Table of Contents

1. Introduction

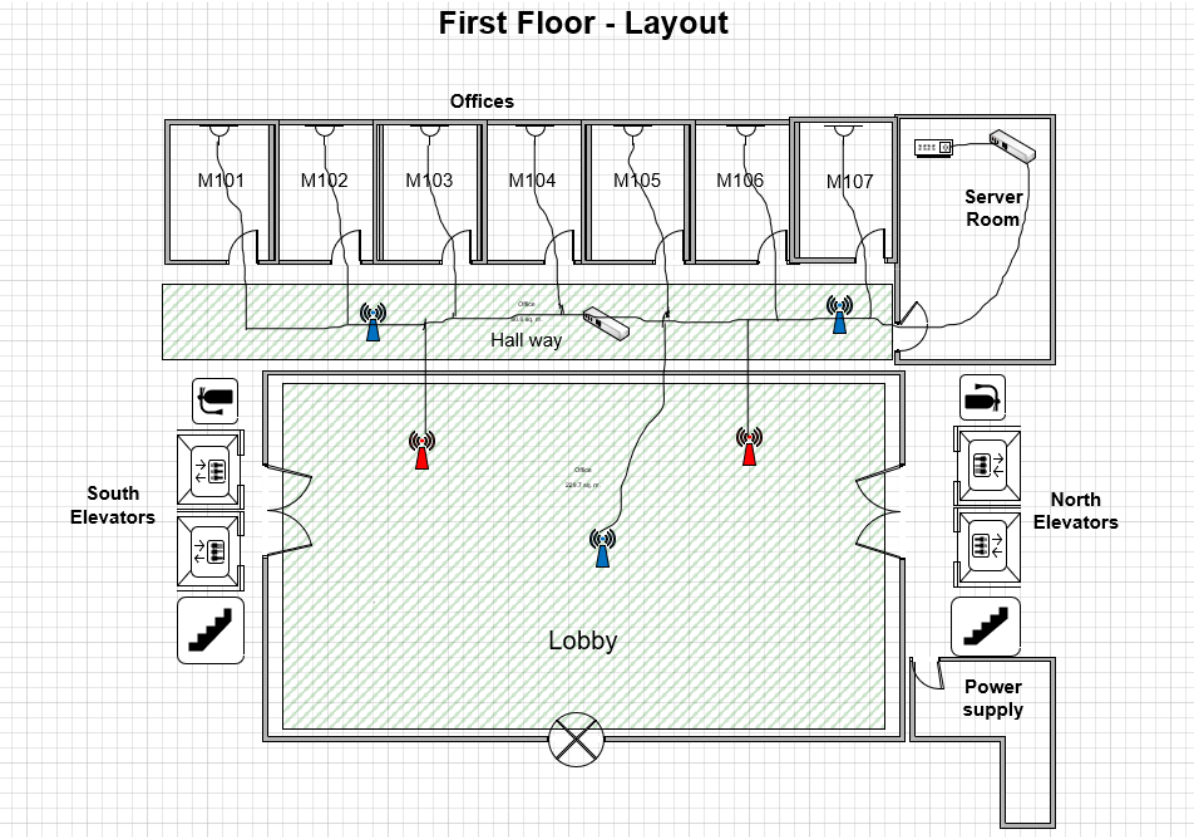
The project's goal is to design a network for a luxury residence hall that will serve honor students at the University of Houston. In this report, I will go into detail on the LANS for each floor, the distribution layer backbone that will connect the different floors in the building, and the part of the network that will connect in the campus core backbone. I will also specify the products/devices in the design and provide their cost and the total cost of the network.

2. Recommendations

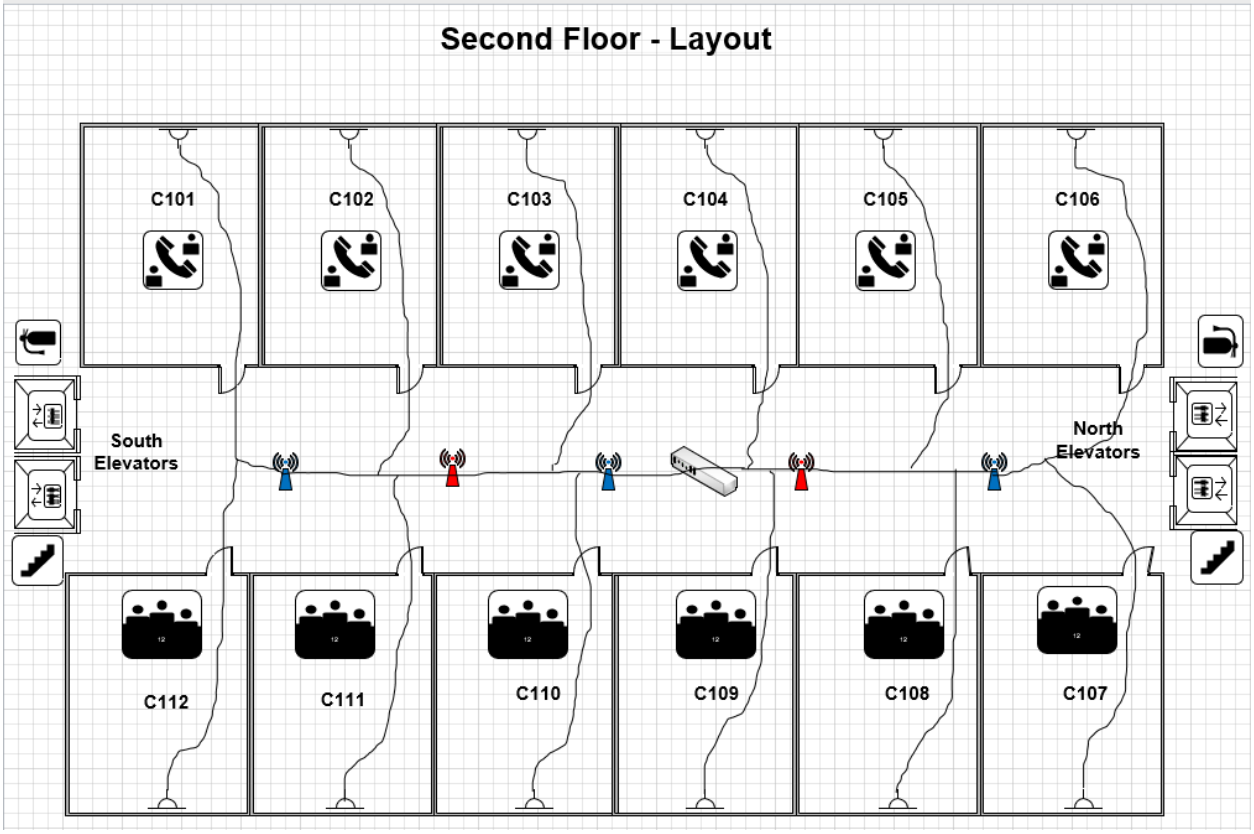
The recommendations I have considered in my design are:

- Wired network including drops for offices including Voice/IP
- Wired network including drops for residents' rooms including Voice/IP
- Wi-Fi for employees and residents 5 GHZ
- Wi-Fi for visitors 2.4 GHZ

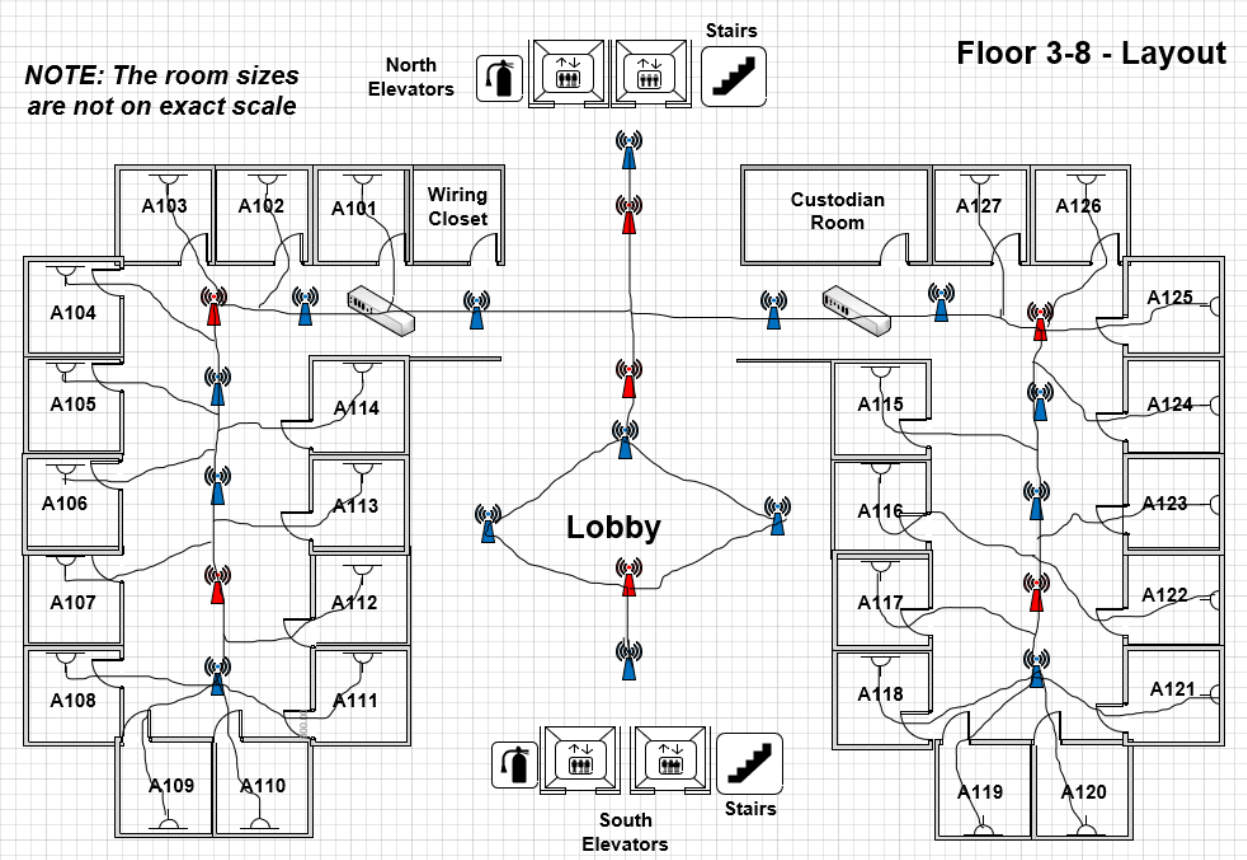
3. Diagrams/Maps



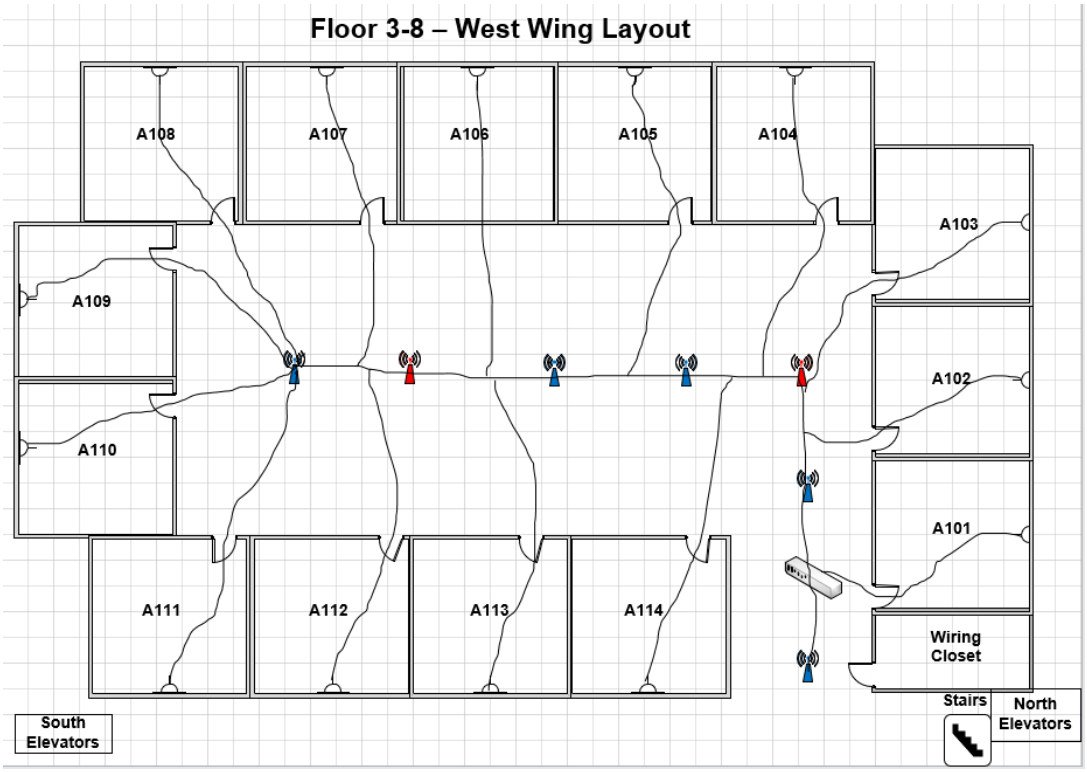
The layout of the first floor consists of Ethernet and Voice/IP drops, 2.4 GHZ Wi-Fi access points, 5 GHZ Wi-Fi access points, switches, and a router. There are Ethernet and Voice/IP drops located in each office room which connect to the switch in the hallway. The 2.4 GHZ and 5 GHZ Wi-Fi access points also connect to the switch in the hallway. There are two 2.4 GHZ Wi-Fi access points (marked in red) which cover the entire floor area. The amount of 2.4 GHZ Wi-Fi access points was calculated through multiplying the floor dimensions and dividing by the multiplication of the network range radius. The floor dimensions of floor 1 is 100 feet by 70 feet. 100 x 70 = 7000. The network range radius of a 2.4 GHZ access point is 75 feet. 75 x 75 = 5625. 7000 / 5625 = 1.245. This means that two 2.4 GHZ Wi-Fi access points will cover the entire floor area. There are three 5 GHZ Wi-Fi access points (marked in blue) which cover the entire floor area. The amount of 5 GHZ Wi-Fi access points was calculated with the same method which is multiplication of floor dimensions divided by multiplication of network range radius. Floor dimensions: 100 x 70 = 7000. The network range radius of a 5 GHZ access point is 50 feet. 50 x 50 = 2500. 7000 / 2500 = 2.8. This means that three 5 GHZ Wi-Fi access points will cover the entire floor area. The switch in the hallway is connected to the switch in the server room. Every switch in the building is connected to the switch in the server room which makes up the distribution layer backbone of the building, but these cable connections aren’t shown due to model constraints. The switch in the server room is connected to the router. This router connects into the campus core backbone which connects to the data center and enterprise edge, but this cable connection isn’t shown either due to model constraints.

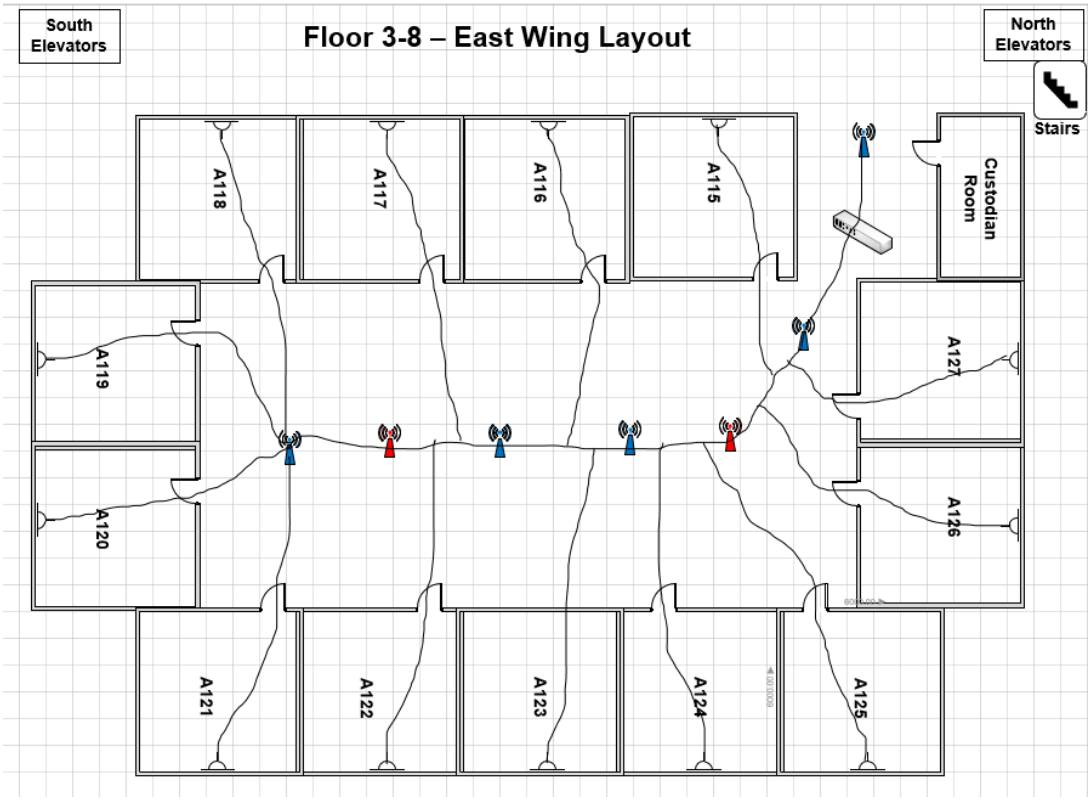


The layout of the second floor is similar to the layout of the first floor. There are Ethernet and Voice/IP drops in both the meeting and conference rooms which connect to the switch in the hallway. The 2.4 GHZ and 5 GHZ Wi-Fi access points are also connected to the switch in the hallway. There are two 2.4 GHZ Wi-Fi access points and three 5 GHZ Wi-Fi access points. The number of access points for each network type is the same as floor 1 because the dimensions of floor 1 and floor 2 are the exact same. The switch on this floor is connected to the switch in the server room of floor 1. This means that this floor is connected to the distribution layer backbone of the building.

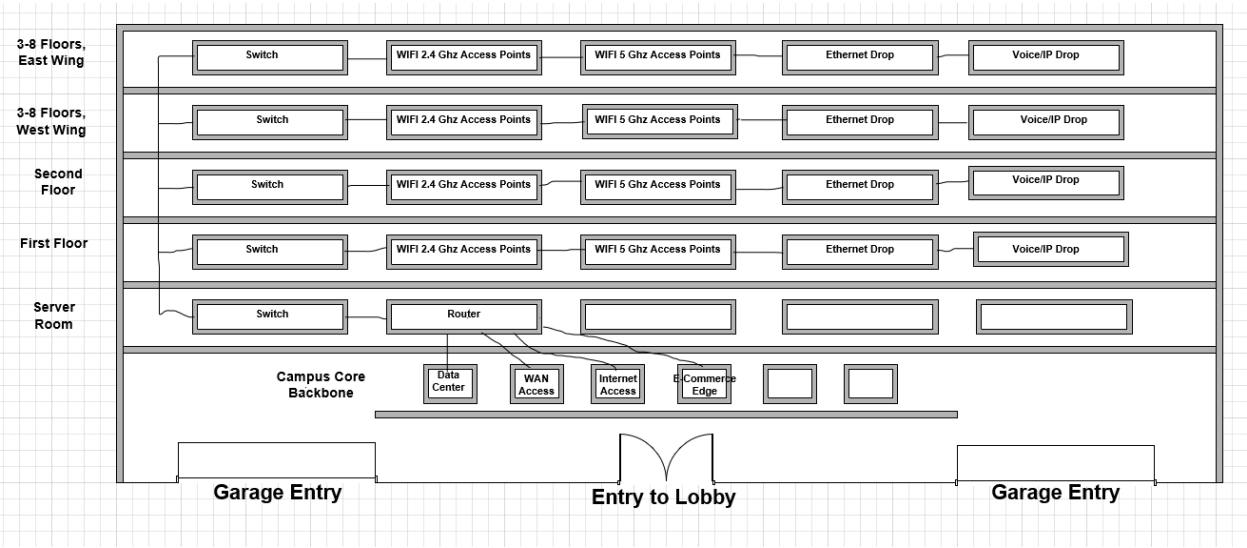


The layout of floors 3-8 consists of Ethernet and Voice/IP drops in each room, 2.4 and 5 GHZ Wi-Fi access points, and switches. The Ethernet and Voice/IP drops along with the Wi-Fi access points are all connected to the switches. There are seven 2.4 GHZ Wi-Fi access points which cover the entire floor area. The amount of 2.4 GHZ Wi-Fi access points was calculated by using the same method. The dimensions of floors 3-8 are 240 by 150 feet. 240 x 150 = 36000. The network range radius of a 2.4 GHZ access point is 75 feet. 75 x 75 = 5625. 36000 / 5625 = 6.4. This means that seven 2.4 GHZ Wi-Fi access points will cover the entire floor area. There are fifteen 5 GHZ Wi-Fi access points. This number of access points was calculated with the same method. Floor dimensions: 240 x 150 = 36000. The network range radius of a 5 GHZ access point is 50 feet. 50 x 50 = 2500. 36000 / 2500 = 14.4. This means that fifteen 5 GHZ access points will cover the entire floor area. Both switches on the floor are connected to the switch in the server room on floor 1 meaning that floors 3-8 are connected to the distribution layer backbone of the building.


Floor 3-8 – West Wing Layout
A108
A107
A106
A105
A104
A103
A109
A102
A110
A101
A111
A112
A113
A114
Wiring Closet
Stairs
North Elevators
South Elevators


South Elevators
Floor 3-8 – East Wing Layout
North Elevators
Stairs
A118
A117
A116
A115
Custodian Room
A119
A127
A120
A126
A121
A122
A123
A124
A125

Floor 3-8 West and East wings have the exact same layout for their network. There are Ethernet and Voice/IP drops, two 2 GHZ Wi-Fi access points, and three 5 GHZ Wi-Fi access points on each wing which all connect to a switch. I won't repeat any of the details for calculation of access points for the Floor 3-8 wings because that was previously explained in the report. I will reiterate that the switches for each wing on Floors 3-8 are connected to the switch in the server room on floor 1 to reaffirm that the wings are connected to the distribution layer backbone of the building.



This layout is a high-level map for all floors. It shows that everything is connected to the distribution layer backbone of the building. All of the drops and access points are connected to the floor switches. The floor switches are connected to the switch in the server room. The switch in the server room is connected to the router. The router connects to the campus core backbone. The campus core backbone connects to the data center, Wide Area Network Access, Internet Access, and E-Commerce Edge.

4. Cost Assessment

Equipment	Product Name	Quantity	Cost per Item	Total Cost
RJ45 Cable	Tripp Lite 50ft Cat6 Gigabit Snagless Molded Patch Cable RJ45 M/M Black 50' - patch cable - 50 ft - black	87	$17.99	$1,565.13
Wireless Access Point	HPE Aruba AP-505 (US) - Campus - wireless access point - Bluetooth, 802.11a/b/g/n/ac/ax	32	$620.50	$19,856.00
Switch	Cisco Meraki Cloud Managed MS225-48FP - switch - 48 ports - managed - rack-mountable	5	$7,323.99	$36,619.95
Ethernet Wall Mount	Tripp Lite Center Plate Insert, Decora Style - Vertical, 4 Ports - faceplate	46	$2.99	$137.54
Voice/IP Wall Mount	Cisco Spare - telephone wall mount kit for VoIP phone	46	$67.99	$3,127.54
Router	Cisco Catalyst 8200-1N-4T - router - rack-mountable	1	$3,577.99	$3,577.99
			Total	$64,884.15

5. Subnets

The IPv4 subnet result for 172.16.0.0 is a network address of 172.16.0.0, usable host IP range of 172.16.0.0 – 172.16.63.254, broadcast address of 172.16.63.255, total number of hosts is 16,834, number of usable hosts is 16,832, subnet mask is 255.255.192.0, binary subnet mask is 11111111.11111111.11000000.00000000, IP class is B, CIDR notation is /18, and IP type is private. For the visitors Wi-Fi which comes from the 2.4 GHZ Wi-Fi access point, the DHCP host range is 192.168.0.2 – 192.168.0.254. This means that any visitor using the Wi-Fi will be assigned an IP in this host range. For the Wired Network which comes from the ethernet drops in the rooms, the DHCP host range is 172.16.64.1 – 172.16.127.254. This means that any employee or resident using the wired network will be assigned an IP in this host range. For the employee and resident Wi-Fi which comes from the 5 GHZ Wi-Fi access point, the DHCP host range is 172.16.192.2 – 172.16.255.254. This means that any employee or resident using the Wi-Fi will be assigned an IP in this host range.

References

CDW. (n.d.). Retrieved November 21, 2023, from https://www.cdw.com/.