Enterprise Network for Axiom Arcade

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DECLARATION

The thesis is our original work and has not been submitted previously for a degree at this or any other university/institute.

To the best of my knowledge, it does not contain any material published or written by another person, except as acknowledged in the text.

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This is to certify that this project is based on the work of ……………………… under my supervision. The report has been prepared according to the format stipulated and is of an acceptable standard.

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ABSTRACT

This project focuses on setting up a modern and secure network infrastructure for a new shopping mall. The primary objectives include designing and deploying a scalable network, implementing robust security measures, providing tailored connectivity for tenants, integrating smart technology, and establishing centralized network management.

Through the successful execution of these objectives, the project endeavors to establish a cutting-edge network infrastructure that not only meets the immediate connectivity and security demands of the shopping mall but also lays a foundation for future technological advancements and innovation in the retail space.

The aim is to create a reliable, efficient, and interconnected environment that that meets the technological needs of a new shopping mall while ensuring a secure and seamless experience for shoppers and business.

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1. Introduction

This is the Axiom Arcade Mall enterprise network solution proposal, outlining our plan to design and implement a comprehensive network system that meets the unique requirements for the big shopping mall. According to our analysis of this mall we have made these requirements.

- There are 3 floors including basement.
  There are 32 shops in ground floor.
  There are 39 shops in 1st floor.
  We expect 500+ visitors per Day.

There also have some gaming areas, some huge open spaces for people to visit and reception. All these spaces are covered using APs for uninterrupted Connection between connected devices and Internet. The servers will be implemented inside Network Control Area and each floor will have their own switches which will be fixed to a rack. And we have used a technology that helps visitors to connect to the limited access Internet wirelessly.

- To ensure the security of important rooms such as private Storerooms we will install biometric scanners on each floor as required and installation of high-quality access points and CCTV cameras on each floor Additionally, IP phones will be installed on each floor to provide reliable communication for administrate whole Building.

We believe that our proposed network infrastructure will deliver a scalable and efficient network, meeting the specific requirements of the Axiom Arcade Shopping Mall. Our team is consisting experienced professionals will work diligently to ensure the system is installed seamlessly with minimal disruption to the Company's operations.

1.2 Problem Solution Statement

1.2.1 Problem:

Axiom Arcade Mall is growing shopping mall that currently has no network infrastructure in place. The lack of a network system hinders the mall's ability to communicate and collaborate effectively between floors and connected devices, and it can cause delays and errors in day-to-day operations. As the mall continues to expand, the need for a reliable and scalable network infrastructure becomes increasingly critical.

1.2.2 Solution:

To address the challenge of the lack of a network infrastructure, our proposed enterprise solution includes the design and implementation of a comprehensive network system that is tailored to meet the specific requirements of Axiom Arcade Mall Solution. Our team of experienced professionals will work closely with the mall to ensure that the system is installed seamlessly and with minimal disruption to its operations.

Our solution includes the installation of high-quality access point, switches, and servers that will provide reliable connectivity and enhance the connection between floors and connected devices. The network system will be designed with scalability in mind, allowing it to grow and adapt as the mall's needs change over time.

Additionally, our solution includes the installation of biometric scanners, CCTV cameras, and IP phones on each floor to provide enhanced security measures for the employees and private storerooms.

With our proposed solution, Axiom Arcade Mall can look forward to reliable and secure network infrastructure that will support its growing business needs and enable effective communication and collaboration between floors and connected devices.

2.Network Design

2.1 Network Diagram

Figure 01: Network Topology Diagram
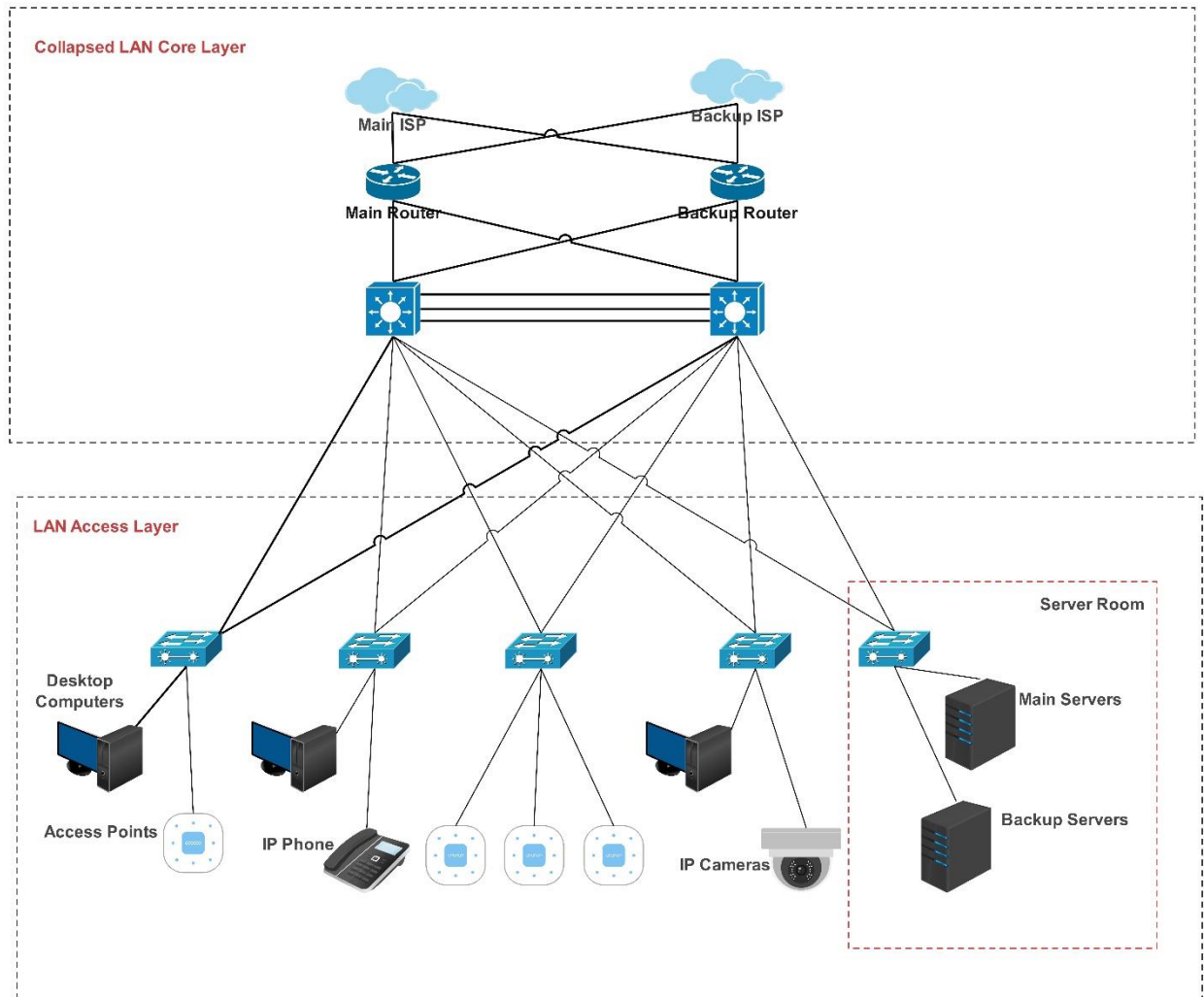
- On the top we use two ISPs to our network, one we use as Main ISP and another one we use as a Backup ISP. After that we have used two routers one act as a backup router. The router is used to configure NAT and to do the job of a firewall. Then we have a core layer, we used two multilayer switches. And next we have added the distribution layer. At last, there is the access layer.

2.2 PROTOCOLS

HSRP (Hot Standby Router Protocol)

• HSRP is a Cisco proprietary protocol that allows multiple routers to work together in high availability setups, ensuring uninterrupted network connectivity by designating one router as active and others as standby for failover.

VTP (VLAN Trunking Protocol)

• VTP is a Cisco protocol that manages VLAN configuration across a network, simplifying the process of adding, modifying, or deleting VLANs on multiple switches simultaneously.

DHCP (Dynamic Host Configuration Protocol)

• DHCP is a network protocol used to automatically assign IP addresses and other network configuration parameters to devices, making it easier to manage and maintain IP addressing in large networks.

SNMP (Simple Network Management Protocol)

• SNMP is a protocol for monitoring and managing network devices and their performance, allowing administrators to collect information and make configuration changes remotely.

STP (Spanning Tree Protocol)

• STP is a network protocol used to prevent loops in Ethernet networks by selecting the best path and blocking redundant links, ensuring a loop-free topology.

VLAN (Virtual Local Area Network)

• VLAN is a network technology that divides a physical network into multiple logical segments, improving network security, manageability, and flexibility.

HTTP (Hypertext Transfer Protocol)

• HTTP is the foundation of data communication on the World Wide Web, enabling the transfer of web pages, images, and other resources between a web server and a client's browse

TCP (Transmission Control Protocol)

• TCP is a reliable, connection-oriented protocol that ensures data is delivered accurately and in order between devices on a network, making it suitable for applications like web browsing and email.

UDP (User Datagram Protocol)

• UDP is a connectionless, lightweight protocol that provides faster data transfer but does not guarantee data delivery or order, making it suitable for real-time applications like video streaming and online gaming.

2.3 IP ADDRESSING TABLE AND VLANS

Floor		VLAN No	No of Users	Network Address	Subnet Mask	Usable Ip Range
Ground floor	Reception	5	3	192.168.14.0	255.255.255.248	192.168.14.1-192.168.14.6
	Electronic and technology	10	10	192.168.14.8	255.255.255.240	192.168.14.9-192.168.14.24
	Footwear stores	15	6	192.168.14.26	255.255.255.248	192.168.14.27-192.168.14.33
	Restaurants	20	10	192.168.14.35	255.255.255.240	192.168.14.36-192.168.14.48
	Jewelry stores	25	6	192.168.14.50	255.255.255.248	192.168.14.51-192.168.14.56
	Bookstores	30	10	192.168.14.58	255.255.255.240	192.168.14.59-192.168.14.71
	Bank atm	35	4	192.168.14.73	255.255.255.248	192.168.14.74-192.168.14.78
	Furniture Stores	40	4	192.168.14.80	255.255.255.248	192.168.14.81-192.168.14.84
1st floor	Health and Wellness	45	5	192.168.15.0	255.255.255.248	192.168.15.1-192.168.15.6
	Kids play area	50	6	192.168.15.8	255.255.255.248	192.168.15.9-192.168.15.15
	Entertainment	55	6	192.168.15.17	255.255.255.248	192.168.15.18-192.168.15.24
	Sporting goods stores	60	6	192.168.15.26	255.255.255.248	192.168.15.27-192.168.15.33
	Restaurants	70	10	192.168.15.35	255.255.255.240	192.168.15.36-192.168.15.46
	Cosmetics and beauty supply	75	6	192.168.15.48	255.255.255.248	192.168.15.49-192.168.15.55
	Electronics repair centers	80	10	192.168.15.57	255.255.255.240	192.168.15.58-192.168.15.68
	Information desk	85	3	192.168.15.70	255.255.255.248	192.168.15.71-192.168.15.74
Basement	Wi-Fi users	90	1024	192.168.10.0	255.255.252.0	192.168.10.1-192.168.13.254
	Printers/Scanners/Fax /IP Phones	95	100	192.168.16.0	255.255.255.128	192.168.16.1-192.168.16.126
	Indoor Cameras	110	110	192.168.16.128	255.255.255.128	192.168.16.129-192.168.16.254
	Access points	115	36	192.168.17.0	255.255.255.128	192.168.17.1-192.168.17.126
	Switches	120	25	192.168.17.128	255.255.255.192	192.168.17.65-192.168.17.128

	Outdoor cameras	110	100	192.168.17.130	255.255.255.128	192.168.17.131-192.168.17.231
	admin	115	10	192.168.17.233	255.255.255.240	192.168.17.234-192.168.17.244
	Server	118	8	192.168.18.0	255.255.255.240	192.168.18.0 – 192.168.18.15

The IP addressing table shows the IP address ranges of each category of showrooms and the other important networks such as Wireless user Network. We have used the same IP range for every IP camera (CCTV) that have been used. And we have used separate IP range for all the servers. For the wireless users we have taken 3 IP ranges and combined into a single network. For all the printer/Fax/Scanner and IP phone that is used by the company will have the same IP range.

2.4 Port Assignment Table

- The following are the ports assigned to each device. Each port interface is given a specific port to which it should be connected.
- All connecting ports should be labeled with the proper names.
- All the DHCP assigned ports should be configured as access ports except the ports that are connecting to core switches.

Device	Port	Connect to	port
R1 (main Router)	G0/0	Main ISP	Internet Link
R2 (Backup Router)	G0/0	Backup ISP	Backup Internet Link
R1 (main Router)	G0/1	Backup ISP	Backup Internet Link
R2 (Backup Router)	G0/1	Main ISP	Internet Link
R1	G0/2	L3-S1	G1/0/24
R2	G0/2	L3-S2	G1/0/24
R1	G0/3	L3-S2	G1/0/23
R2	G0/3	L3-S1	G1/0/23
L3-S1	G 1/0/22	L3-S2	G 1/0/22 (ether ch.)
L3-S1	G 1/0/21	L3-S2	G 1/0/21 (ether ch.)
L3-S1	G 1/0/20	L3-S2	G 1/0/20 (ether ch.)
L3-S1	G 1/0/1	Sw-01 (Server Switch)	G0/1 (ether ch.)
L3-S2	G 1/0/1	Sw-01 (Server Switch)	G0/2
Sw-01	Fa 0/1	Server-01	G0 (VLAN 118)
Sw-01	Fa 0/2	Server-02	G0 (VLAN 118)
L3-S1	G 1/0/5	Sw-2	G0/48
L3-S1	G 1/0/6	Sw-3	G0/48
L3-S1	G 1/0/7	Sw-4	G0/48
L3-S1	G 1/0/8	Sw-5	G0/48

L3-S1	G 1/0/9	Sw-6	G0/48
L3-S1	G 1/0/10	Sw-7	G0/48
L3-S1	G 1/0/11	Sw-8	G0/48
L3-S1	G 1/0/12	Sw-9	G0/48
L3-S1	G 1/0/13	Sw-10	G0/48
L3-S1	G 1/0/14	Sw-11	G0/48
L3-S1	G 1/0/15	Sw-12	G0/48
L3-S1	G 1/0/16	Sw-13	G0/48
L3-S1	G 1/0/17	Sw-14	G0/48
L3-S1	G 1/0/18	Sw-15	G0/48
L3-S1	G 1/0/19	Sw-16	G0/48
L3-S1	G 1/0/20	Sw-17	G0/48
L3-S1	G 1/0/21	Sw-18	G0/48
L3-S1	G 1/0/22	Sw-19	G0/48
L3-S1	G 1/0/23	Sw-20	G0/48

Device	Port	Connect to	Port
L3-S2	G 1/0/5	Sw-2	G0/47
L3-S2	G 1/0/6	Sw-3	G0/47
L3-S2	G 1/0/7	Sw-4	G0/47
L3-S2	G 1/0/8	Sw-5	G0/47
L3-S2	G 1/0/9	Sw-6	G0/47
L3-S2	G 1/0/10	Sw-7	G0/47
L3-S2	G 1/0/11	Sw-8	G0/47
L3-S2	G 1/0/12	Sw-9	G0/47
L3-S2	G 1/0/13	Sw-10	G0/47
L3-S2	G 1/0/14	Sw-11	G0/47
L3-S2	G 1/0/15	Sw-12	G0/47
L3-S2	G 1/0/16	Sw-13	G0/47
L3-S2	G 1/0/17	Sw-14	G0/47
L3-S2	G 1/0/18	Sw-15	G0/47
L3-S2	G 1/0/19	Sw-16	G0/47
L3-S2	G 1/0/20	Sw-17	G0/47
L3-S2	G 1/0/21	Sw-18	G0/47

| L3-S2 | G 1/0/22 | Sw-19 | G0/47 |
| L3-S2 | G 1/0/23 | Sw-20 | G0/47 |

Device	Int.range	Assign to	
Sw-2	G 0/2-6	Vlan 5	Reception(1st floor)
Sw-3	G 0/2-12	Vlan 10	Electronic and technology(1st floor)
Sw-4	G 0/2-8	Vlan 15	Footwear stores(1st floor)
Sw-5	G 0/2-12	Vlan 20	Restaurants(1st floor)
Sw-6	G 0/2-8	Vlan 25	Jewelry stores(1st floor)
Sw-7	G 0/2-12	Vlan 30	Bookstores(1st floor)
Sw-8	G 0/2-6	Vlan 35	Bank atm(1st floor)
Sw-9	G 0/2-6	Vlan 40	Furniture Stores(1st floor)
Sw-10	G 0/2-8	Vlan 45	Health and Wellness(2nd floor)
Sw-11	G 0/2-9	Vlan 50	Kids play area(2nd floor)
Sw-12	G 0/2-9	Vlan 55	Entertainment(2nd floor)
Sw-13	G 0/2-9	Vlan 60	Sporting goods stores(2nd floor)

Sw-14	G 0/2-12	Vlan 65	Restaurants(2nd floor)
Sw-15	G 0/2-9	Vlan 70	Cosmetics and beauty supply(2nd floor)
Sw-16	G 0/2-12	Vlan 75	Electronics repair centers(2nd floor)
Sw-17	G 0/2-6	Vlan 80	Information desk(2nd floor)

Device	Int. Range	Assign to	
Sw-1	G 1/0/5	Sw-2	G0/47
Sw-1	G 1/0/6	Sw-3	G0/47
Sw-1	G 1/0/7	Sw-4	G0/47
Sw-1	G 1/0/8	Sw-5	G0/47
Sw-1	G 1/0/9	Sw-6	G0/47
Sw-1	G 1/0/10	Sw-7	G0/47
Sw-1	G 1/0/11	Sw-8	G0/47
Sw-1	G 1/0/12	Sw-9	G0/47

Sw-02

Interface	Connect to	Ip address	Default Gateway
Fa 0/2	F1-5-RE-01	192.168.14.1	192.168.14.6
Fa 0/3	F1-5-RE-02	192.168.14.2	192.168.14.6
Fa 0/4	F1-5-RE-03	192.168.14.3	192.168.14.6
Fa 0/5	F1-5-RE-04	192.168.14.4	192.168.14.6

Sw-03

Interface	Connect to	Ip address	Default Gateway
Fa 0/2	F1-10-ET-01	192.168.14.9	192.168.14.24
Fa 0/3	F1-10-ET-02	192.168.14.10	192.168.14.24
Fa 0/4	F1-10-ET-03	192.168.14.11	192.168.14.24
Fa 0/5	F1-10-ET-04	192.168.14.12	192.168.14.24
Fa 0/6	F1-10-ET-05	192.168.14.13	192.168.14.24
Fa 0/7	F1-10-ET-06	192.168.14.14	192.168.14.24
Fa 0/8	F1-10-ET-07	192.168.14.15	192.168.14.24
Fa 0/9	F1-10-ET-08	192.168.14.16	192.168.14.24
Fa 0/10	F1-10-ET-09	192.168.14.17	192.168.14.24
Fa 0/11	F1-10-ET-10	192.168.14.18	192.168.14.24

Sw-04

Interface	Connect to	Ip address	Default Gateway
Fa 0/2	F1-15-FT-01	192.168.14.27	192.168.14.33
Fa 0/3	F1-15-FT-02	192.168.14.28	192.168.14.33
Fa 0/4	F1-15-FT-03	192.168.14.29	192.168.14.33
Fa 0/5	F1-15-FT-04	192.168.14.30	192.168.14.33
Fa 0/6	F1-15-FT-05	192.168.14.31	192.168.14.33
Fa 0/7	F1-15-FT-06	192.168.14.32	192.168.14.33

Sw-05

Interface	Connect to	Ip address	Default Gateway
Fa 0/2	F1-20-RT1-01	192.168.14.36	192.168.14.48
Fa 0/3	F1-20-RT1-02	192.168.14.37	192.168.14.48
Fa 0/4	F1-20-RT1-03	192.168.14.38	192.168.14.48

Fa 0/5	F1-20-RT1-04	192.168.14.39	192.168.14.48
Fa 0/6	F1-20-RT1-05	192.168.14.40	192.168.14.48
Fa 0/7	F1-20-RT1-06	192.168.14.41	192.168.14.48
Fa 0/8	F1-20-RT1-07	192.168.14.42	192.168.14.48
Fa 0/9	F1-20-RT1-08	192.168.14.43	192.168.14.48
Fa 0/10	F1-20-RT1-09	192.168.14.44	192.168.14.48
Fa 0/11	F1-20-RT1-10	192.168.14.45	192.168.14.48

Sw-06

Interface	Connect to	Ip address	Default Gateway
Fa 0/2	F1-25-JS-01	192.168.14.51	192.168.14.56
Fa 0/3	F1-25-JS-02	192.168.14.52	192.168.14.56
Fa 0/4	F1-25-JS-03	192.168.14.53	192.168.14.56
Fa 0/5	F1-25-JS-04	192.168.14.54	192.168.14.56
Fa 0/5	F1-25-JS-05	192.168.14.55	192.168.14.56

Sw-07

Interface	Connect to	Ip address	Default Gateway
Fa 0/2	F1-30-BS-01	192.168.14.59	192.168.14.71
Fa 0/3	F1-30-BS-02	192.168.14.60	192.168.14.71
Fa 0/4	F1-30-BS-03	192.168.14.61	192.168.14.71
Fa 0/5	F1-30-BS-04	192.168.14.62	192.168.14.71
Fa 0/6	F1-30-BS-05	192.168.14.63	192.168.14.71
Fa 0/7	F1-30-BS-06	192.168.14.64	192.168.14.71
Fa 0/8	F1-30-BS-07	192.168.14.65	192.168.14.71
Fa 0/9	F1-30-BS-08	192.168.14.66	192.168.14.71
Fa 0/10	F1-30-BS-09	192.168.14.67	192.168.14.71
Fa 0/11	F1-30-BS-010	192.168.14.68	192.168.14.71

Sw-08

Interface	Connect to	Ip address	Default Gateway
Fa 0/2	F1-35-BA-01	192.168.14.74	192.168.14.78
Fa 0/3	F1-35-BA-02	192.168.14.75	192.168.14.78
Fa 0/4	F1-35-BA-03	192.168.14.76	192.168.14.78
Fa 0/5	F1-35-BA-04	192.168.14.77	192.168.14.78

Sw-09

Interface	Connect to	Ip address	Default Gateway
Fa 0/2	F1-40-FS-01	192.168.14.81	192.168.14.84
Fa 0/3	F1-40-FS-02	192.168.14.82	192.168.14.84
Fa 0/4	F1-40-FS-03	192.168.14.83	192.168.14.84

Sw-10

Interface	Connect to	Ip address	Default Gateway
Fa 0/2	F2-45-HW-01	192.168.15.1	192.168.15.6
Fa 0/3	F2-45-HW-02	192.168.15.2	192.168.15.6
Fa 0/4	F2-45-HW-03	192.168.15.3	192.168.15.6
Fa 0/5	F2-45-HW-04	192.168.15.4	192.168.15.6
Fa 0/6	F2-45-HW-05	192.168.15.5	192.168.15.6

Sw-11

Interface	Connect to	Ip address	Default Gateway
Fa 0/2	F2-50-KDA-01	192.168.14.9	192.168.15.15
Fa 0/3	F2-50-KDA-02	192.168.14.10	192.168.15.15

Fa 0/4	F2-50-KDA-03	192.168.14.11	192.168.15.15
Fa 0/5	F2-50-KDA-04	192.168.14.12	192.168.15.15
Fa 0/6	F2-50-KDA-05	192.168.14.13	192.168.15.15
Fa 0/7	F2-50-KDA-06	192.168.14.14	192.168.15.15

Sw-12

Interface	Connect to	Ip address	Default Gateway
Fa 0/2	F2-55-EN-01	192.168.15.18	192.168.15.24
Fa 0/3	F2-55-EN-02	192.168.15.19	192.168.15.24
Fa 0/4	F2-55-EN-03	192.168.15.20	192.168.15.24
Fa 0/5	F2-55-EN-04	192.168.15.21	192.168.15.24
Fa 0/6	F2-55-EN-05	192.168.15.22	192.168.15.24
Fa 0/7	F2-55-EN-06	192.168.15.23	192.168.15.24

Sw-13

Interface	Connect to	Ip address	Default Gateway
Fa 0/2	F2-60-SGS-01	192.168.15.27	192.168.15.33
Fa 0/3	F2-60-SGS-02	192.168.15.28	192.168.15.33
Fa 0/4	F2-60-SGS-03	192.168.15.29	192.168.15.33
Fa 0/5	F2-60-SGS-04	192.168.15.30	192.168.15.33
Fa 0/6	F2-60-SGS-05	192.168.15.29	192.168.15.33
Fa 0/7	F2-60-SGS-06	192.168.15.30	192.168.15.33

Sw-14

Interface	Connect to	Ip address	Default Gateway
Fa 0/2	F2-70-RE2-01	192.168.15.36	192.168.15.46
Fa 0/3	F2-70-RE2-02	192.168.15.37	192.168.15.46
Fa 0/4	F2-70-RE2-03	192.168.15.38	192.168.15.46
Fa 0/5	F2-70-RE2-04	192.168.15.39	192.168.15.46
Fa 0/6	F2-70-RE2-05	192.168.15.40	192.168.15.46
Fa 0/7	F2-70-RE2-06	192.168.15.41	192.168.15.46
Fa 0/8	F2-70-RE2-07	192.168.15.42	192.168.15.46
Fa 0/9	F2-70-RE2-08	192.168.15.43	192.168.15.46
Fa 0/10	F2-70-RE2-09	192.168.15.44	192.168.15.46
Fa 0/3	F2-70-RE2-10	192.168.15.45	192.168.15.46

Sw-15

Interface	Connect to	Ip address	Default Gateway
Fa 0/2	F2-75-CBS-01	192.168.15.49	192.168.15.55
Fa 0/3	F2-75-CBS-02	192.168.15.50	192.168.15.55
Fa 0/4	F2-75-CBS-03	192.168.15.51	192.168.15.55
Fa 0/5	F2-75-CBS-04	192.168.15.52	192.168.15.55
Fa 0/6	F2-75-CBS-05	192.168.15.51	192.168.15.55
Fa 0/7	F2-75-CBS-06	192.168.15.52	192.168.15.55

Sw-16

Interface	Connect to	Ip address	Default Gateway
Fa 0/2	F2-80-ERC-01	192.168.15.56	192.168.15.68
Fa 0/3	F2-80-ERC-02	192.168.15.57	192.168.15.68
Fa 0/4	F2-80-ERC-03	192.168.15.58	192.168.15.68
Fa 0/5	F2-80-ERC-04	192.168.15.59	192.168.15.68
Fa 0/6	F2-80-ERC-05	192.168.15.60	192.168.15.68
Fa 0/7	F2-80-ERC-06	192.168.15.61	192.168.15.68
Fa 0/8	F2-80-ERC-07	192.168.15.62	192.168.15.68
Fa 0/9	F2-80-ERC-08	192.168.15.63	192.168.15.68
Fa 0/10	F2-80-ERC-09	192.168.15.64	192.168.15.68
Fa 0/11	F2-80-ERC-010	192.168.15.65	192.168.15.68

Sw-17

Interface	Connect to	Ip address	Default Gateway
Fa 0/2	F2-85-ID-01	192.168.15.71	192.168.15.74
Fa 0/3	F2-85-ID-02	192.168.15.72	192.168.15.74
Fa 0/4	F2-85-ID-03	192.168.15.73	192.168.15.74

3. Implementation
Configuration on Devices

3.1 Router Configuration

➢ Port Assignment

```
!
interface GigabitEthernet0/0
 ip address dhcp
 ip nat outside
 ip virtual-reassembly in
 duplex auto
 speed auto
!
interface GigabitEthernet0/1
 ip address 10.10.10.1 255.255.255.0
 ip access-group 101 in
 ip nat inside
 ip virtual-reassembly in
 duplex auto
 speed auto
!
```

Figure 02: Router Configuration

➢ OSPF Configuration

```
!
router ospf 1
 network 10.10.10.0 0.0.0.255 area 0
 network 192.168.16.0 0.0.0.255 area 0
!
```

Figure 02: Router Configuration

➢ ACL Configuration

```
access-list 1 permit any
access-list 101 permit ip host 192.168.55.15 host 192.124.249.11
access-list 101 deny   ip any host 192.124.249.11
access-list 101 permit ip any any
!
```

3.2 L3-Main Configuration

➢ Port Assignment

```
interface Port-channel1
 switchport mode trunk
!
interface GigabitEthernet0/0
 vrf forwarding Mgmt-vrf
 no ip address
 negotiation auto
!
interface GigabitEthernet1/0/1
 switchport mode trunk
!
interface GigabitEthernet1/0/2
 switchport mode trunk
!
interface GigabitEthernet1/0/3
 switchport mode trunk
!
interface GigabitEthernet1/0/4
 shutdown
!
interface GigabitEthernet1/0/5
 shutdown
!
interface GigabitEthernet1/0/6
 shutdown
!
interface GigabitEthernet1/0/7
 shutdown
!
interface GigabitEthernet1/0/8
 shutdown
!
interface GigabitEthernet1/0/9
 shutdown
!
interface GigabitEthernet1/0/10
 shutdown
!
interface GigabitEthernet1/0/11
 shutdown
!
interface GigabitEthernet1/0/12
 shutdown
```

```
!
interface GigabitEthernet1/0/18
 shutdown
!
interface GigabitEthernet1/0/19
 shutdown
!
interface GigabitEthernet1/0/20
 shutdown
!
interface GigabitEthernet1/0/21
 switchport mode trunk
 channel-group 1 mode desirable
!
interface GigabitEthernet1/0/22
 switchport mode trunk
 channel-group 1 mode desirable
!
interface GigabitEthernet1/0/23
 switchport mode trunk
 channel-group 1 mode desirable
!
interface GigabitEthernet1/0/24
 no switchport
 ip address 10.10.10.2 255.255.255.0
!
```

Figure 03: L3-Main Switch Configuration

➢ VLAN Configuration

```
!
interface Vlan10
 ip address 192.168.10.253 255.255.255.0
 ip helper-address 192.168.118.10
 standby 0 ip 192.168.10.254
 standby 0 priority 110
!
interface Vlan20
 no ip address
!
interface Vlan55
 ip address 192.168.55.253 255.255.255.0
 ip helper-address 192.168.118.10
 standby 0 ip 192.168.55.254
 standby 0 priority 110
 standby 0 preempt
!
interface Vlan114
 ip address 192.168.114.253 255.255.255.0
 ip helper-address 192.168.118.10
 standby 0 ip 192.168.114.254
 standby 0 priority 110
 standby 0 preempt
!
interface Vlan115
 ip address 192.168.115.253 255.255.255.0
 ip helper-address 192.168.118.10
 standby 0 ip 192.168.115.254
 standby 0 priority 110
 standby 0 preempt
!
interface Vlan118
 ip address 192.168.118.253 255.255.255.0
 ip helper-address 192.168.118.10
 standby 0 ip 192.168.118.254
 standby 0 priority 110
 standby 0 preempt
!
interface Vlan120
 ip address 192.168.120.253 255.255.255.0
 ip helper-address 192.168.118.10
 standby 0 ip 192.168.120.254
 standby 0 priority 110
 standby 0 preempt
!
```

Figure 03: L3-Main Switch Configuration

➢ OSPF Configuration

```
!
router ospf 1
 network 10.10.10.0 0.0.0.255 area 0
 network 192.168.16.0 0.0.0.255 area 0
 network 192.168.0.0 0.0.255.255 area 0
!
```

➢ EtherChannel

```
interface GigabitEthernet1/0/21
 switchport mode trunk
 channel-group 1 mode desirable
!
interface GigabitEthernet1/0/22
 switchport mode trunk
 channel-group 1 mode desirable
!
interface GigabitEthernet1/0/23
 switchport mode trunk
 channel-group 1 mode desirable
!
```

➢ HSRP Configuration

```
L3-BACKUP#show standby brief
                 P indicates configured to preempt.
                 |
Interface   Grp  Pri P State    Active     Standby     Virtual IP
Vl10        0    100 P Active   local      unknown     192.168.10.254
Vl55        0    100 P Active   local      unknown     192.168.55.254
Vl114       0    100 P Active   local      unknown     192.168.114.254
Vl115       0    100 P Active   local      unknown     192.168.115.254
Vl118       0    100 P Active   local      unknown     192.168.118.254
Vl120       0    100 P Init     unknown    unknown     192.168.120.254
L3-BACKUP#
```

Figure 03: L3-Main Switch Configuration

➢ VTP Configuration

```
L3-BACKUP#show vtp status
VTP Version capable             : 1 to 3
VTP version running             : 2
VTP Domain Name                 : DNE-G
VTP Pruning Mode                : Disabled
VTP Traps Generation            : Disabled
Device ID                       : 2c5a.0fbb.da80
Configuration last modified by 192.168.10.253 at 10-27-23 10:41:13
Local updater ID is 192.168.10.252 on interface Vl10 (lowest numbered VLAN interface found)

Feature VLAN:
--------------
VTP Operating Mode              : Server
Maximum VLANs supported locally : 1005
Number of existing VLANs        : 11
Configuration Revision          : 8
MD5 digest                      : 0xA0 0x28 0x1D 0x61 0xE2 0x90 0x46 0x93
                                  0x4E 0xD2 0x6B 0xBB 0x06 0x39 0xBF 0x14
L3-BACKUP#
```

Figure 03: L3-Main Switch Configuration

3.3 L3-Backup Configuration

➢ **Port Assignment**

```
!
interface Port-channel1
 switchport mode trunk
!
interface GigabitEthernet0/0
 vrf forwarding Mgmt-vrf
 no ip address
 negotiation auto
!
interface GigabitEthernet1/0/1
 switchport mode trunk
!
interface GigabitEthernet1/0/2
 switchport mode trunk
!
interface GigabitEthernet1/0/3
 switchport mode trunk
!
interface GigabitEthernet1/0/4
 shutdown
!
interface GigabitEthernet1/0/5
 shutdown
!
interface GigabitEthernet1/0/6
 shutdown
!
interface GigabitEthernet1/0/7
 shutdown
!
interface GigabitEthernet1/0/8
 shutdown
!
interface GigabitEthernet1/0/9
 shutdown
!
```

```
!
interface GigabitEthernet1/0/18
 shutdown
!
interface GigabitEthernet1/0/19
 shutdown
!
interface GigabitEthernet1/0/20
 shutdown
!
interface GigabitEthernet1/0/21
 switchport mode trunk
 channel-group 1 mode desirable
!
interface GigabitEthernet1/0/22
 switchport mode trunk
 channel-group 1 mode desirable
!
interface GigabitEthernet1/0/23
 switchport mode trunk
 channel-group 1 mode desirable
!
interface GigabitEthernet1/0/24
 no switchport
 ip address 10.10.10.3 255.255.255.0
!
```

Figure 04: L3-Backup Switch Configuration

➢ VLAN Configuration

```
!
interface Vlan10
 ip address 192.168.10.252 255.255.255.0
 ip helper-address 192.168.118.10
 standby 0 ip 192.168.10.254
 standby 0 preempt
!
interface Vlan55
 ip address 192.168.55.252 255.255.255.0
 ip helper-address 192.168.118.10
 standby 0 ip 192.168.55.254
 standby 0 preempt
!
interface Vlan114
 ip address 192.168.114.252 255.255.255.0
 ip helper-address 192.168.118.10
 standby 0 ip 192.168.114.254
 standby 0 preempt
!
interface Vlan115
 ip address 192.168.115.252 255.255.255.0
 ip helper-address 192.168.118.10
 standby 0 ip 192.168.115.254
 standby 0 preempt
!
interface Vlan118
 ip address 192.168.118.252 255.255.255.0
 ip helper-address 192.168.118.10
 standby 0 ip 192.168.118.254
 standby 0 preempt
!
interface Vlan120
 ip address 192.168.120.252 255.255.255.0
 ip helper-address 192.168.118.10
 standby 0 ip 192.168.120.254
 standby 0 preempt
!
router ospf 1
 network 10.10.10.0 0.0.0.255 area 0
 network 192.168.16.0 0.0.0.255 area 0
 network 192.168.0.0 0.0.255.255 area 0
!
ip forward-protocol nd
ip http server
ip http secure-server
ip route 0.0.0.0 0.0.0.0 10.10.10.1
!
!
```

Figure 04: L3-Backup Switch Configuration

➢ OSPF Configuration

```
!
router ospf 1
 network 10.10.10.0 0.0.0.255 area 0
 network 192.168.16.0 0.0.0.255 area 0
 network 192.168.0.0 0.0.255.255 area 0
!
```

➢ EtherChannel

```
interface GigabitEthernet1/0/21
 switchport mode trunk
 channel-group 1 mode desirable
!
interface GigabitEthernet1/0/22
 switchport mode trunk
 channel-group 1 mode desirable
!
interface GigabitEthernet1/0/23
 switchport mode trunk
 channel-group 1 mode desirable
!
```

➢ HSRP Configuration

```
L3-BACKUP#show standby brief
                  P indicates configured to preempt.
                  |
Interface   Grp  Pri P State    Active      Standby      Virtual IP
Vl10        0    100 P Active   local       unknown      192.168.10.254
Vl55        0    100 P Active   local       unknown      192.168.55.254
Vl114       0    100 P Active   local       unknown      192.168.114.254
Vl115       0    100 P Active   local       unknown      192.168.115.254
Vl118       0    100 P Active   local       unknown      192.168.118.254
Vl120       0    100 P Init     unknown     unknown      192.168.120.254
L3-BACKUP#
```

Figure 04: L3-Backup Switch Configuration

➢ VTP Configuration

```
L3-BACKUP#show vtp status
VTP Version capable             : 1 to 3
VTP version running             : 2
VTP Domain Name                 : DNE-G
VTP Pruning Mode                : Disabled
VTP Traps Generation            : Disabled
Device ID                       : 2c5a.0fbb.da80
Configuration last modified by 192.168.10.253 at 10-27-23 10:41:13
Local updater ID is 192.168.10.252 on interface V110 (lowest numbered VLAN interface found)

Feature VLAN:
--------------
VTP Operating Mode              : Server
Maximum VLANs supported locally : 1005
Number of existing VLANs        : 11
Configuration Revision          : 8
MD5 digest                      : 0xA0 0x28 0x1D 0x61 0xE2 0x90 0x46 0x93
                                  0x4E 0xD2 0x6B 0xBB 0x06 0x39 0xBF 0x14

L3-BACKUP#
```

3.4 L2-Sw1

➢ Port Assignment

```
!
interface FastEthernet0/1
 switchport access vlan 118
 switchport mode access
!
interface FastEthernet0/2
 switchport access vlan 118
 switchport mode access
!
interface FastEthernet0/3
 switchport access vlan 118
 switchport mode access
!
interface FastEthernet0/4
 switchport access vlan 118
 switchport mode access
!
```

Figure 05: L2-Switch 1 Configuration

```
!
interface FastEthernet0/5
 switchport access vlan 118
 switchport mode access
!
interface FastEthernet0/6
 switchport access vlan 118
 switchport mode access
!
interface FastEthernet0/7
 switchport access vlan 118
 switchport mode access
!
interface FastEthernet0/8
 switchport access vlan 118
 switchport mode access
!
interface FastEthernet0/9
 switchport access vlan 118
 switchport mode access
!
interface FastEthernet0/10
 switchport access vlan 118
 switchport mode access
!
interface FastEthernet0/11
 switchport access vlan 118
 switchport mode access
!
interface FastEthernet0/12
 switchport access vlan 118
 switchport mode access
!
interface FastEthernet0/13
 switchport access vlan 115
 switchport mode access
!
interface FastEthernet0/14
 switchport access vlan 115
 switchport mode access
!
interface FastEthernet0/15
 switchport access vlan 115
 switchport mode access
!
interface FastEthernet0/16
 switchport access vlan 115
 switchport mode access
!
interface FastEthernet0/17
 switchport access vlan 115
 switchport mode access
!
interface FastEthernet0/18
 switchport access vlan 115
 switchport mode access
!
interface FastEthernet0/19
 switchport access vlan 115
 switchport mode access
!
interface FastEthernet0/20
 switchport access vlan 115
 switchport mode access

interface FastEthernet0/21
 switchport access vlan 115
```

```
interface FastEthernet0/13
 switchport access vlan 115
 switchport mode access
!
interface FastEthernet0/14
 switchport access vlan 115
 switchport mode access
!
interface FastEthernet0/15
 switchport access vlan 115
 switchport mode access
!
interface FastEthernet0/16
 switchport access vlan 115
 switchport mode access
!
interface FastEthernet0/17
 switchport access vlan 115
 switchport mode access
!
interface FastEthernet0/18
 switchport access vlan 115
 switchport mode access
!
interface FastEthernet0/19
 switchport access vlan 115
 switchport mode access
!
interface FastEthernet0/20
 switchport access vlan 115
 switchport mode access
!
interface FastEthernet0/21
 switchport access vlan 115
 switchport mode access
!
interface FastEthernet0/22
 switchport access vlan 115
 switchport mode access
!
interface FastEthernet0/23
 switchport access vlan 115
 switchport mode access
!
interface FastEthernet0/24
 switchport access vlan 115
 switchport mode access
!
interface GigabitEthernet0/1
 switchport mode trunk
!
interface GigabitEthernet0/2
 switchport mode trunk
!
```

Figure 05: L2-Switch 1 Configuration

➢ Trunk Configuration

```
sw1#sh int trunk

Port        Mode            Encapsulation   Status      Native vlan
Gi0/1       on              802.1q          trunking    1
Gi0/2       on              802.1q          trunking    1

Port        Vlans allowed on trunk
Gi0/1       1-4094
Gi0/2       1-4094

Port        Vlans allowed and active in management domain
Gi0/1       1,10,55,95,114-115,118
Gi0/2       1,10,55,95,114-115,118

Port        Vlans in spanning tree forwarding state and not pruned
Gi0/1       none
Gi0/2       1,10,55,95,114-115,118
```

➢ VLAN Configuration

```
sw1#sh vlan

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active
10   E&T                              active
55   ENTERTAINMENT                    active
95   ACCESSORIES                      active
114  AP                               active
115  ADMIN                            active    Fa0/13, Fa0/14, Fa0/15, Fa0/16
                                                Fa0/17, Fa0/18, Fa0/19, Fa0/20
                                                Fa0/21, Fa0/22, Fa0/23, Fa0/24
118  SERVER                           active    Fa0/1, Fa0/2, Fa0/3, Fa0/4
                                                Fa0/5, Fa0/6, Fa0/7, Fa0/8
                                                Fa0/9, Fa0/10, Fa0/11, Fa0/12

1002 fddi-default                     act/unsup
1003 trcrf-default                    act/unsup
1004 fddinet-default                  act/unsup
1005 trbrf-default                    act/unsup
```

➢ VTP Configuration

```
sw1#sh vtp status
VTP Version capable             : 1 to 3
VTP version running             : 2
VTP Domain Name                 : DNE-G
VTP Pruning Mode                : Disabled
VTP Traps Generation            : Disabled
Device ID                       : 2c86.d26e.5080
Configuration last modified by 192.168.10.253 at 10-27-23 10:41:13

Feature VLAN:
--------------
VTP Operating Mode              : Client
Maximum VLANs supported locally : 255
Number of existing VLANs        : 11
Configuration Revision          : 8
MD5 digest                      : 0xA0 0x28 0x1D 0x61 0xE2 0x90 0x46 0x93
                                  0x4E 0xD2 0x6B 0xBB 0x06 0x39 0xBF 0x14
```

3.5 L2-Sw2

➢ Port Assignment

```
!
interface FastEthernet0/1
 switchport access vlan 114
 switchport mode access
!
interface FastEthernet0/2
 switchport access vlan 114
 switchport mode access
!
interface FastEthernet0/3
 switchport access vlan 114
 switchport mode access
!
interface FastEthernet0/4
 switchport access vlan 114
 switchport mode access
!
interface FastEthernet0/5
 switchport access vlan 114
 switchport mode access
!
interface FastEthernet0/6
 switchport access vlan 114
```

```
interface FastEthernet0/15
 switchport access vlan 95
 switchport mode access
!
interface FastEthernet0/16
 switchport access vlan 95
 switchport mode access
!
interface FastEthernet0/17
 switchport access vlan 95
 switchport mode access
!
interface FastEthernet0/18
 switchport access vlan 95
 switchport mode access
!
interface FastEthernet0/19
 switchport access vlan 95
 switchport mode access
!
interface FastEthernet0/20
 switchport access vlan 95
 switchport mode access
!
interface FastEthernet0/21
 switchport access vlan 95
 switchport mode access
!
interface FastEthernet0/22
 switchport access vlan 95
 switchport mode access
!
interface FastEthernet0/23
 switchport access vlan 95
 switchport mode access
!
interface FastEthernet0/24
 switchport access vlan 95
 switchport mode access
!
interface GigabitEthernet0/1
 switchport mode trunk
!
interface GigabitEthernet0/2
 switchport mode trunk
!
```

Figure 06: L2-Switch 2 Configuration

Trunk Configuration

```
SW2#show int trunk

Port        Mode            Encapsulation  Status        Native vlan
Gi0/1       on              802.1q         trunking      1
Gi0/2       on              802.1q         trunking      1

Port        Vlans allowed on trunk
Gi0/1       1-4094
Gi0/2       1-4094

Port        Vlans allowed and active in management domain
Gi0/1       1,10,55,95,114-115,118
Gi0/2       1,10,55,95,114-115,118

Port        Vlans in spanning tree forwarding state and not pruned
Gi0/1       none
Gi0/2       1,10,55,95,114-115,118
SW2#
SW2#
```

➢ VLAN Configuration

```
SW2#sh vlan

VLAN Name                           Status    Ports
---- ------------------------------ --------- -------------------------------
1    default                        active
10   E&T                            active
55   ENTERTAINMENT                  active
95   ACCESSORIES                    active    Fa0/13, Fa0/14, Fa0/15, Fa0/16
                                              Fa0/17, Fa0/18, Fa0/19, Fa0/20
                                              Fa0/21, Fa0/22, Fa0/23, Fa0/24
114  AP                             active    Fa0/1, Fa0/2, Fa0/3, Fa0/4
                                              Fa0/5, Fa0/6, Fa0/7, Fa0/8
                                              Fa0/9, Fa0/10, Fa0/11, Fa0/12
115  ADMIN                          active
118  SERVER                         active
1002 fddi-default                   act/unsup
1003 trcrf-default                  act/unsup
1004 fddinet-default                act/unsup
1005 trbrf-default                  act/unsup
```

➢ VTP Configuration

```
SW2>
SW2>en
Password:
Password:
SW2#sh vtp status
VTP Version capable             : 1 to 3
VTP version running             : 2
VTP Domain Name                 : DNE-G
VTP Pruning Mode                : Disabled
VTP Traps Generation            : Disabled
Device ID                       : 2c31.24b2.1080
Configuration last modified by 192.168.10.253 at 10-27-23 10:41:13
Local updater ID is 192.168.115.249 on interface Vl115 (lowest numbered VLAN interface found)

Feature VLAN:
--------------
VTP Operating Mode              : Server
Maximum VLANs supported locally : 255
Number of existing VLANs        : 11
Configuration Revision          : 8
MD5 digest                      : 0xA0 0x28 0x1D 0x61 0xE2 0x90 0x46 0x93
                                  0x4E 0xD2 0x6B 0xBB 0x06 0x39 0xBF 0x14
```

3.6 L2-Sw3

➢ Port Assignment

```
!
interface FastEthernet0/1
 switchport access vlan 55
 switchport mode access
!
interface FastEthernet0/2
 switchport access vlan 55
 switchport mode access
!
interface FastEthernet0/3
 switchport access vlan 55
 switchport mode access
!
interface FastEthernet0/4
 switchport access vlan 55
 switchport mode access
!
interface FastEthernet0/5
 switchport access vlan 55
 switchport mode access
!
interface FastEthernet0/6
 switchport access vlan 55
 switchport mode access
!
interface FastEthernet0/7
 switchport access vlan 55
 switchport mode access
!
interface FastEthernet0/8
 switchport access vlan 55
 switchport mode access
!
interface FastEthernet0/9
 switchport access vlan 55
 switchport mode access
!
interface FastEthernet0/10
 switchport access vlan 55
 switchport mode access
!
interface FastEthernet0/11
 switchport access vlan 55
 switchport mode access
!
interface FastEthernet0/12
 switchport access vlan 55
 switchport mode access
!
```

```
interface FastEthernet0/15
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/16
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/17
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/18
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/19
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/20
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/21
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/22
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/23
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/24
 switchport access vlan 10
 switchport mode access
!
interface GigabitEthernet0/1
 switchport mode trunk
!
interface GigabitEthernet0/2
 switchport mode trunk
```

Figure 07: L2-Switch 3 Configuration

➢ Trunk Configuration

```
SW3#sh int trunk

Port            Mode            Encapsulation  Status        Native vlan
Gi0/1           on              802.1q         trunking      1
Gi0/2           on              802.1q         trunking      1


Port            Vlans allowed on trunk
Gi0/1           1-4094
Gi0/2           1-4094
```

➢ VLAN Configuration

```
SW3#sh vlan

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active
10   E&T                              active    Fa0/13, Fa0/14, Fa0/15, Fa0/16
                                                Fa0/17, Fa0/18, Fa0/19, Fa0/20
                                                Fa0/21, Fa0/22, Fa0/23, Fa0/24
55   ENTERTAINMENT                    active    Fa0/1, Fa0/2, Fa0/3, Fa0/4
                                                Fa0/5, Fa0/6, Fa0/7, Fa0/8
                                                Fa0/9, Fa0/10, Fa0/11, Fa0/12

95   ACCESSORIES                      active
114  AP                               active
115  ADMIN                            active
118  SERVER                           active
1002 fddi-default                     act/unsup
1003 trcrf-default                    act/unsup
1004 fddinet-default                  act/unsup
1005 trbrf-default                    act/unsup
```

➢ VTP Configuration

```
SW3#sh vtp status
VTP Version capable             : 1 to 3
VTP version running             : 2
VTP Domain Name                 : DNE-G
VTP Pruning Mode                : Disabled
VTP Traps Generation            : Disabled
Device ID                       : 2c31.2413.c080
Configuration last modified by 192.168.10.253 at 10-27-23 10:41:13

Feature VLAN:
--------------
VTP Operating Mode              : Client
Maximum VLANs supported locally : 255
Number of existing VLANs        : 11
Configuration Revision          : 8
MD5 digest                      : 0xA0 0x28 0x1D 0x61 0xE2 0x90 0x46 0x93
                                  0x4E 0xD2 0x6B 0xBB 0x06 0x39 0xBF 0x14
```

Figure 07: L2-Switch 3 Configuration

3.7 Server Configuration

3.7.1 DHCP Server Configuration
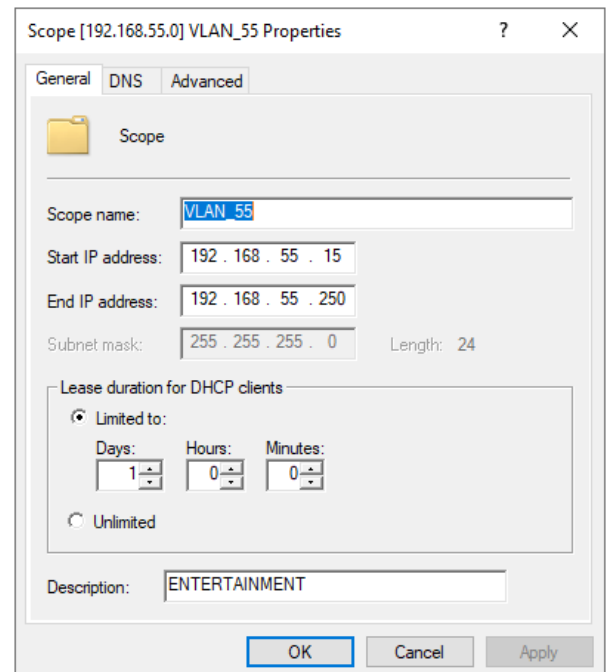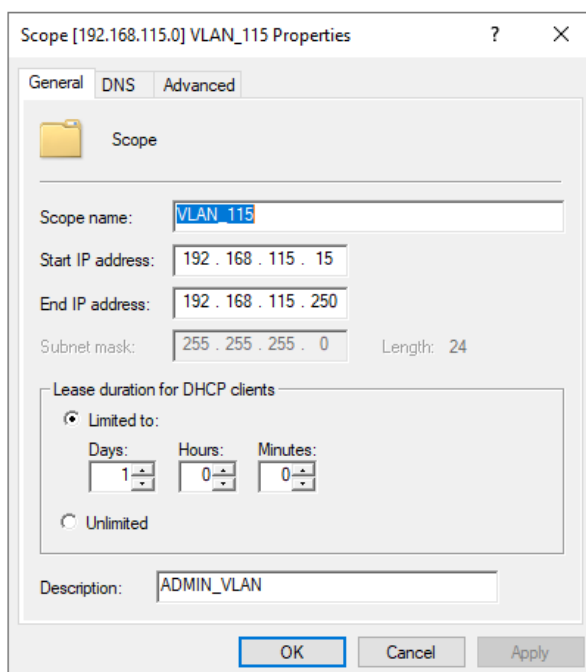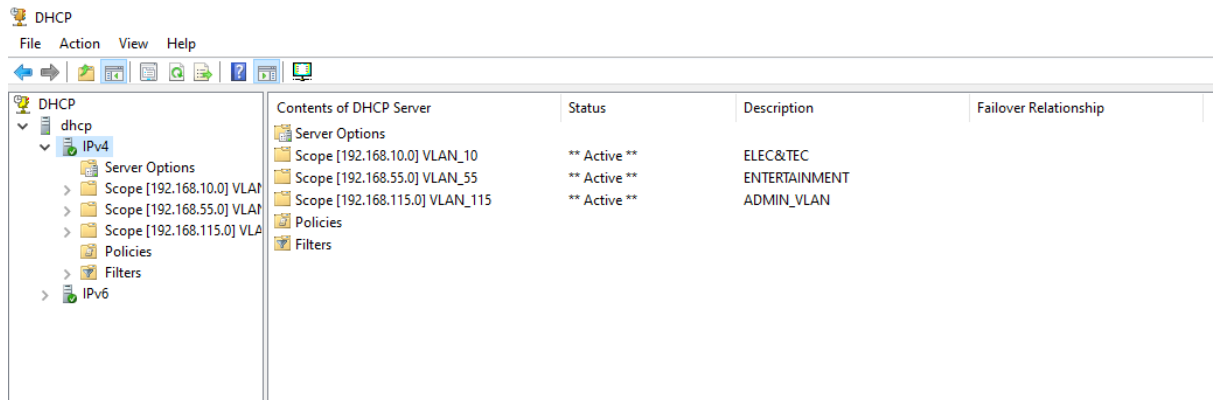
Figure 08: Server Configuration

Figure 09: DHCP Server Configuration

Figure 09: DHCP Server Configuration

3.7.2 DNS Server Configuration
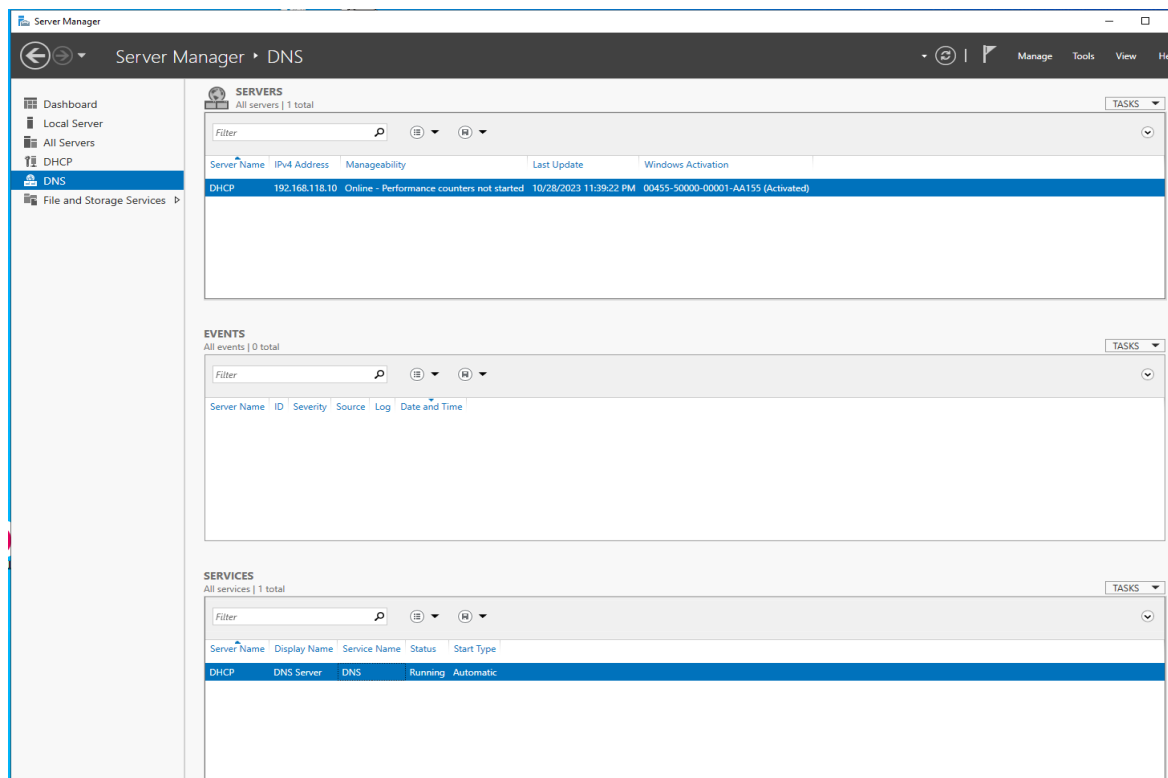
Figure 10: DNS Server Configuration

3.7.3 TFTP Server Configuration
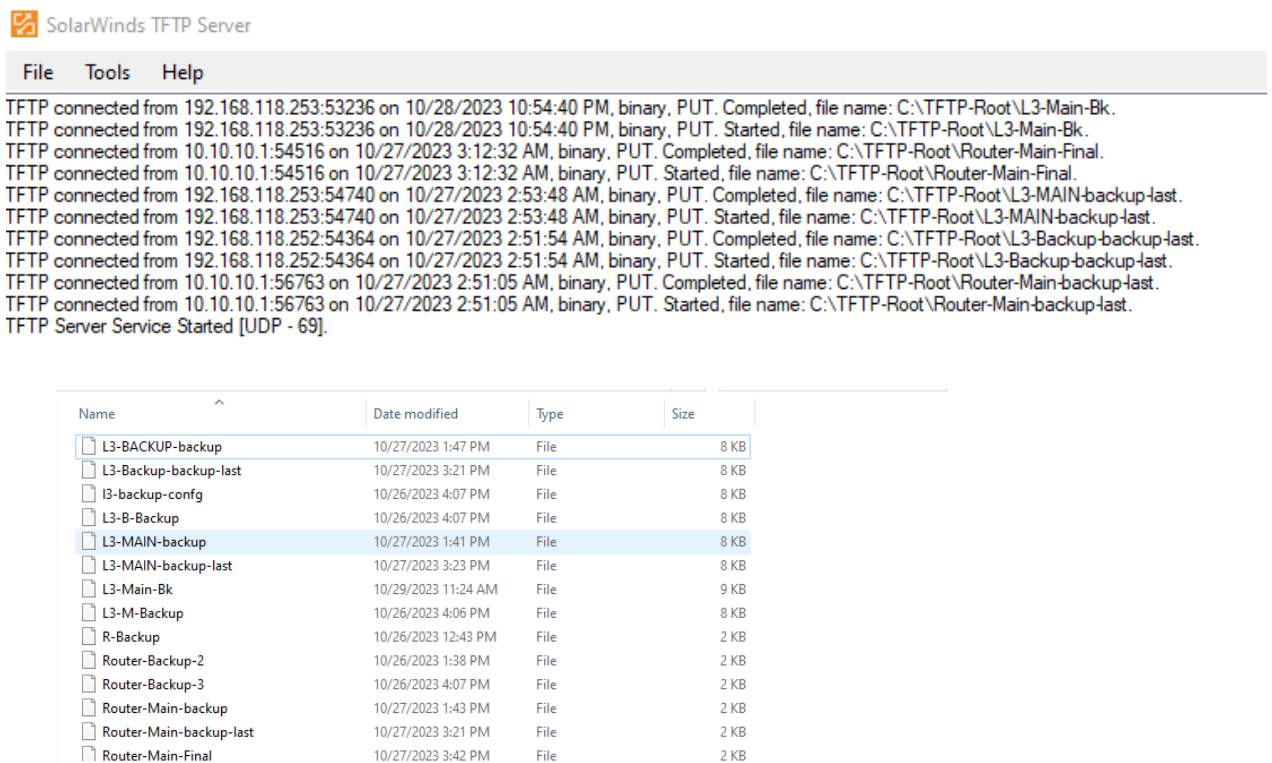
Figure 11: TFTP Server Configuration

3.7.4 Syslog Server Configuration

Figure 12: Syslog Server Configuration
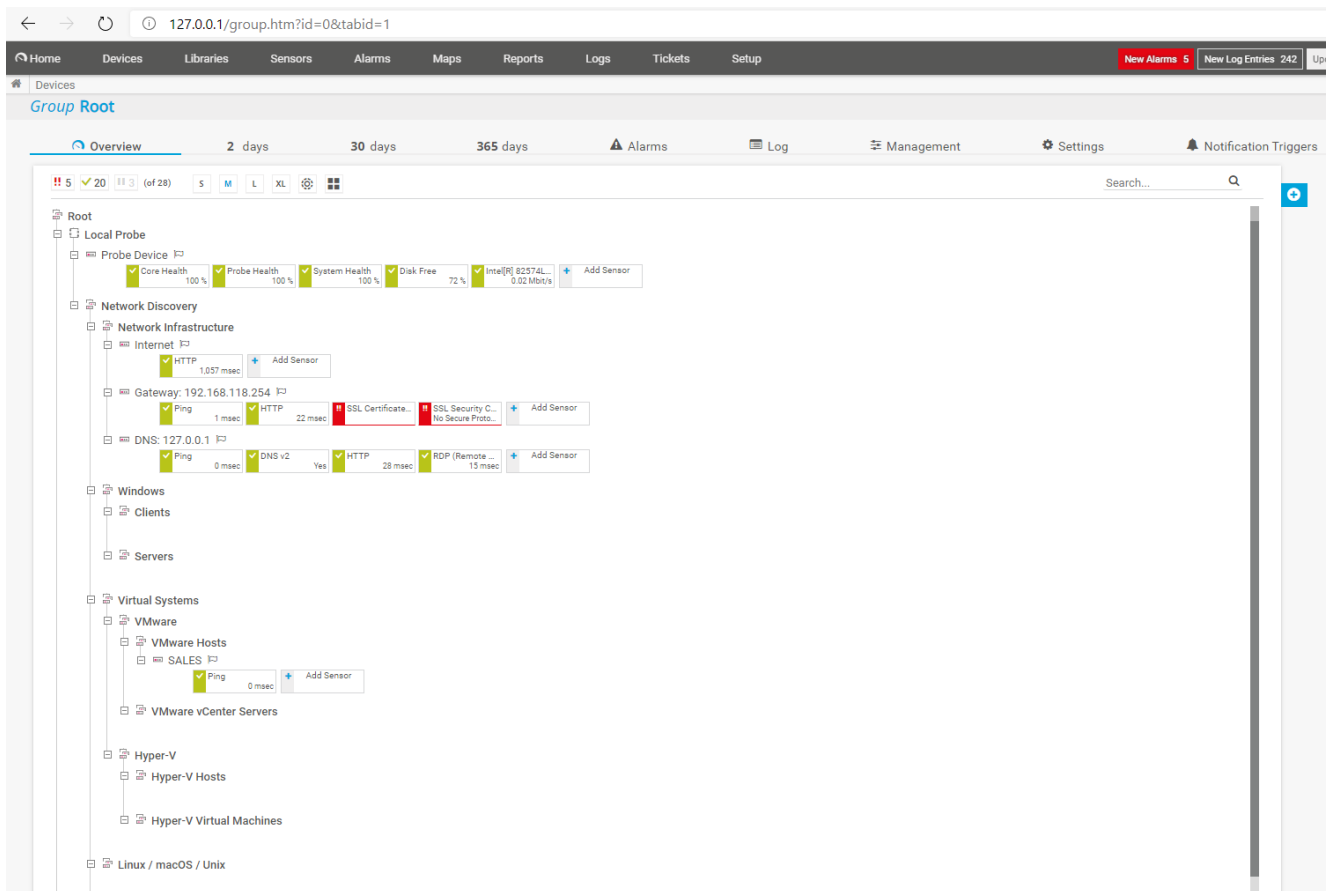
➤ Server IP Details

4. Evaluations

4.1 Budget calculation

Bill of Quantities Grand Summary				
Ref.	Bill Section	Qty	Unit Price (USD)	Total Amount (USD)
Bill no. 1	ASR 1006-X Router	2	8,950	17,900
Bill no. 2	Cisco Catalyst C9500X-28C8D	2	14,320	28,640
Bill no. 3	Cisco Catalyst 9300X Series Switch	8	2,740	21,920
Bill no. 4	Dell PowerEdge R760 Rack Server	2	69,500	139,000
Bill no. 5	Dell PowerEdge R760xd2 Rack Server	4	40,635	162,540
Bill no. 6	Dell PowerEdge R940 Rack Server	1	95,420	95,420
Bill no. 7	Cisco MR44 Access Point	60	1,540	92,400
Bill no. 8	Cisco MR86 Outdoor Access Point	40	1,600	64,000
Bill no. 9	Hikvision D5-2CD2132F-1 (W) (S)	200	135	27,000
Bill no. 10	Cisco CP-7841-K9 IP Phone	10	151	1,510
Bill no. 11	Timmy Finger Attendance-UT61	50	120	6,000
Bill no. 12	APC Smart-UPS X 3000 Rack	5	1,900	9,500
Bill no. 13	Network Rack	4	120	480
Bill no. 14	Cat 8 Network Cables (m)	5,000	5	25,000
Grand Total (USD)				691,310

4.2 Bandwidth calculation

Categories	Number of users	Bandwidth per user	Total Bandwidth
Reception	3	10mbs	30mbs
Electronic and technology	10	50mbs	500mbs
Footwear stores	6	2mbs	12mbs
Restaurants	10	10mbs	100mbs
Jewelry stores	6	5mbs	30mbs
Book stores	10	5mbs	50mbs
Bank ATM	4	25mbs	100mbs
Furniture stores	4	2mbs	8mbs
Health and Wellness	5	10mbs	50mbs
Kids play area	6	2mbs	12mbs
Entertainment	6	50mbs	300mbs
Sporting goods stores	6	5mbs	30mbs
Restaurants	10	10mbs	100mbs
Cosmetics and Beauty supply	6	5mbs	30mbs
Electronics repair centers	10	25mbs	250mbs
Information desk	3	50mbs	150mbs
Wi-Fi users	1024	50mbs	51200mbs
Printers/Scanners/Fax /IP Phones	100	10mbs	1000mbs
Indoor Cameras	110	10mbs	1100mbs
Access points	36	200mbs	7200mbs
Switches	25	300mbs	7500mbs
Outdoor cameras	100	10mbs	1000mbs
Admin	10	100mbs	1000mbs
Server	8	1000mbs	8000mbs
Total Bandwidth			**79752mbs**

According to our calculation we need 79752 mbs total Bandwidth, Therefor we need approximately 80000 mbs Total link, So we Recommend 50000 mbs main link and 30000 mbs backup Link. Also We need 2 Internet Service Providers for our Main Link and Backup Link.

4.3 The Duration

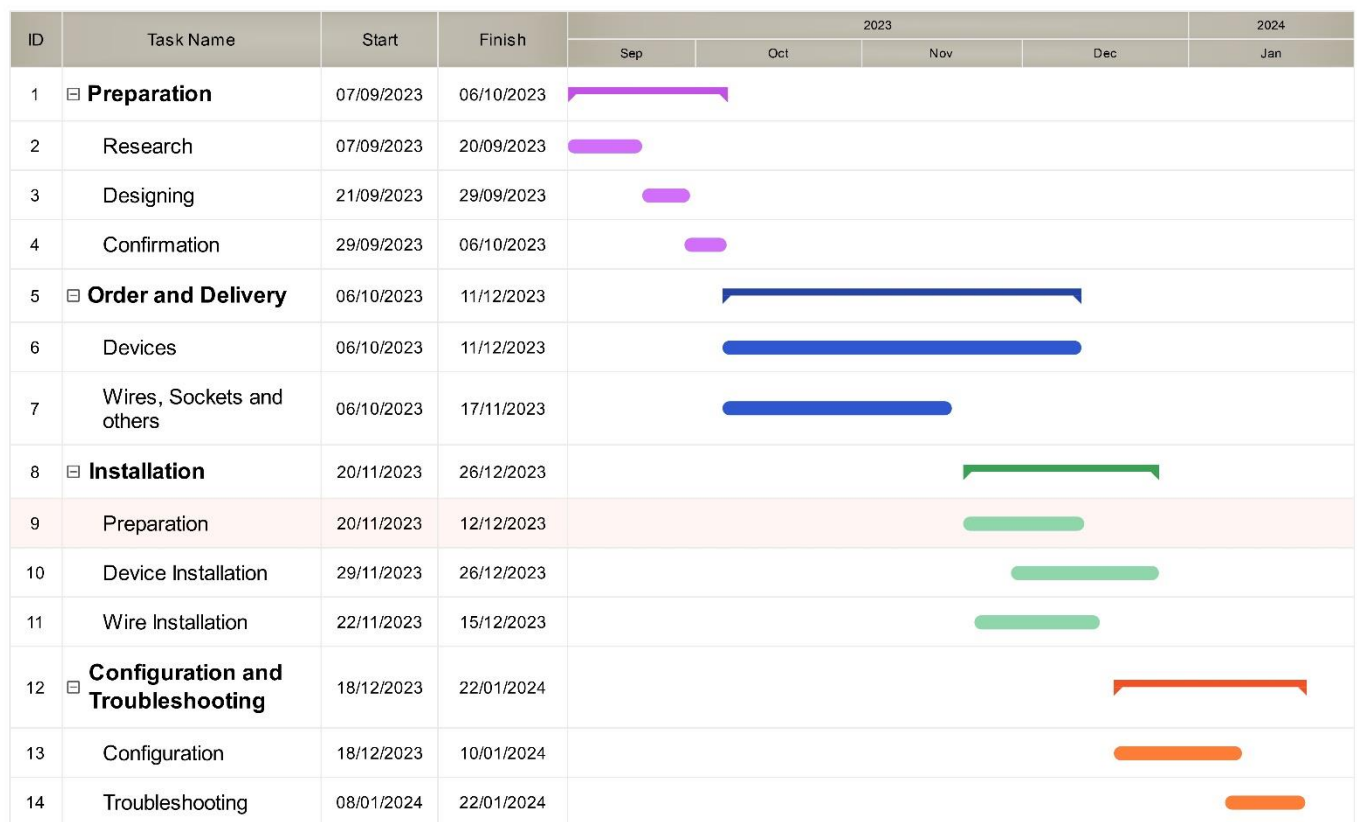In this chart the time duration that will be taken to finish this project is given step by step.

ID	Task Name	Start	Finish	2023				2024
				Sep	Oct	Nov	Dec	Jan
1	⊟ **Preparation**	07/09/2023	06/10/2023					
2	Research	07/09/2023	20/09/2023					
3	Designing	21/09/2023	29/09/2023					
4	Confirmation	29/09/2023	06/10/2023					
5	⊟ **Order and Delivery**	06/10/2023	11/12/2023					
6	Devices	06/10/2023	11/12/2023					
7	Wires, Sockets and others	06/10/2023	17/11/2023					
8	⊟ **Installation**	20/11/2023	26/12/2023					
9	Preparation	20/11/2023	12/12/2023					
10	Device Installation	29/11/2023	26/12/2023					
11	Wire Installation	22/11/2023	15/12/2023					
12	⊟ **Configuration and Troubleshooting**	18/12/2023	22/01/2024					
13	Configuration	18/12/2023	10/01/2024					
14	Troubleshooting	08/01/2024	22/01/2024					

Figure 13: Timeline

5. Conclusion

The successful implementation of the Shopping Mall Network Project marks a significant milestone in improving the overall shopping experience and operational efficiency within the mall environment. The project not only addressed existing challenges, but also positioned the shopping mall as a modern, technologically advanced hub, thanks to meticulous planning, robust infrastructure development, and seamless integration of cutting-edge technologies.

The newly installed network infrastructure has greatly improved connectivity, allowing for a consistent and high-speed internet connection throughout the mall. This improvement directly translates to higher customer satisfaction because customers can now enjoy a seamless online shopping experience, access real-time promotions, and use digital services without interruption.

Finally, the successful implementation of the Shopping Mall Network Project has not only transformed the mall into a technologically advanced and customer-friendly environment, but it has also established it as a forward-thinking and competitive player in the retail industry. As technology advances, the mall is well-positioned to adapt and leverage new innovations, ensuring its long-term success in providing an exceptional shopping experience.

6. REFERENCES

Cisco, 25/09/023, Cisco Catalyst 9164 Series Access points Data Sheet, https:// www.router-switch.com

Cisco, Catalyst 9200 Series models, https://www.cisco.com/site/us/en/products/networking/switches/cat alyst-9200-series-switches/index.html ,19/11/2022

Cisco, 22/09/2023, Cisco Catalyst 9500 Series Switches Data Sheet,https://www.cisco.com/c/en/us/products/collater al/switches/catalyst -9500-series-switches/nb-06-cat9500-ser-data-sheet-cte-en.html

Dell Technologies, PowerEdge R830 Rack Server, https://serverental.com/product/dell-poweredge-r830-rack-server-forsale/ , 25/09/2023

JWaves, Heat Maps, http://jwaves.io/, 20/09/2023

Landmark Computers, HP PROONE 400 G6 ALL IN-ONE PC 24INCH [9AV46AV], https://www.ewainsolutions.com/product-page/hp-proone-400-g624-all-in-one-pc , 25/09/2023

ikvision DS-2CD2626G2-IZS , https://www.ipcamshop.nl/en/ds-2cd2626g2-izs.html , 25/09/2023

Server Rack SKU DS6842-https://www.serverrack24.com/42u-patch-rackunmounted-measurements-wxdxh600x800x2000mm.html , 25/09/2023

12U Wall Mount Rack Cabinet , https://richcom.lk/product/19-12u-wall-mount-rackcabinet-price-srilanka/ , 25/09/2023

U Wall Mount Rack Cabinet , https://richcom.lk/product/19-16u-wall-mount-rackcabinet-price-srilanka/ , 25/09/2023

UPS Prolink 1.2kva Pro1201sfc ,
https://www.barclays.lk/itemdesc.asp?ic=UPSP2447
&eq=&Tp= , 25/09/2023

PROLINK PROFESSIONAL II SERIES 3KVA,
https://www.nanotek.lk/product/1796 , 25/09/2023

AMP 48 PORT CAT6 NETWORK PATCH PANEL ,
https://www.sense.lk/product/patch-panel-networkamp-48-
port-cat6 , 25/09/2023

MP 24 Port Patch Panel ,
https://www.bestofelectricals.com/amp-24-portpatch-panel ,
25/09/2023

Ethernet RJ45 CAT6 Network Cable ,
https://buyitem.lk/product/ethernet-rj45-cat6network-
cable/?v=2c16b194a0d9 ,25/09/2023

7. The Floor Plans

- The shopping Mall is located in two story building with basement and various stores on the ground floor and first floor.

Basement
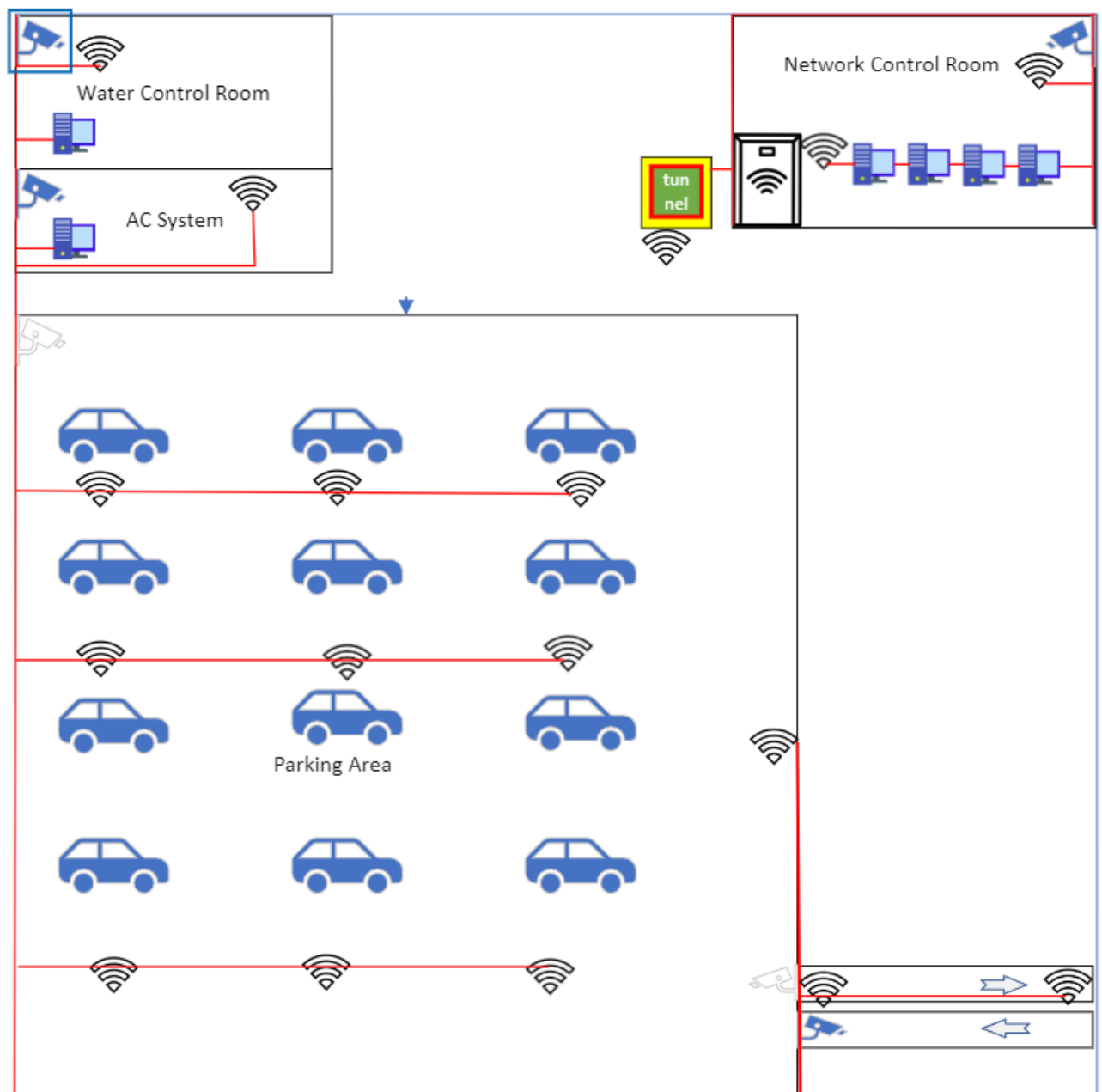
Figure 14: Basement Floor Plan

Ground Floor
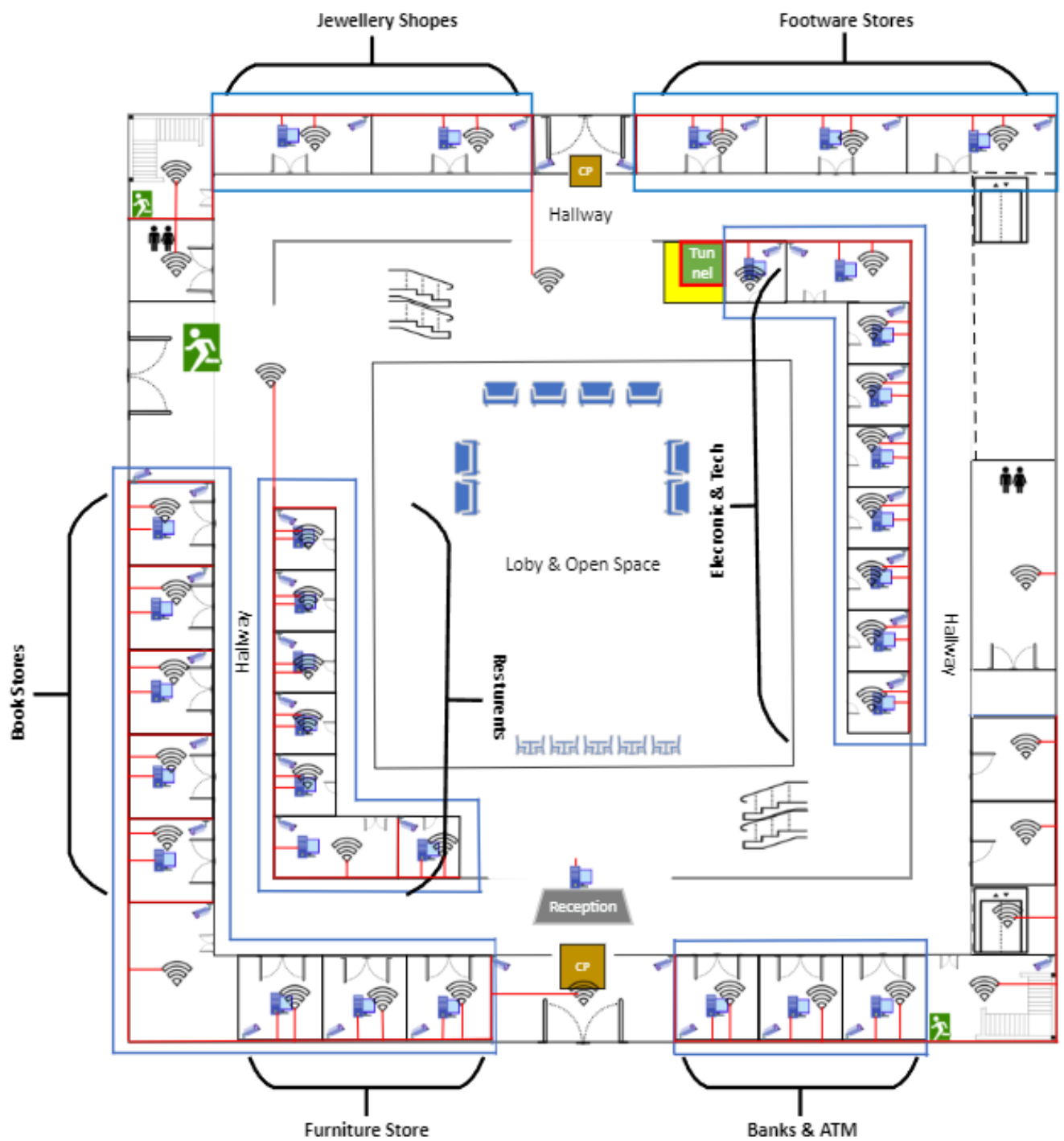
Figure 14: Ground Floor Plan

First Floor
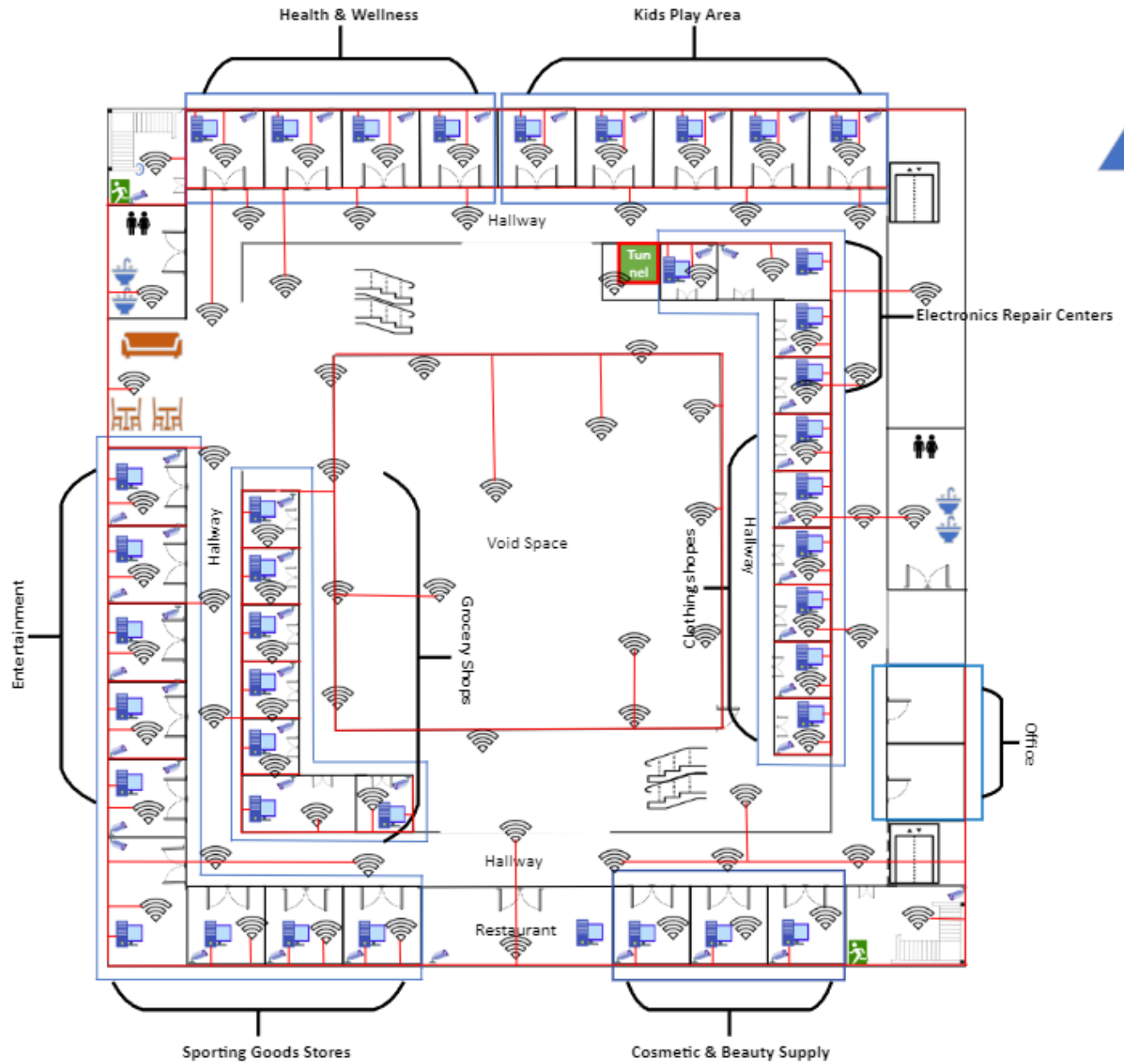
Figure 14: Level 1 Floor Plan

Heat Maps for Each Floor

We have used 2.4GHZ range Access points. The red color area shows the most coverage area and the blue color area shows the least coverage area.

NOTE: Ground floor lobby and open space area covered by 1st floor access points. (There is no floor between void space and ground floor lobby space)

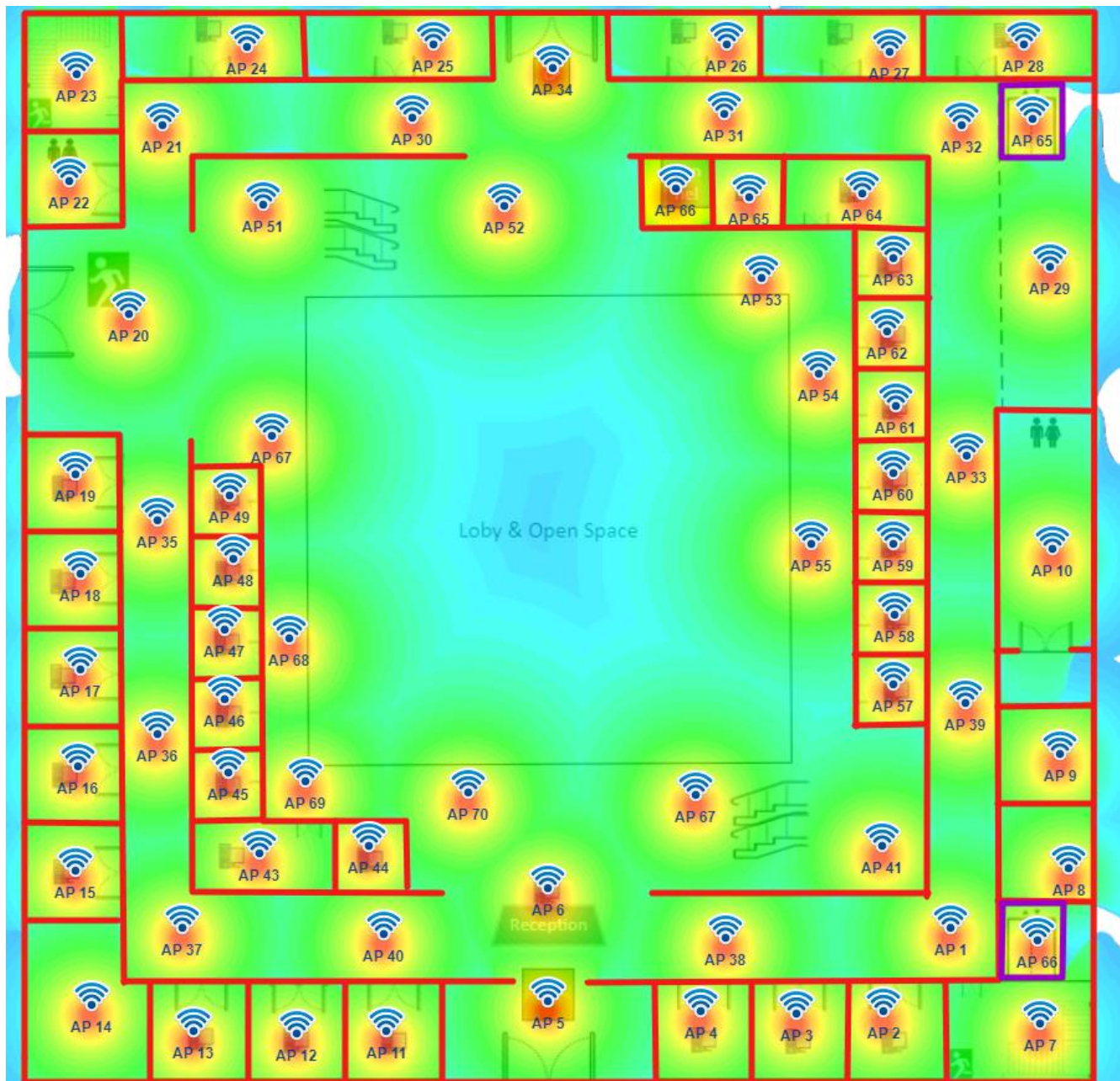## Basement
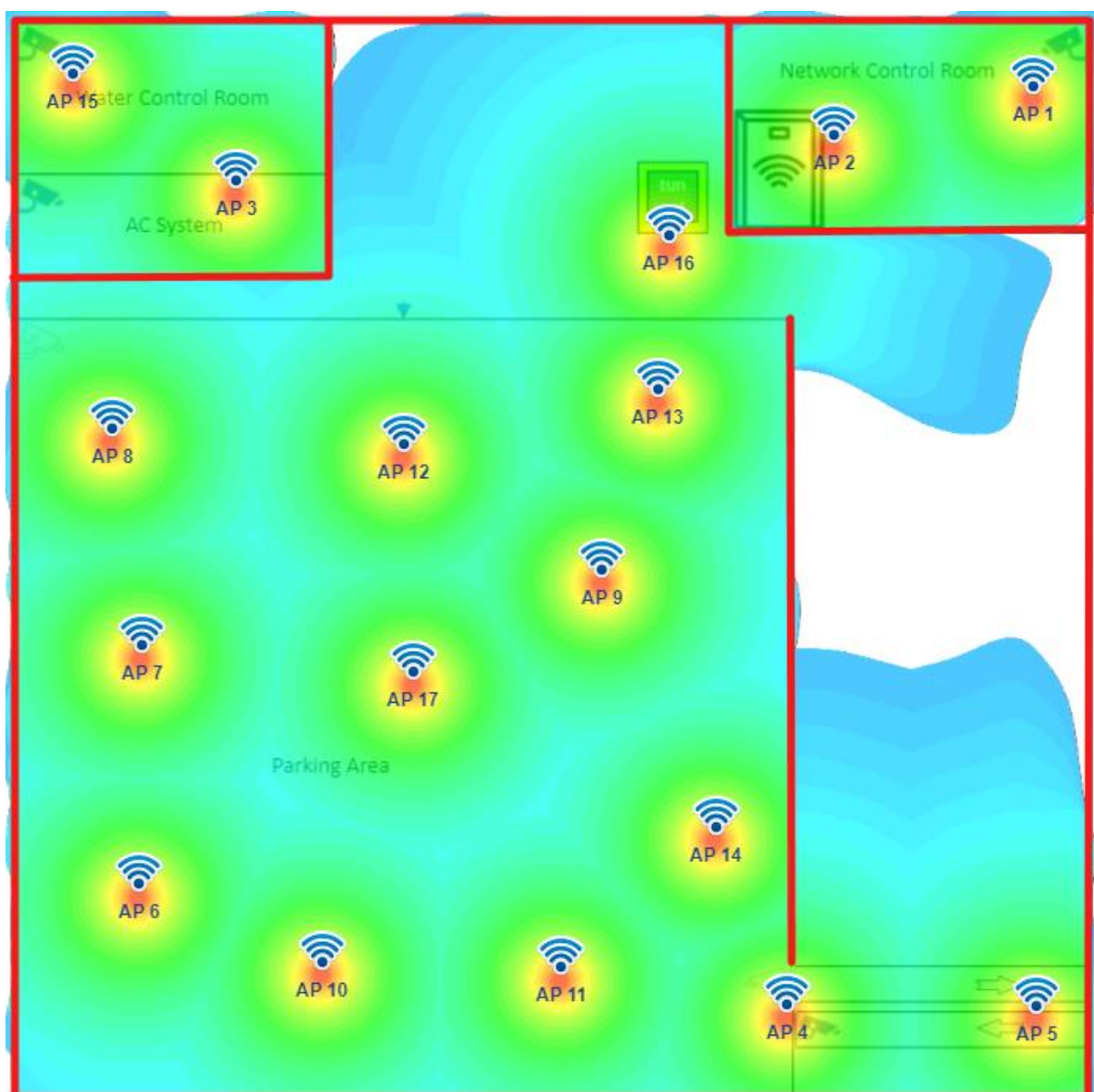
Figure 15: Basement Heat Map

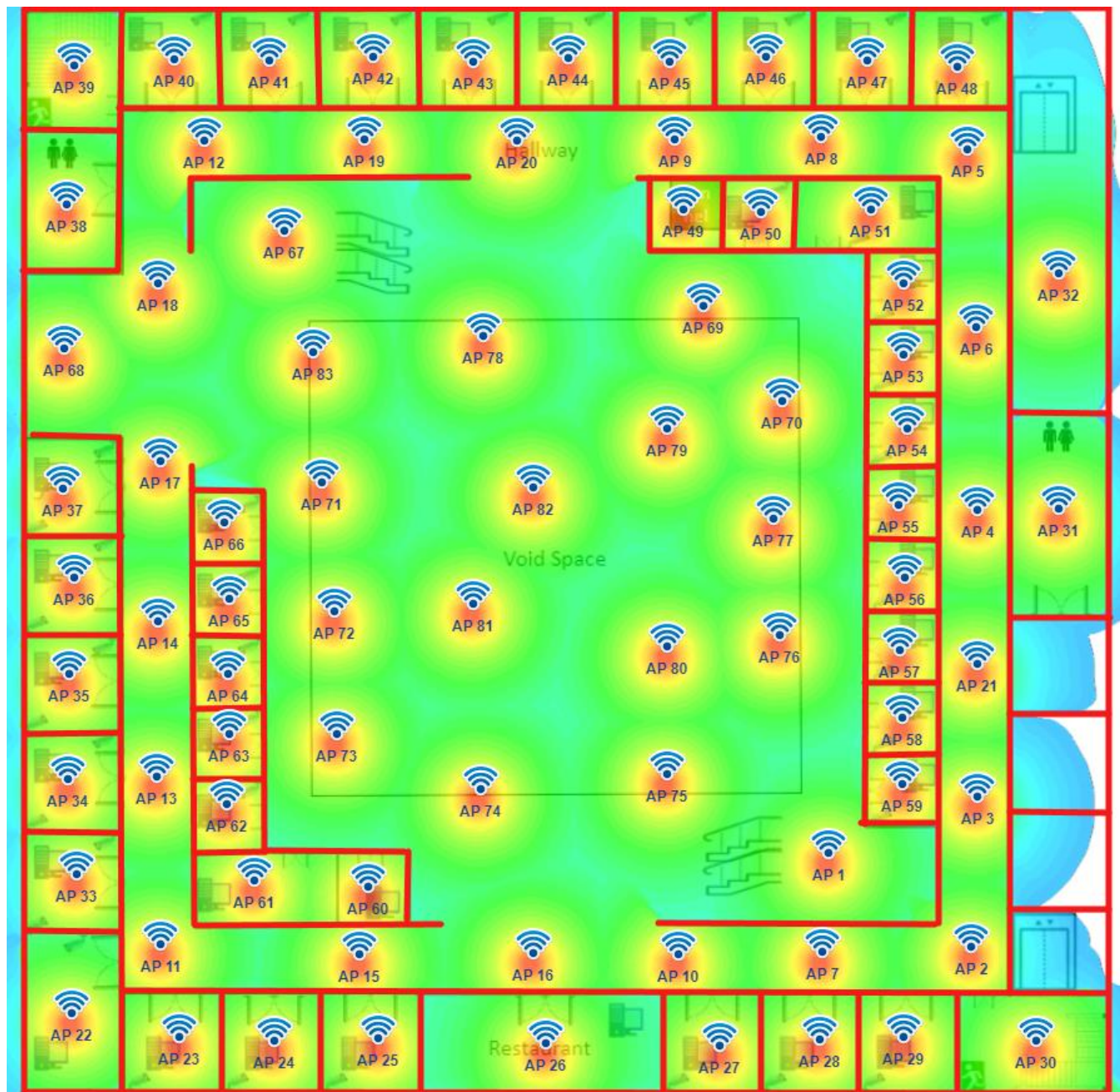# Ground Floor

Figure 09: Ground Heat Map

First Floor

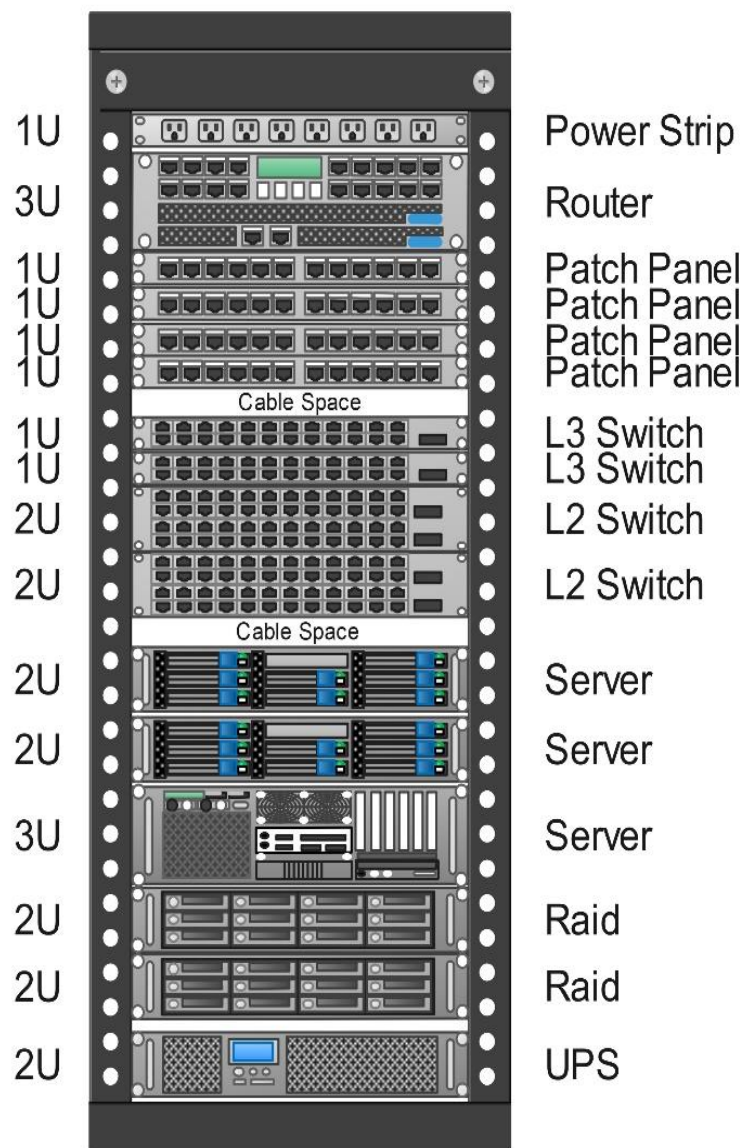Figure 10: Level 1 Floor Heat Map

Rack Diagram

Main Racks

Figure 16: Main Server Rack

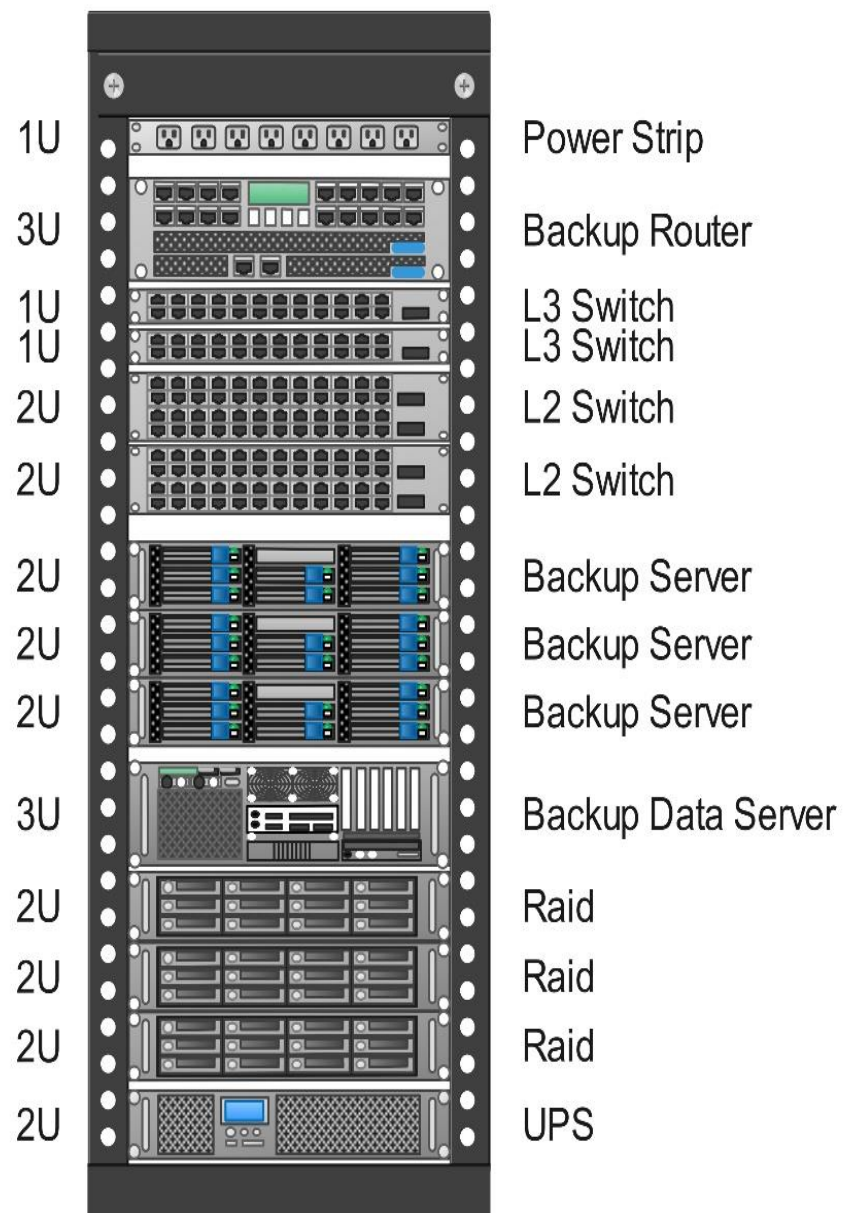Figure 16: Backup Server Rack

Floor Racks

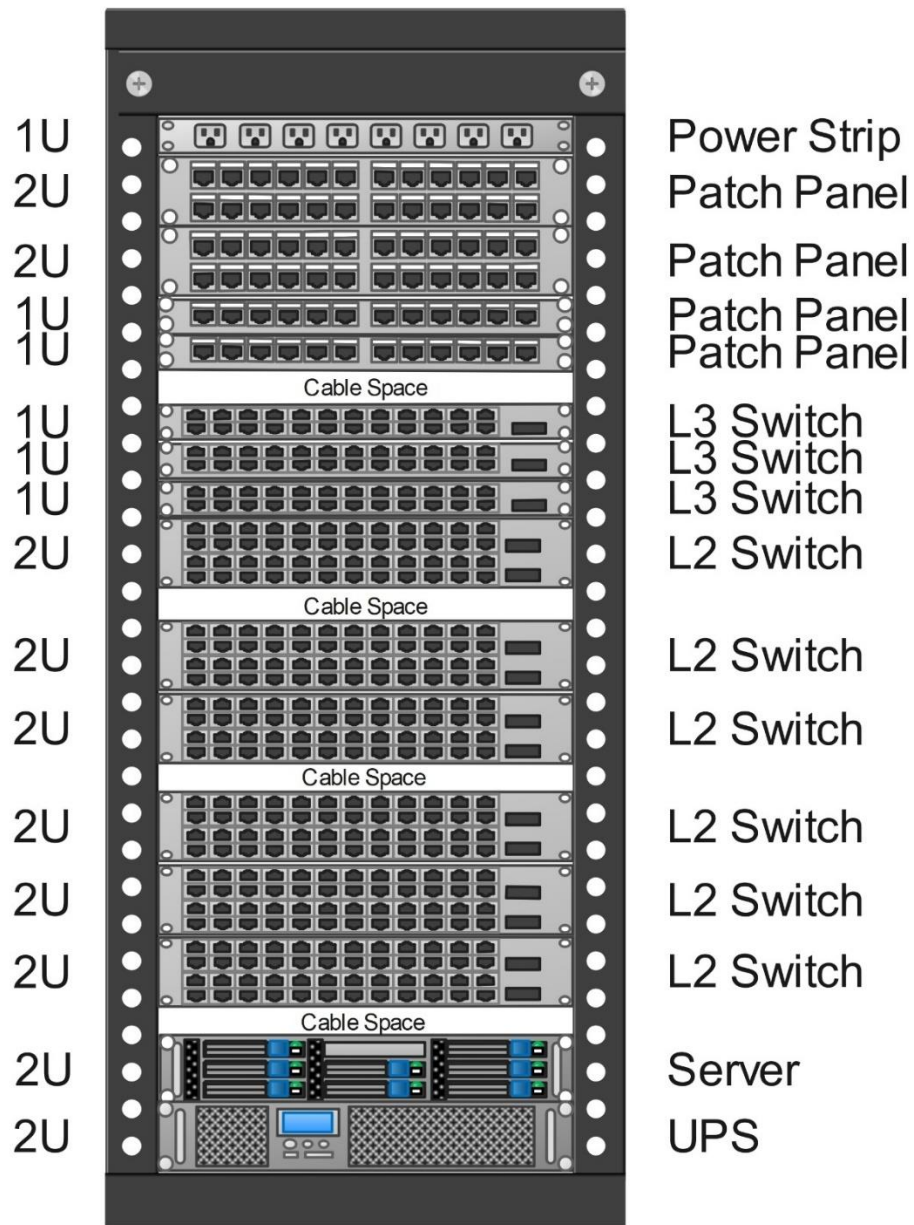| 1U | Power Strip |
2U	Patch Panel
2U	Patch Panel
1U	Patch Panel
1U	Patch Panel
	Cable Space
1U	L3 Switch
1U	L3 Switch
1U	L3 Switch
2U	L2 Switch
	Cable Space
2U	L2 Switch
2U	L2 Switch
	Cable Space
2U	L2 Switch
2U	L2 Switch
2U	L2 Switch
	Cable Space
2U	Server
2U	UPS

Figure 16 : Floor Switch Rack

8. Device Specification

1. ASR 1006-X Router

Figure 11: ASR 1006-X Server

Description: A high-performance router designed to provide reliable, scalable, and secure connectivity for enterprise and service provider networks.

Performance:

- Provides up to 100 Gbps of throughput.
- Supports up to 8 million IPv4 routes and up to 4 million IPv6 routes.

Security:

- Offers advanced security features, including integrated threat control, firewall, and VPN capabilities.
- Supports Cisco TrustSec technology for secure access and policy enforcement.

Scalability:

- Provides a modular design that enables scalability and flexibility.
- Offers support for multiple service types, including broadband, VPN, and MPLS.

Redundancy:

- Offers redundant power supplies and fans for high availability.

2. Cisco Catalyst C9500X-28C8D

Figure 11: Catalyst Switch C9500X

Description: A high-performance, modular switch designed to deliver reliable and secure connectivity for enterprise networks.

Performance:

- Provides up to 24 ports of 10 Gigabit Ethernet and up to 4 ports of 40 Gigabit Ethernet.
- Supports up to 1.44 Tbps of switching capacity.

Modularity:

- Offers a modular design that enables flexibility and scalability.
- Supports Cisco's StackWise Virtual technology for virtualizing up to 8 switches into a single logical switch.

Power over Ethernet (PoE):

- Provides up to 90 watts of PoE per port, making it suitable for powering a range of devices such as cameras and access points.

Redundancy:

- Offers redundant power supplies and fans for high availability.

- Supports Spanning Tree Protocol (STP) and Rapid Spanning Tree Protocol (RSTP) for redundancy.

3. Cisco Catalyst 9300X Series Switch

Figure 12: Catalyst Switch C9300X

Description:

- Product Name: Cisco Catalyst 9300X series switches
- Product Type: Ethernet switch

Physical Specifications:

- Mounting: Rack-mountable, supports front-to-back and back-to-front airflow

Power Requirements:

- Power Consumption: 110W (maximum)
- Input Voltage: 100-240V AC
- Input Frequency: 50-60 Hz

Network Interfaces:

- 24 or 48 Ethernet ports (10/100/1000Mbps) with RJ-45 connectors

Performance:

- Switching Capacity: Up to 320 Gbps
- Forwarding Rate: Up to 238 Mpps
- VLANs: Up to 4096

- MAC Addresses: Up to 32,000

- Management and Security

4. Dell PowerEdge R760 Rack Server (Main Servers)

Processor:
- Up to 2x 4th Gen Intel Xeon Scalable processors with up to 56 cores per processor

Memory:
- Up to 8TB (32 DIMM slots) of DDR5 RDIMM, LRDIMM, and Intel Optane persistent memory

Storage:
- Supports up to 24x 2.5" SAS/SATA/NVMe drives or up to 12x 3.5" SAS/SATA drives, plus up to 8x PCIe NVMe drives via optional front-access storage.

RAID:
- Optional PERC H755P RAID controller with 8GB cache support

Networking:
- 4X 25GbE LOM (Optional add-in NIC's)

Power Supply:
- Dual, Hot-Plug, Fully Redundant Power Supply (1 + 1) 1400W, Mixed Mode

Expansion Slots:
- Up to 4x PCIe Gen 5 slots
- Up to 8x PCIe Gen 4 slots

Management:
- iDRAC 9 Enterprise with Lifecycle Controller

Operating Systems:
- Windows Server
- VMware ESXi
- Red Hat Enterprise
- Ubuntu Server

- SUSE Linux Enterprise

5. Dell PowerEdge R760xd2 Rack Server (Storage Servers)

Processor:
- Up to 2x 4th Gen Intel Xeon Scalable processors with up to 32 cores per processor

Memory:
- Up to 1TB (16 DIMM slots) of DDR5 RDIMM, LRDIMM, and Intel Optane persistent memory

Storage:
  Front bays:
- Up to 12 x 3.5-inch SAS/SATA max 264 TB
  Mid bays:
- Up to 12 x 3.5-inch SAS/SATA max 264 TB
  Rear bays:
- Up to 4 x 3.5-inch SAS/SATA max 88 TB
- Up to 4 x 2.5-inch NVMe with 3.5-inch carrier max 30.72 TB
- Up to 2 x 2.5-inch NVMe max 15.36 TB
- 4 x E3.S NVMe max 30.72 TB

RAID:
- Optional PERC H755P RAID controller with 8GB cache support

Networking:
- 2x 1GbE LOM (Optional add-in NIC's)

Power Supply:
- Dual, Hot-Plug, Fully Redundant Power Supply (1 + 1) 1800W, Mixed Mode

Expansion Slots:
- Up to 5x PCIe Gen 4 slots

Management:
- iDRAC 9 Enterprise with Lifecycle Controller

Operating Systems:
- Windows Server
- VMware ESXi
- Red Hat Enterprise
- Ubuntu Server
- SUSE Linux Enterprise

6. Dell PowerEdge R940 Rack Server (Backup Server)
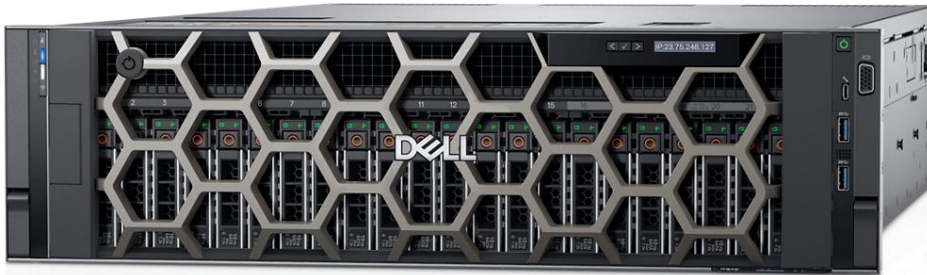

Figure 12: Dell Server R940

Processor:
- Up to 4x 2nd Gen Intel Xeon Scalable processors with up to 28 cores per processor

Memory:
- Up to 6TB (48 DIMM slots) of DDR5 RDIMM, LRDIMM, and Intel Optane persistent memory

Storage:
- Front drive bays: Up to 24 x 2.5" SAS/SATA (HDD/SSD) with up to 12 NVMe PCIe SSD, max 184.32TB

RAID:
- Optional PERC H740P RAID controller with 8GB cache support or HBA330

Networking:
- 4X 10GbE LOM (Optional add-in NIC's)

Power Supply:
- Dual, Hot-Plug, Fully Redundant Power Supply (1 + 1) 1600W, Mixed Mode

Expansion Slots:
- Up to 13x PCIe Gen 3 slots

Management:
- iDRAC 9 Enterprise with Lifecycle Controller

Operating Systems:
- Windows Server
- VMware ESXi
- Red Hat Enterprise
- Ubuntu Server
- SUSE Linux Enterprise

7. Cisco MR44 Access Point

- Four radios: 2.4 GHz, 5 GHz, embedded WIDS/WIPS and Bluetooth® Low Energy
- 4-stream UL/DL MU-MIMO 802.11ax (5 GHz)
- 2-stream UL/DL MU-MIMO 802.11ax (2.4 GHz)
- One 2.5 Gbps multigigabit Ethernet port
- PoE: 802.3af/at

8. Cisco MR86 Outdoor Access Point

- IP67-rated, tested for dust, shock, vibration, and moisture.
- Four radios: 2.4 GHz and 5 GHz, dual-band WIDS/WIPS, and Bluetooth® Low Energy

- 4-stream UL/DL MU-MIMO 802.11ax, up to 3.55 Gbps dual-aggregate throughput
- One 2.5G multigigabit Ethernet port, PoE: 802.3at

9. Hikvision DS-2CD2132F-I(W)(S)

- Image sensor: 1/3" Progressive Scan CMOS
- Lens: 4mm or 6mm fixed lens
- Angle of View: 4mm: 70.9°(4mm), 6mm: 44.6°(6mm)
- Day/Night: IR cut filter with auto switch.
- Minimum Illumination: Lux @ (F1.2, AGC ON), 0 Lux with IR
- Shutter Time: 1/3 s to 1/100,000 s
- Video Compression: H.264/MJPEG
- Video Bit Rate: 32 Kbps ~ 16 Mbps
- Max. Resolution: 2048 × 1536
- Frame Rate: 60Hz: 20fps (2048 × 1536), 30fps (1920 × 1080), 30fps (1280 × 720), 50Hz: 20fps (2048 × 1536), 25fps (1920 × 1080), 25fps (1280 × 720)
- IR Range: Up to 30m
- Network Storage: NAS (Support NFS, SMB/CIFS), ANR
- Alarm Trigger: Motion detection, tampering alarm, Network disconnect, IP address conflict, Storage exception.
- Protocols: TCP/IP, HTTP, DHCP, DNS, DDNS, RTP, RTSP, PPPoE, SMTP, NTP, UPnP, SNMP, HTTPS, FTP, 802.1x, QoS, IPv6, Bonjour
- Power Supply: 12 VDC ± 10%, PoE (802.3af)
- Power Consumption: Max. 5W Weatherproof Rating: IP66

10.Cisco CP-7841-K9 IP Phone

- Display: 3.5-inch (396x162 pixels) grayscale display
- Protocol support: SIP
- Audio features: Full-duplex speakerphone, headset port, wideband audio support
- Network features: 10/100BASE-T Ethernet connectivity, Power over Ethernet (PoE) support, Class 1 PoE, Energy Star compliant
- Call features: Caller ID, call waiting, call transfer, call hold, conference calling, and more
- Dimensions: 207 x 197 x 28 mm (8.15 x 7.75 x 1.10 in)
- Weight: 867g (30.56oz)

11.Timmy Finger Attendance – UT61

- Model No.- UT-61
- Display - 2.8" TFT LCD
- Languages - English, Chinese (T/S), Thai, Viet, Spanish, and more
- Verification Modes - Fingerprint, Card, PIN
- Fingerprint Capacity - 3,000 Card Capacity
- Log Capacity - 100,000
- Communications - TCP/IP, USB Drive, [Optional WIFI]
- Power Supply - DC 9V
- Operating Temperature - 20°C - 60°C
- Dimensions - 185 x 150 x 40mm

12. APC Smart-UPS X 3000 Rack

- Output Power Capacity: 2700 watts / 3000 VA
- Output Connections: 8 x NEMA 5-15R, 2 x NEMA 5-20R
- Input Voltage Range for Main Operations: 82 - 144V
- Battery Type: Maintenance-free sealed Lead-Acid battery with suspended electrolyte
- Typical Recharge Time: 3 hour(s)
- Runtime: 4.1 minutes at full load, 13.3 minutes at half load
- Interface Port(s): Smart Slot, USB, Ethernet
- Control Panel: Multi-function LCD status and control console
- Surge Energy Rating: 645 Joules
- Dimensions (H x W x D): 3.4 x 17.0 x 26.0 inches
- Weight: 112.00 lbs
- Operating Temperature: 32 - 104 °F
- Operating Relative Humidity: 0 - 95% non-condensing
- Certifications: CSA, FCC Part 15 Class A, UL 1778