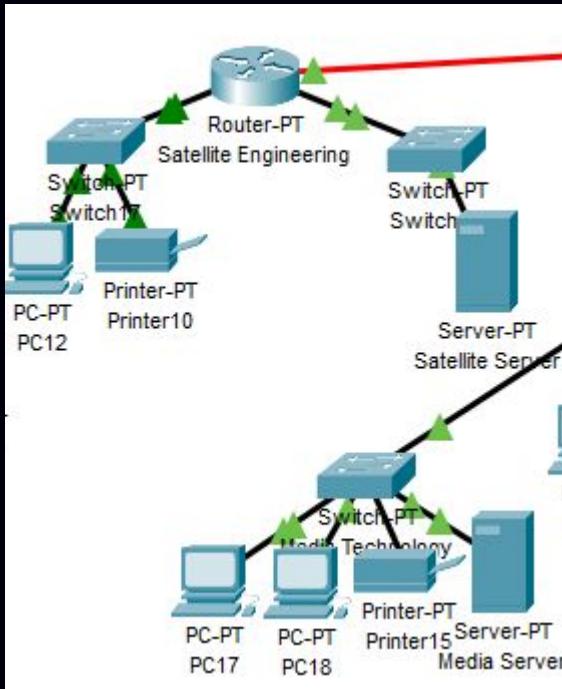
- Servers that cater to the needs of specific workgroups are connected to the distribution layer routers of the corresponding workgroups
- ensures that these servers are easily accessible to their target users while maintaining appropriate network segmentation

DHCP Servers

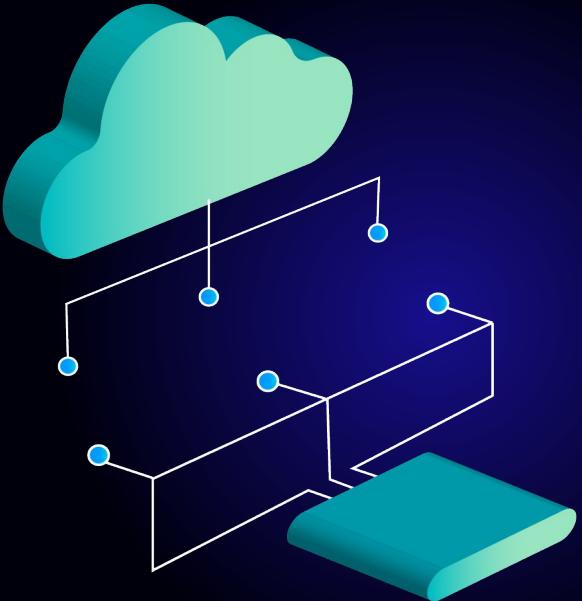


- Employed whenever there are excess IPs available in a subnet
- Placed under the switch for the respective subnet, allowing for efficient IP address assignment
- Contributes to overall network organization and simplifies administration tasks

Lab Servers



- Each lab server should only be accessible from its specific lab, ensuring a secure and controlled environment
- To allow for easy access while maintaining necessary separation from other network segments, lab servers placed under switches
- Some lab groups with insufficient IPs in the subnet, a /30 subnet is assigned to the server and placed under the same router as the respective lab work group

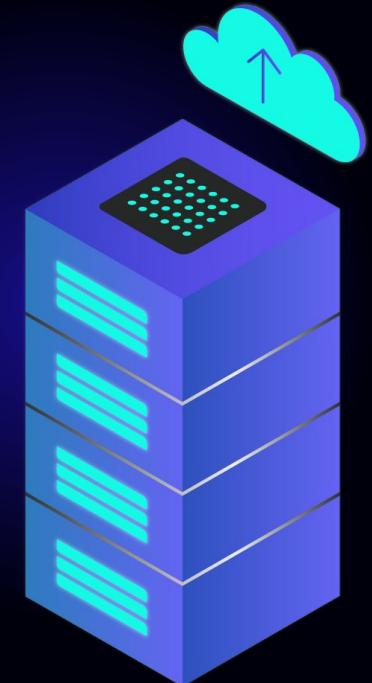


06

Network Security

Access Control Lists (ACL)

- Controls access to shared servers
- Denies/Permits communication
- Employs a series of commands
- Standard vs Extended
 - Standard: 1-99 and 1300-1999
 - Extended: 100-199 and 2000-2699



ACL Requirements

- Lab users are not allowed to access the SQL server, email server, other labs or other work groups.
- Only Acad and Admin workgroups can access a shared server on Port 138 for data sharing.
- Only Acad and Admin workgroups can access the Admin server.
- The Acad server and RS server allow only access from their respective workgroups
- Acad users allow only RS users to establish FTP connection with them through port 21.
- All external access into the campus network is denied, except for the access to the enterprise web server for HTTP service.

Access Control Lists

A	B	C	D	E	F	G	H
Router	ACL Statement	Port	Config	Purpose			
Acad + Admin Router	access-list 1 permit 200.10.8.0 0.0.3.255	Serial 0/0 Serial 1/0	ip acc 1 in ip acc 1 in	To deny access from external hosts and laboratory users			
Research Router	access-list 2 permit 200.10.8.0 0.0.3.255	Serial 0/0 Serial 1/0	ip acc 2 in ip acc 2 in	To deny access from external hosts and laboratory users			
Lab S2.1	access-list 3 permit host 200.10.9.250	Serial 0/0 Serial 1/0	ip acc 3 in ip acc 3 in	To only allow access to and from the enterprise web server for HTTP service			
Lab S2.2	access-list 4 permit host 200.10.9.250	Serial 0/0 Serial 1/0	ip acc 4 in ip acc 4 in	To only allow access to and from the enterprise web server for HTTP service			
Lab S2.1	access-list 5 permit host 200.10.9.250	Serial 2/0 Serial 3/0 Serial 4/0 Serial 5/0 Fast Ethernet 6/0 Fast Ethernet 7/0	ip acc 5 out	To deny access to other laboratory users To only allow access to and from the enterprise web server for HTTP service			
Lab S2.2	access-list 6 permit host 200.10.9.250	Serial 2/0 Serial 3/0 Serial 4/0 Fast Ethernet 5/0 Fast Ethernet 6/0 Fast Ethernet 7/0	ip acc 6 out	To deny access to other laboratory users To only allow access to and from the enterprise web server for HTTP service			
Core Router 1	access-list 7 permit 200.10.8.0 0.0.3.255	Fast Ethernet 6/0 Fast Ethernet 7/0	ip acc 7 out	To deny access to the Enterprise SQL Server and Email Server from external hosts and laboratory users			

Acad/Admin S2.2 Router	access-list 101 permit tcp 200.10.11.0 0.0.0.255 200.10.10.208 0.0.0.15 eq 21 access-list 101 deny tcp any 200.10.10.208 0.0.0.15 eq 21 access-list 101 permit ip any any	Fast Ethernet 2/0	config inter fast 2/0 ip acc 101 out	To allow FTP connections between Acad and RS		
Acad/Admin S2.2 Router	access-list 102 permit tcp 200.10.11.0 0.0.0.255 200.10.10.192 0.0.0.15 eq 21 access-list 102 deny tcp any 200.10.10.192 0.0.0.15 eq 21 access-list 102 permit ip any any	Fast Ethernet 3/0	config inter fast 3/0 ip acc 102 out			
Acad/Admin S2.1 Router	access-list 103 permit tcp 200.10.11.0 0.0.0.255 200.10.10.96 0.0.0.31 eq 21 access-list 103 deny tcp any 200.10.10.96 0.0.0.31 eq 21 access-list 103 permit ip any any	Fast Ethernet 2/0	config inter fast 2/0 ip acc 103 out			
Acad/Admin S2.1 Router	access-list 104 permit tcp 200.10.11.0 0.0.0.255 200.10.10.64 0.0.0.15 eq 21 access-list 104 deny tcp any 200.10.10.64 0.0.0.15 eq 21 access-list 104 permit ip any any	Fast Ethernet 3/0	config inter fast 3/0 ip acc 104 out			
Acad/Admin Router	access-list 105 permit tcp 200.10.10.0 0.0.0.255 200.10.10.230 0.0.0.0 eq 138 access-list 105 deny tcp any 200.10.10.230 0.0.0.0 eq 138 access-list 105 permit ip 200.10.10.0 0.0.0.255 200.10.10.230 0.0.0.0	Fast Ethernet 6/0	config inter fast 6/0 ip acc 105 out	To allow Acad & Admin staff to access a shared server on Port 138 for data sharing		
	access-list 8 permit 200.10.10.192 0.0.0.31 access-list 8 permit 200.10.10.64 0.0.0.15 access-list 8 permit 200.10.10.96 0.0.0.31	Fast Ethernet 7/0	config inter fast 7/0 ip acc 8 out	To restrict access of the Acad server to Acad users only		
	access-list 9 permit 200.10.10.0 0.0.0.255	Fast Ethernet 8/0	ip acc 9 out	To allow Acad & Admin staff to access Admin Server		
Research Router	access-list 10 permit 200.10.11.0 0.0.0.255	Fast Ethernet 6/0	ip acc 10 out	To restrict access of the RS server to Acad users only		

07

Simulation & Testing



SCENARIOS

Scenario 1

Only lab and external users should be unable to access the campus SQL and email server. Hence the accessibility of all users to the two servers are tested in this scenario.

Scenario 3

The Acad server should only be accessible by an Acad user. The RS server should only be accessible by RS users.

Scenario 2

Admin server and Acad Admin shared server should be accessible by only Acad and Admin workgroup.

Scenario 4

Only Research students can establish FTP connections (Port 21) with the Acad staff for file exchange.

SCENARIOS

Scenario 5

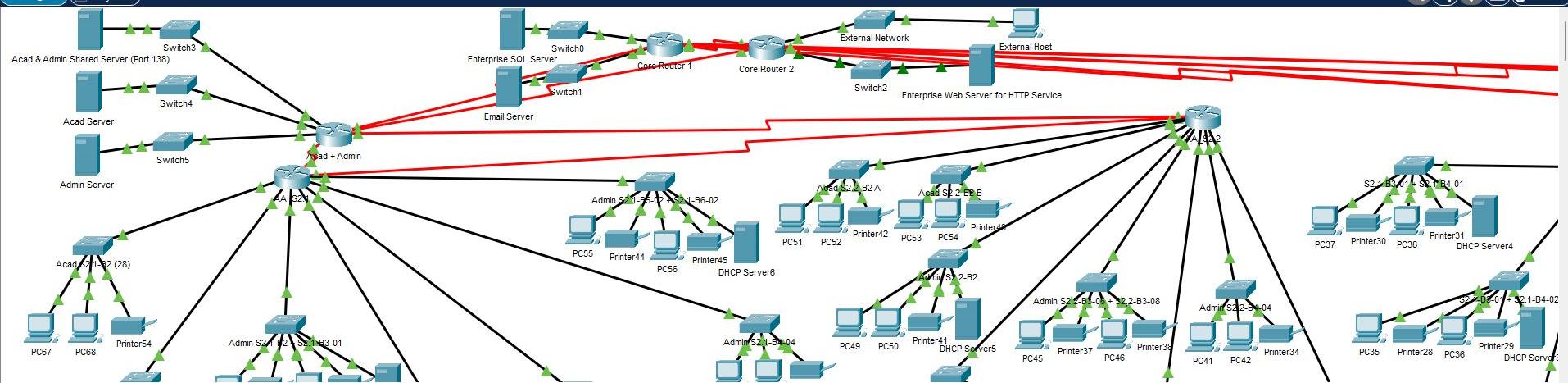
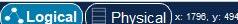
External IPs should only be allowed to access the HTTP server. The external IP is simulated by attaching another switch to the core router 2. The external switch is attached to a single end user.

Scenario 6

Random destinations are tested for different sources.

SCENARIO 0

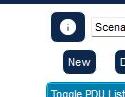
Source	Destination	Accessibility
Acad S2.1	SQL/Email server	Allow
Admin S2.2	SQL/Email server	Allow
RS 2.1	SQL/Email server	Allow
RS 2.2	SQL/Email server	Allow
Satellite Engineering Lab	SQL/Email server	Deny
Media Technology Lab	SQL/Email server	Deny
Software Engineering Lab A	SQL/Email server	Deny
Infocomm Research Lab	SQL/Email server	Deny
Intelligent Robotic Lab	SQL/Email server	Deny



PDU List Window

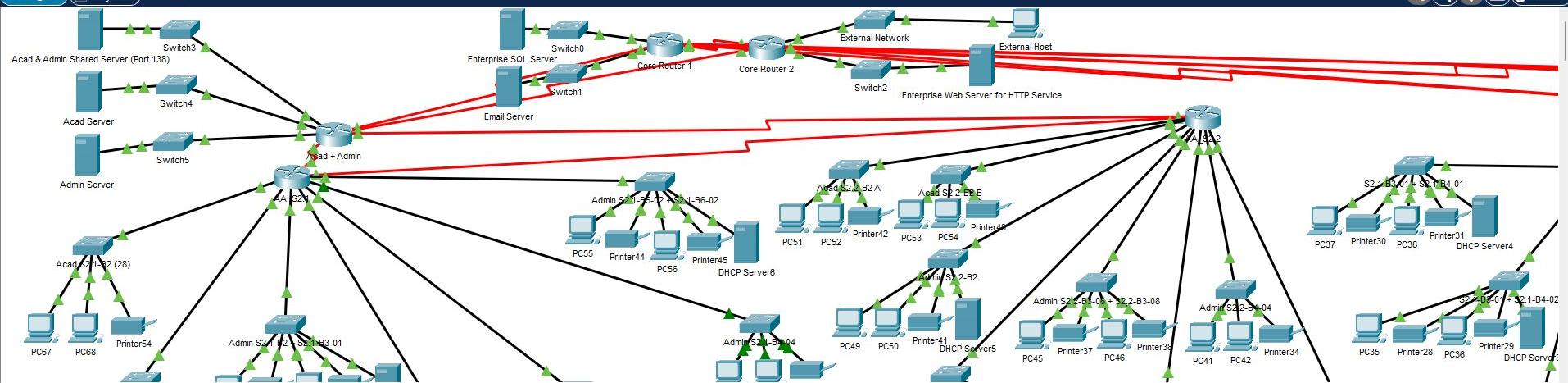
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
●	Successful	PC67	Enterprise SQL Se...	ICMP	■■■■■	0.000	N	0	(edit)	(edit)
●	Successful	PC45	Email Server	ICMP	■■■■■	0.000	N	1	(edit)	(edit)
●	Successful	PC35	Enterprise SQL Se...	ICMP	■■■■■	0.000	N	2	(edit)	(edit)
●	Successful	PC31	Email Server	ICMP	■■■■■	0.000	N	3	(edit)	(edit)
●	Failed	PC12	Enterprise SQL Se...	ICMP	■■■■■	0.000	N	4	(edit)	(edit)
●	Failed	PC17	Email Server	ICMP	■■■■■	0.000	N	5	(edit)	(edit)
●	Failed	PC19	Enterprise SQL Se...	ICMP	■■■■■	0.000	N	6	(edit)	(edit)
●	Failed	PC8	Email Server	ICMP	■■■■■	0.000	N	7	(edit)	(edit)
●	Failed	PC9	Email Server	ICMP	■■■■■	0.000	N	8	(edit)	(edit)

Time: 00:39:37



SCENARIO 1

<u>Source</u>	<u>Destination</u>	<u>Accessibility</u>
Acad S2.1	Admin Server	Allow
Admin S2.1	Admin/Acad Admin share server	Allow
Admin S2.2	Admin Server	Allow
Acad S2.2	Admin/Acad Admin share server	Allow
RS 2.1	Admin Server	Deny
RS 2.2	Admin/Acad Admin share server	Deny
Software Engineering Lab A	Admin Server	Deny
Infocomm Research Lab	Admin/Acad Admin share server	Deny
Intelligent Robotic Lab	Admin/Acad Admin share server	Deny



PDU List Window

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Del
●	Successful	PC67	Admin Server	ICMP	Yellow	0.000	N	0	(edit)	
●	Successful	PC63	Acad & Admin Sha...	ICMP	Gold	0.000	N	1	(edit)	
●	Successful	PC45	Admin Server	ICMP	Purple	0.000	N	2	(edit)	
●	Successful	PC51	Acad & Admin Sha...	ICMP	Green	0.000	N	3	(edit)	
●	Failed	PC35	Admin Server	ICMP	Grey	0.000	N	4	(edit)	
●	Failed	PC23	Acad & Admin Sha...	ICMP	Dark Green	0.000	N	5	(edit)	
●	Failed	PC19	Admin Server	ICMP	Purple	0.000	N	6	(edit)	
●	Failed	PC8	Acad & Admin Sha...	ICMP	Pink	0.000	N	7	(edit)	
●	Failed	PC0	Acad & Admin Sha...	ICMP	Blue	0.000	N	8	(edit)	

Time: 00:39:47



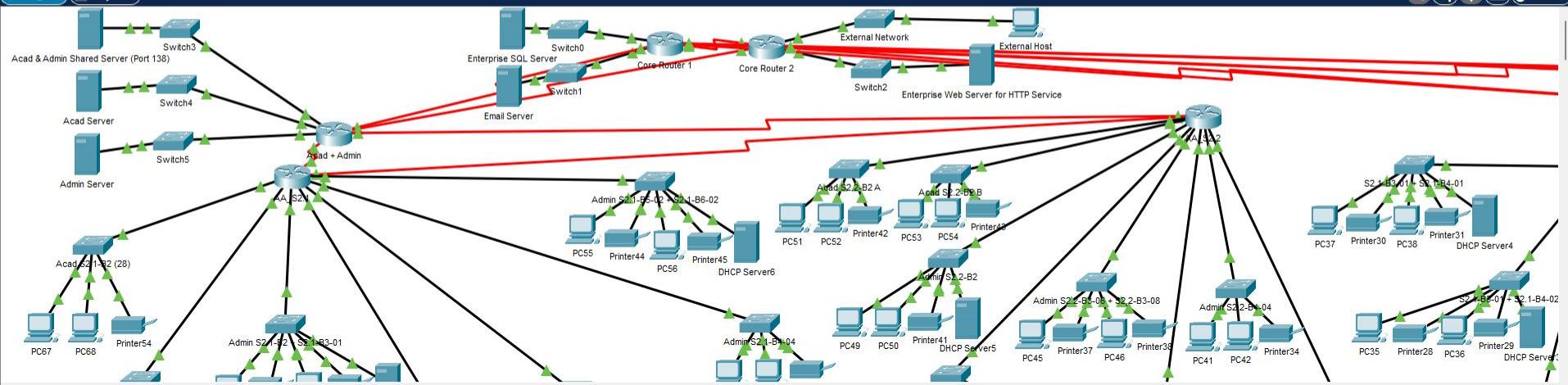
SCENARIO 2

<u>Source</u>	<u>Destination</u>	<u>Accessibility</u>
Acad S2.1	Acad server	Allow
Admin S2.2	RS server	Deny
RS 2.1	Acad server	Deny
RS 2.2	RS server	Allow
Satellite Engineering Lab	Acad server	Deny
Media Technology Lab	RS server	Deny
RS 2.1	RS Server	Allow
Admin S2.1	Acad Server	Deny
Acad S2.2	RS Server	Deny



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PDU List Window

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
●	Successful	PC67	Acad Server	ICMP	blue	0.000	N	0	(edit)	(delete)
●	Failed	PC43	Research Server	ICMP	purple	0.000	N	1	(edit)	(delete)
●	Failed	PC35	Acad Server	ICMP	green	0.000	N	2	(edit)	(delete)
●	Successful	PC28	Research Server	ICMP	pink	0.000	N	3	(edit)	(delete)
●	Failed	PC12	Acad Server	ICMP	blue	0.000	N	4	(edit)	(delete)
●	Failed	PC17	Research Server	ICMP	purple	0.000	N	5	(edit)	(delete)
●	Successful	PC37	Research Server	ICMP	purple	0.000	N	6	(edit)	(delete)
●	Failed	PC55	Acad Server	ICMP	blue	0.000	N	7	(edit)	(delete)
●	Failed	PC54	Research Server	ICMP	purple	0.000	N	8	(edit)	(delete)

Time: 00:39:53 ⏪ ⏹

Realtime Simulation



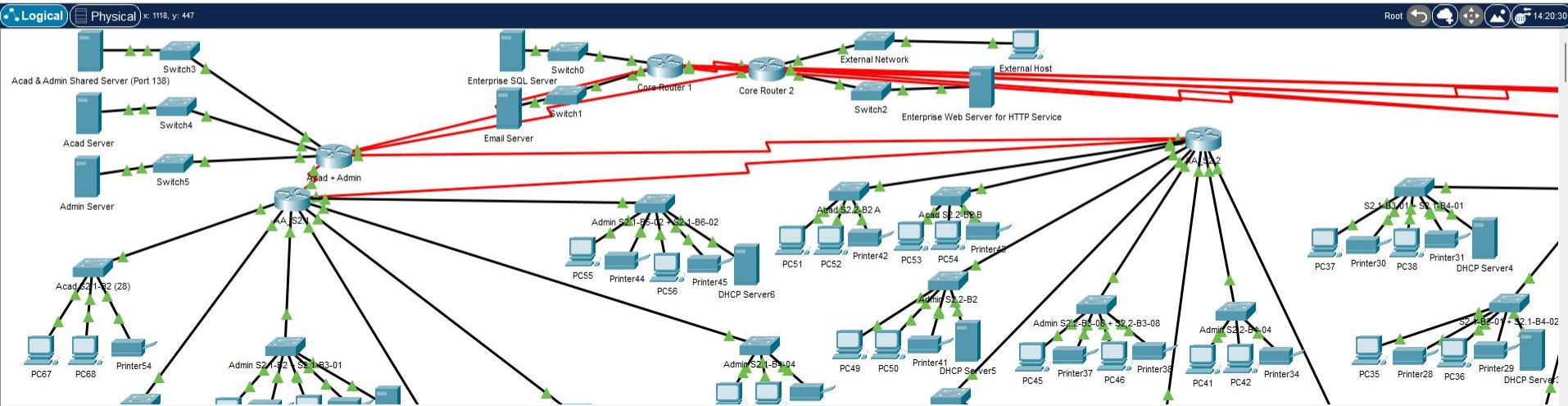
Scenario 2
New Delete
Toggle PDU List Window

SCENARIO 3

<u>Source</u>	<u>Destination (port 21)</u>	<u>Accessibility</u>
Admin S2.1	Acad S2.1	Deny
RS S2.1	Acad S2.2	Allow
RS S2.2	Acad S2.1	Allow
Satellite Engineering Lab	Acad S2.2	Deny
Media Technology Lab	Acad S2.1	Deny
Software Engineering Lab A	Acad S2.2	Deny
Infocomm Research Lab	Acad S2.1	Deny
Intelligent Robotic Lab	Acad S2.2	Deny

SCENARIO 4

Source	Destination	Accessibility
Acad S2.1	HTTP server	Allow
Admin S2.2	HTTP server	Allow
RS S2.1	HTTP server	Allow
RS S2.2	HTTP server	Allow
Satellite Engineering Lab	HTTP server	Allow
External IP	HTTP server	Allow
External IP	Acad S2.1	Deny
External IP	Email server	Deny
External IP	SQL server	Deny



PDU List Window										
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	D
●	Successful	PC67	Enterprise Web Se...	ICMP	orange	0.000	N	0	(edit)	
●	Successful	PC41	Enterprise Web Se...	ICMP	red	0.000	N	1	(edit)	
●	Successful	PC37	Enterprise Web Se...	ICMP	green	0.000	N	2	(edit)	
●	Successful	PC27	Enterprise Web Se...	ICMP	blue	0.000	N	3	(edit)	
●	Successful	PC12	Enterprise Web Se...	ICMP	olive	0.000	N	4	(edit)	
●	Successful	External...	Enterprise Web Se...	ICMP	purple	0.000	N	5	(edit)	
●	Failed	External...	PC67	ICMP	brown	0.000	N	6	(edit)	
●	Failed	External...	Email Server	ICMP	dark brown	0.000	N	7	(edit)	
●	Failed	External...	Enterprise SQL Se...	ICMP	light green	0.000	N	8	(edit)	

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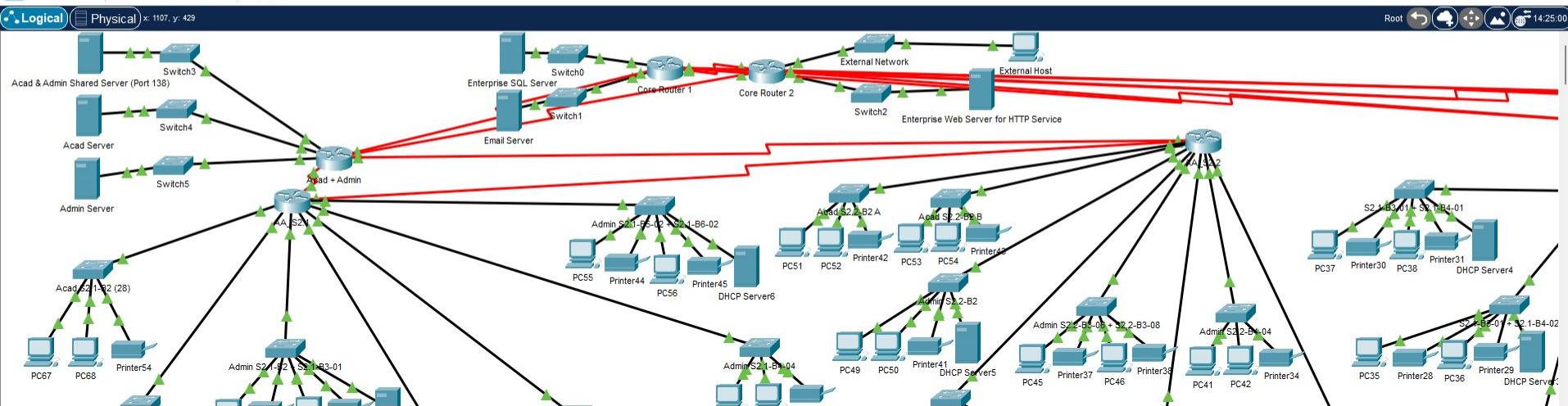
Time: 00:40:01



Realtime Simulation

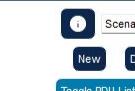
SCENARIO 5

<u>Source</u>	<u>Destination</u>	<u>Accessibility</u>
Acad S2.1	SW Lab B Server	Deny
Admin S2.2	RS S2.1	Allow
RS 2.1	Media Technology Lab Server	Deny
RS 2.2	SQL server	Allow
Satellite Engineering Lab	SW Lab B Server	Deny
Media Technology Lab	Media Technology Lab Server	Allow
Intelligent Robotic Lab	Admin server	Deny
Acad S2.1	Admin Server	Allow
Admin S2.2	Admin Server	Allow
RS S2.1	Admin Server	Deny



PDU List Window										
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Dr
●	Failed	PC67	SW Server B	ICMP	█	0.000	N	0	(edit)	
●	Successful	PC46	PC34	ICMP	█	0.000	N	1	(edit)	
●	Failed	PC36	Media Server	ICMP	█	0.000	N	2	(edit)	
●	Successful	PC28	Enterprise SQL Se...	ICMP	█	0.000	N	3	(edit)	
●	Failed	PC12	SW Server B	ICMP	█	0.000	N	4	(edit)	
●	Successful	PC17	Media Server	ICMP	█	0.000	N	5	(edit)	
●	Failed	PC0	Admin Server	ICMP	█	0.000	N	6	(edit)	
●	Successful	PC66	Admin Server	ICMP	█	0.000	N	7	(edit)	
●	Successful	PC48	Admin Server	ICMP	█	0.000	N	8	(edit)	
●	Failed	PC36	Admin Server	ICMP	█	0.000	N	9	(edit)	

Time: 00:40:06



Realtime Simulation

PROJECT SUCCESS!

Conclusion

All project and design objectives were taken into consideration.

Implementation of the right approaches, layered design, calculated assignments and troubleshooting led to a successful final outcome.



Thank You