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# Data Communications Design Project #2

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## **Network Design Project #2**

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## **Article 1: Summary**

For the final design project in our Fundamentals of Data Communication class, we are tasked with designing the data network infrastructure for a provided company. To begin we were first given the scenario with vague specifications and little details. This forced the students to then uncover what other information would be desired in order to construct the most efficient network for the company. With the newly obtained information, statistics and specifications for ABC company we can now build upon our original designs.

Through utilizing the information provided us for this project, we can further analyze the needs and requirements of the business. Understanding what the business needs accomplished by the network allows us to fine tune our designs to provide effective networks by keeping wasted resources to a minimum. By the conclusion of the design we will be able to present information to the executives of ABC company that will explain how their network will accomplish their desired goals and remain at a fair price.

## **Article 2: Introduction**

ABC company is a rapidly growing entrepreneurial company that has grown from 20 employees, to 348 over the last 5 years. The executives of the company expect this growth will continue at a rate of 12% a year, until after year 4 when they expect it to decrease to 9%. In order to combat this growth, the company is leasing space in a new business development to allow for expansion without relocating in the future.

The company is made up of employees, administration, and support personnel that will all utilize the implemented network. All buildings in the company are located in the same general vicinity, with one being a designated headquarters. With this being said, ABC company has a heavy emphasis on the security requirements of the networks design. They aim to minimize the ability of theft of credentials as well as their physical assets. The company is split into 9 departments including administration, with some departments being declared as “security intensive”.

During this scenario, we are hired on to design ABC company’s data network infrastructure. With the provided information we seek to identify the host, switch, and router configuration along with calculation the associated costs.

## **Article 3: NETWORK DESIGN**

### **PROJECTED GROWTH OF THE COMPANY**

As previously mentioned, ABC company has experienced a rapid growth rate that is expected to continue at 12% for 4 years, then decrease to 9% thereafter. By calculation the expected number of employees we can begin to base specifications off our results. A major goal during this design is to ensure the infrastructure will handle the expansion the company will see years from now.

**Table 1: Total Expected Growth**

	# of Employees	Growth Rate
<b>Present</b>	348	12%
<b>Year 1</b>	390	12%
<b>Year 2</b>	437	12%
<b>Year 3</b>	490	12%
<b>Year 4</b>	549	12%
<b>Year 5</b>	599	9%

As depicted above, based off the growth rates expected by executives of ABC company, they will increase to about 599 employees within a 5-year span. These numbers are very rough estimates but allow us a base goal to begin planning designs for. The infrastructure implemented today should be able to withstand the expansion seen in 5 years. To further analyze this growth we should now begin breaking employees down by departments.

**Table 2: Employee Growth by Department**

Dept.	Dept. Name	Annual Growth Rate	Present	Year 1	Year 2	Year 3	Year 4	Year 5
1	Marketing	12%	56	63	71	80	90	101
2	Customer Support	22%	64	79	97	119	146	179
3	Engineering	8%	29	32	35	38	42	46
4	Direct/Corporate Sales	10%	27	30	33	37	41	46
5	IT	18%	9	11	13	16	19	23
6	Cold Call Sales Center	25%	97	122	153	192	240	300
7	Accounting	5%	36	38	40	42	45	48
8	Finance	3%	18	19	20	21	22	23
A	Administration	8%	12	13	15	17	19	21
		<b>Total Employees:</b>	348	407	477	562	664	787

Displayed in table 2 are the various departments, including administration contained within ABC company. All departments have an anticipated annual growth rate as well as a present number of employees. By calculating the growth rate of individual departments, we can compare our results to the estimate of total employees. It is worth noting that the estimated total number of employees is significantly less than the expected growth by department.

**Table 3: Host Growth by Department**

Dept.	Present # of Hosts	Max Throughput in Mbps	Annual Growth Rate	Department Name	Year 1	Year 2	Year 3	Year 4	Year 5
1	63	1037.88	12%	Marketing	71	80	90	101	114
2	72	3492.72	22%	Customer Support	88	108	132	162	198
3	33	192.08	8%	Engineering	36	39	43	47	51
4	31	21.6	10%	Direct/Corporate Sales	35	39	43	48	53
5	11	1228.8	18%	IT	13	16	19	23	28
6	109	1299.6	25%	Cold Call Sales Center	137	172	215	269	337
7	41	61.25	5%	Accounting	44	47	50	53	56
8	21	5.07	3%	Finance	22	23	24	25	26
A	14	72.9	8%	Administration	16	18	20	22	24
				<b>Total Hosts:</b>	462	542	636	750	887

Although we were only provided a total number of hosts for present day, we can break hosts down by department utilizing the host-to-employee ratio. By dividing the total number of hosts by the total number of employees we can see that for every 1 employee, there are 1.17 hosts. Multiply this ratio by the number of employees in each department and we receive the expected growth of hosts in the network. Obtaining the total number of hosts is vital to the creation of our network as it allows us to decide the type and strength of the hardware required to withstand the number of hosts. For clarification of these calculations, please refer to Appendix A.

**Table 4: Throughput Projections by Department**

Dept.	Present # of Hosts	Max Throughput in Mbps	Annual Growth Rate	Department Name	Year 1	Year 2	Year 3	Year 4	Year 5
1	63	1037.88	12%	Marketing	1162.43	1301.93	1458.17	1633.16	1829.14
2	72	3492.72	22%	Customer Support	4261.12	5198.57	6342.26	7737.56	9439.83
3	33	192.08	8%	Engineering	207.45	224.05	241.98	261.34	282.25
4	31	21.6	10%	Direct/Corporate Sales	23.76	26.14	28.76	31.64	34.81
5	11	1228.8	18%	IT	1449.99	1710.99	2018.97	2382.39	2811.23
6	109	1299.6	25%	Cold Call Sales Center	1624.5	2030.63	2538.29	3172.87	3966.09
7	41	61.25	5%	Accounting	64.32	67.54	70.92	74.47	78.2
8	21	5.07	3%	Finance	5.23	5.39	5.56	5.73	5.91
A	14	72.9	8%	Administration	78.74	85.04	91.85	99.2	107.14
				<b>Total Throughput:</b>	8877.54	10650.28	12796.76	15398.36	18554.6

**Table 5: Interdepartmental Throughput Projections by Year 5**

Dept	1	2	3	4	5	6	7	8	A
1	640.1847	146.332	15.253	0	18.293	9.15	0	0	0
2		943.983	51.322	28.1253	34.9272	0	445.7694	0	513.1952
3			225.785	5.647	2.825	0	0	0	2.822285
4				24.35091	0.173935	0.173935	0.137838	0.125202	0.158687
5					843.359	562.2393	156.8295	0	180.551
6						396.6064	0	0	0
7							7.817225	7.100554	6.125
8								1.175504	1.175504
A									26.7785

Tables 4 and 5 depict the forecasted throughput rates for each department, as well as between departments. Similar to the number of hosts, the amount of throughput between departments allows us to determine locations, strengths, and layouts of hardware between hosts in different departments. We calculated interdepartmental throughput based on the lowest growth rate between the 2 departments in question.

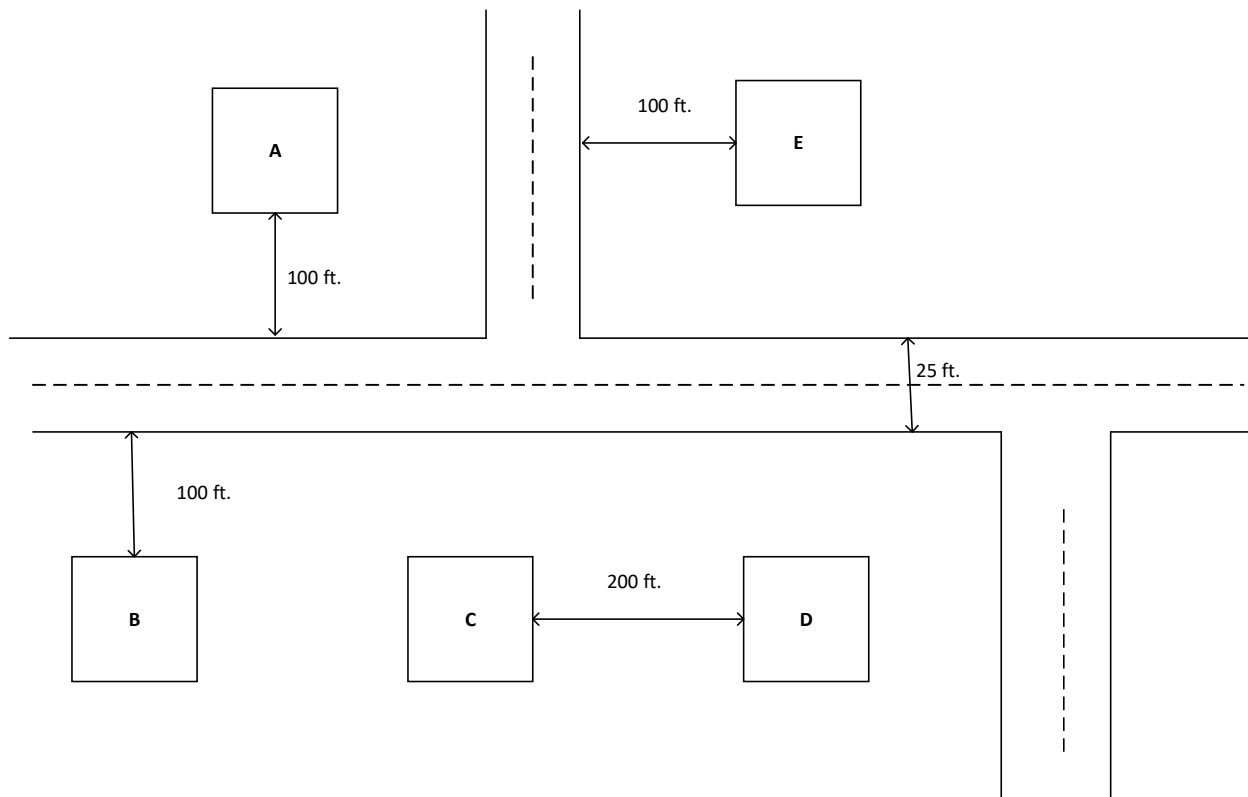


## Article 4: PHYSICAL LAYOUT OF BUILDINGS

ABC company is currently comprised of 5 separate 3-floor buildings all located in the same general vicinity. Three of its buildings are located on their own side of the street with the other 2 being across the road. Through further analyzation of the physical layout between the buildings we are able to plan for the length of wiring required and the range of the network.

Figure 1 depicts the provided specifications for the physical layout of ABC company's buildings. Each building is located 100 feet away from the road, and 200 feet away from each-other. Along with the distance between the building, the length of the road must also be considered as we may be required to place wiring beneath it to implement the backbone network. An assumption was made on the physical layout that buildings A and buildings E are perpendicular with both buildings across from each-other.

**Figure 1: ABC Company Campus Layout**



All buildings contain specific departments, with building A being considered a headquarters. Based on the physical locations, security requirements, and tasks of departments we will then be able to separate departments into designated buildings. First, we must calculate the required space for department employees.

All employees work in cubicles except for administration, which are assigned offices. 10% of personnel in each department are considered “support” employees and are assigned separate cubicles. Currently employees are assigned to cubicles of 180 sq. ft. per person, support personnel 100 feet per person, and administration 300 sq. ft per person. Apart from employee space requirements, we must also allow 30% of the space to be available for walkways, breakrooms, wiring closets, elevators, restrooms, etc.

Each building is sized 75ft by 50ft, allowing for 3,750 sq. ft. per floor. This equates to 11,250 total sq. ft. per building and 56,250 sq. ft. between all 5 locations. Elevators are located in the center of each building with wiring closets located in the same spot on the first floor and located on the wall closest to the horizontal road.

**Table 6: Departmental Space Requirements for Present Day**

Dept.	Dept. Name	Present	Employees/Admin	Employee Sq. Ft	Support	Support Sq. Ft	Admin Sq. Foot
1	Marketing	56	50	9000	6	600	
2	Customer Support	64	57	10260	7	700	
3	Engineering	29	26	4680	3	300	
4	IT	27	24	4320	3	300	
5	Sales	9	8	1440	1	100	
6	Call Center	97	87	15660	10	1000	
7	Accounting	36	32	5760	4	400	
8	Finance	18	16	2880	2	200	
A	Administration	12	10	1800	2	200	3000
	<b>Totals:</b>	348	310	55800	38	3800	3000
				<b>Total Employees:</b>	<b>348</b>		
				<b>Total Sq. Ft</b>	<b>62600</b>		

**Table 7: Available Space for Present Day**

<b>Elevator Sq. Ft Requirements</b>	
Average Elevator Width:	6
Average Elevator Depth:	5
Elevator Sq. Ft. Requirements:	30
<b>Sq. Ft. Allotment</b>	
Floors per Building:	3
Sq. Ft per Floor:	3,750
Usable Sq. Ft per Floor:	3,720
Sq. Ft per Building:	11,250
Usable Sq. Ft per Building:	11,160
Walkways, Break Rooms, Restrooms per Building:	3,348
<b>Total Sq. Ft Required</b>	
Number of Buildings:	5
Walkways, Break Rooms, Restrooms:	16740
Total Space Needed:	62600
Space Available:	39,060
Difference:	(23,540)

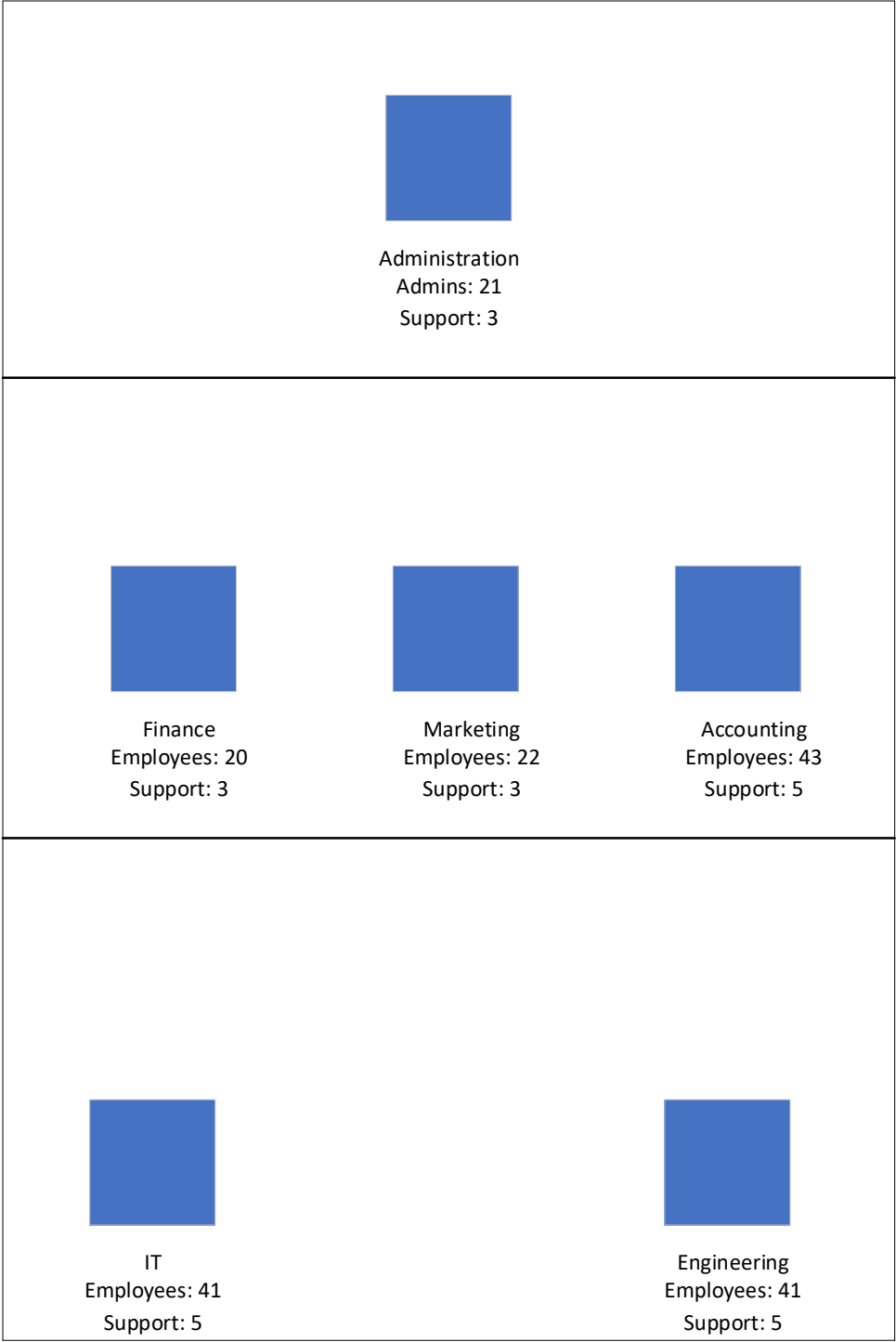
**Table 8: Departmental Space Requirements by Year 5**

Dept.	Dept. Name	Present	Employees/Admin	Employee Sq. Ft	Support	Support Sq. Ft	Admin Sq. Foot
1	Marketing	101	90	16200	11	1100	
2	Customer Support	179	161	28980	18	1800	
3	Engineering	46	41	7380	5	500	
4	IT	46	41	7380	5	500	
5	Sales	23	20	3600	3	300	
6	Call Center	300	270	48600	30	3000	
7	Accounting	48	43	7740	5	500	
8	Finance	23	20	3600	3	300	
A	Administration	21	18	3240	3	300	5400
	<b>Totals:</b>	787	704	126720	83	8300	5400
				<b>Total Employees:</b>	<b>787</b>		
				<b>Total Sq. Ft</b>	<b>140420</b>		

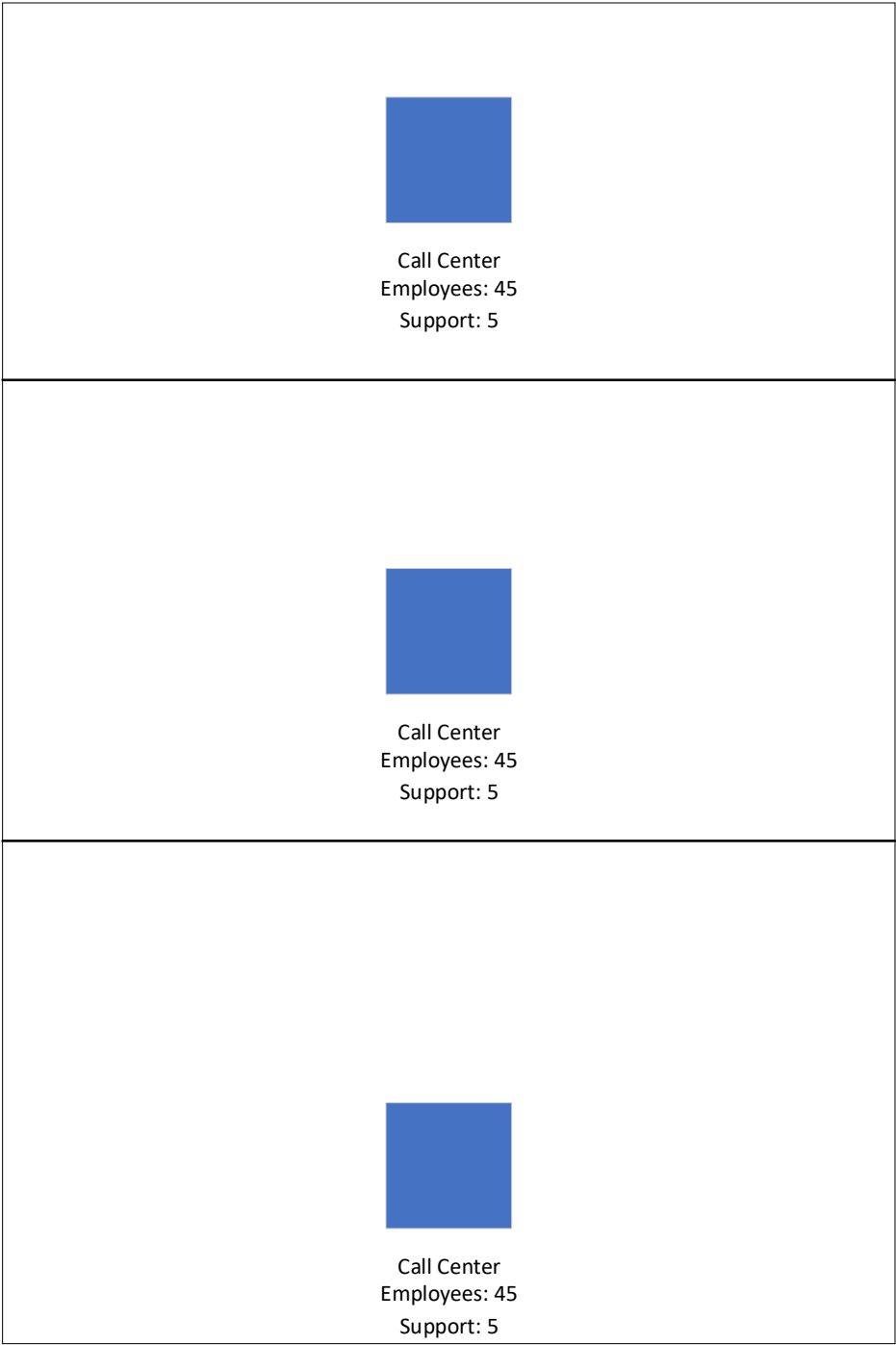
Tables 6, 7, and 8 show space requirements and availability for present day and the expected growth. These rates are where the biggest detriment to this infrastructure lay, there just simply isn't enough space currently to handle the expected growth. Even with our present day of staff of 348 employees, we still see a difference of 23,540 sq. ft. less than what is required. This ultimately means that currently, with all 3 floors in all 5 buildings being utilized, ABC company does not have enough space for all of their employees. This is a major issue that needs to be addressed immediately. The buildings either need to be expanded further than their current size of 11,250 sq. ft. or there needs to be more buildings introduced. To expand further into the project, we assumed that the buildings are expanded upon to handle all employees expected to join the company.

Figures 2 through 6 display the allocation of employees to buildings and floors. Specifications regarding security were provided, with the company expressing that the engineering, finance, accounting and administration departments should not be located with the call center or customer service. With taking into consideration of building A being assigned as a headquarters, we can safely place all of these security intensive departments in the same building. Later on security measures such as firewalls can be implemented to the headquarters to prevent malicious payloads or sensitive information to be transmitted. Other departments were kept together in the other buildings, and physically separated from the headquarters by the main road.

**Figure 2: Building A Employees**



**Figure 3: Building B Employees**



**Figure 4: Building C Employees**

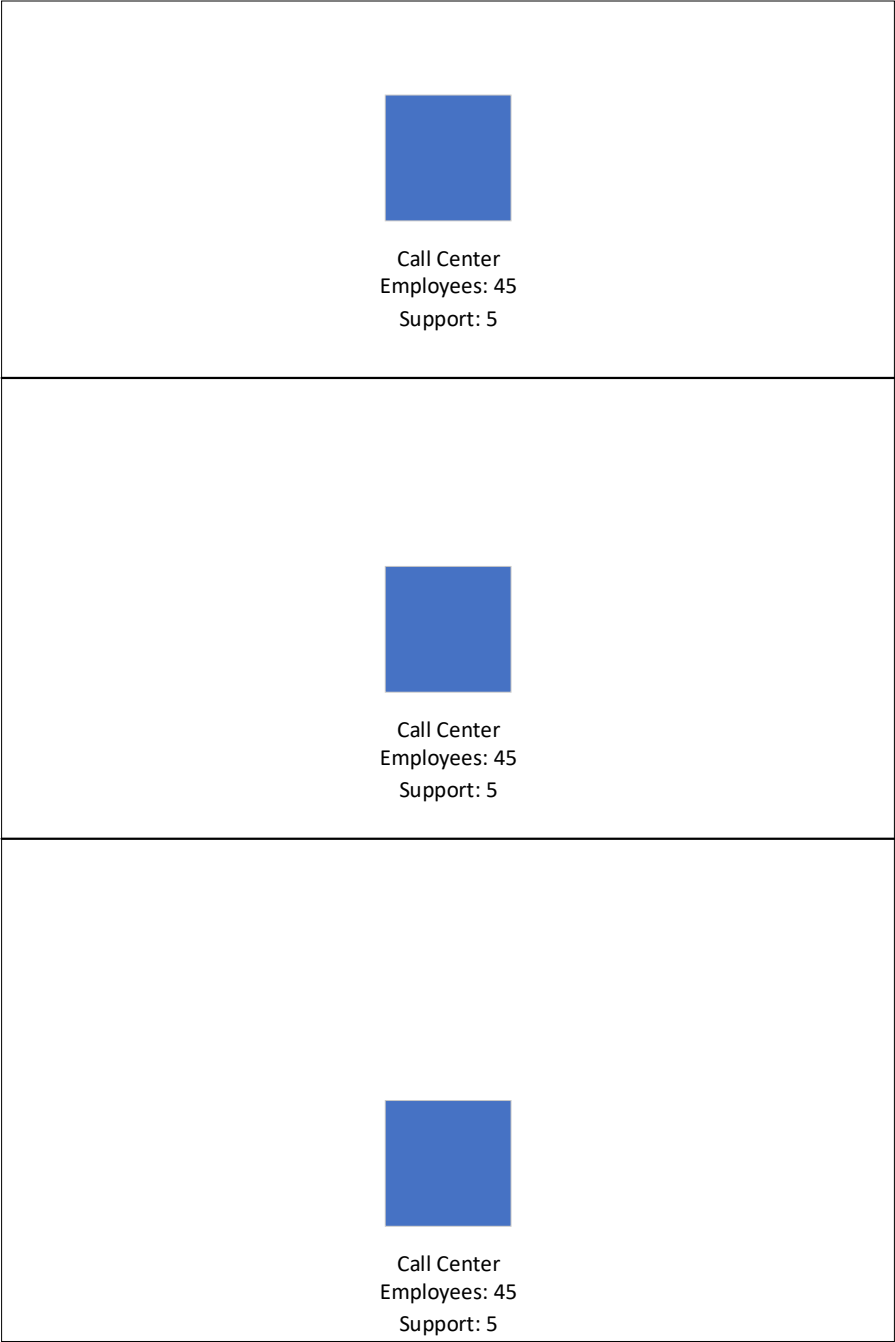
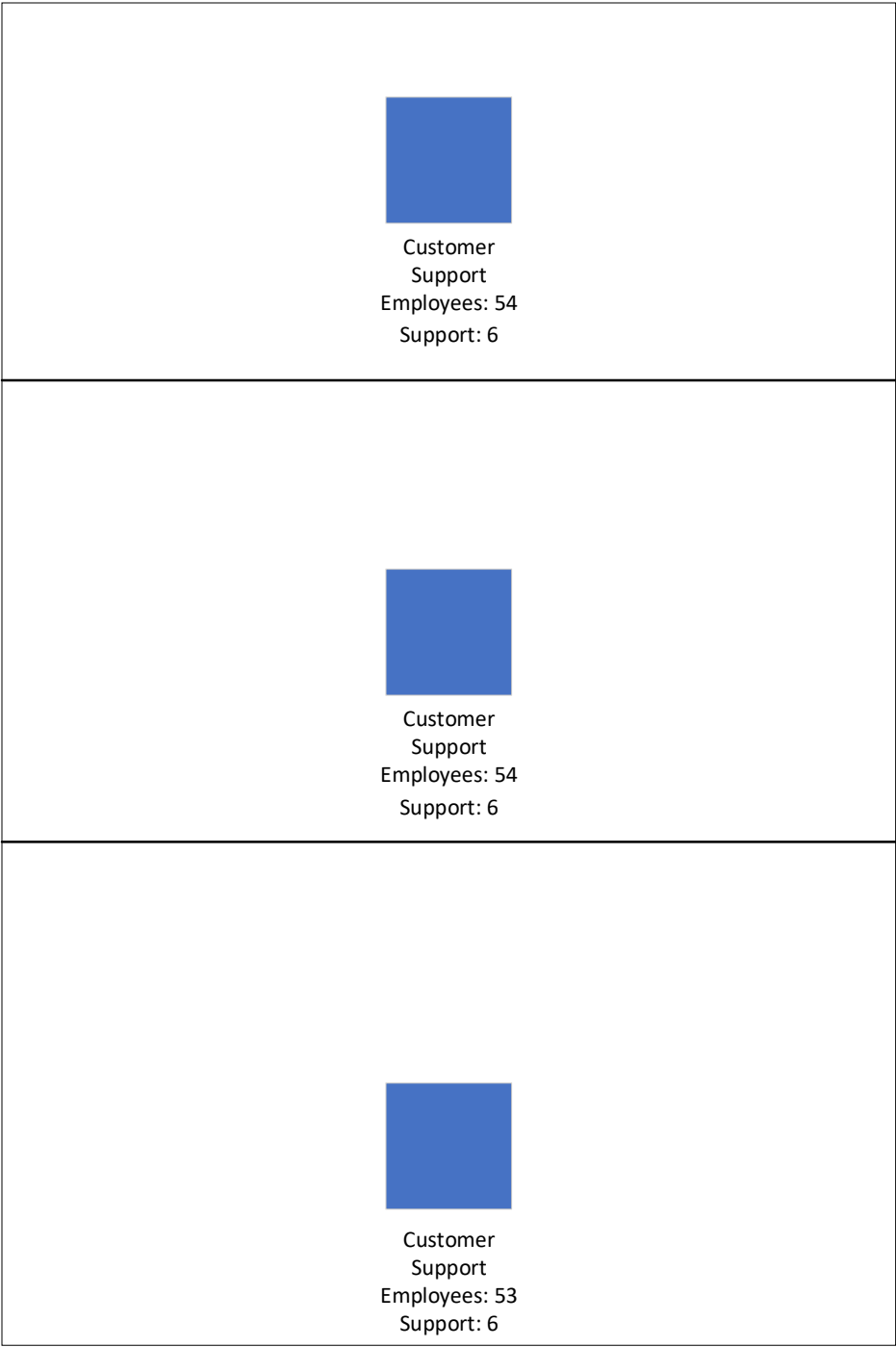
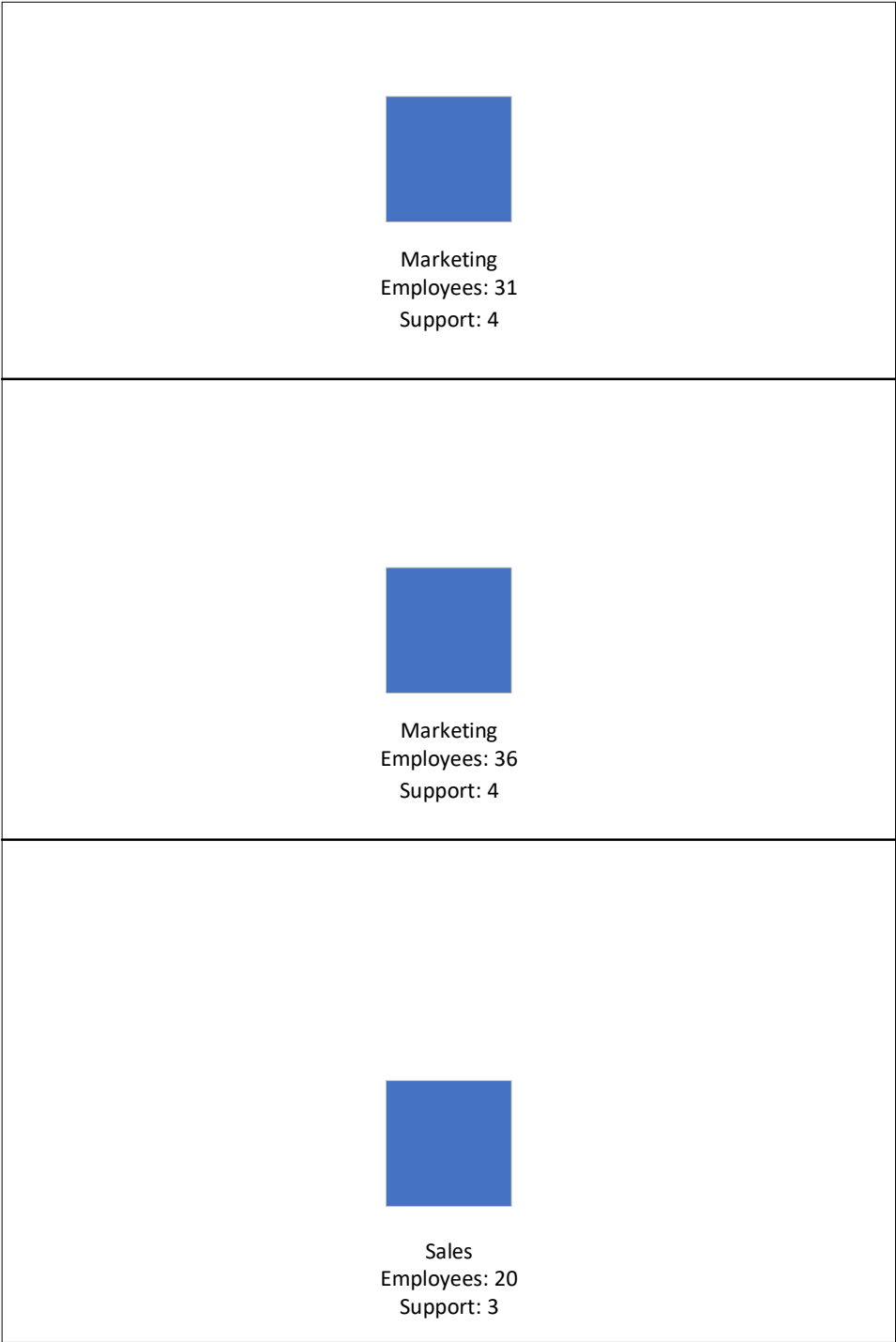


Figure 5: Building D Employees





**Figure 6: Building E Employees**



## **Article 5: NETWORK TOPOLOGY**

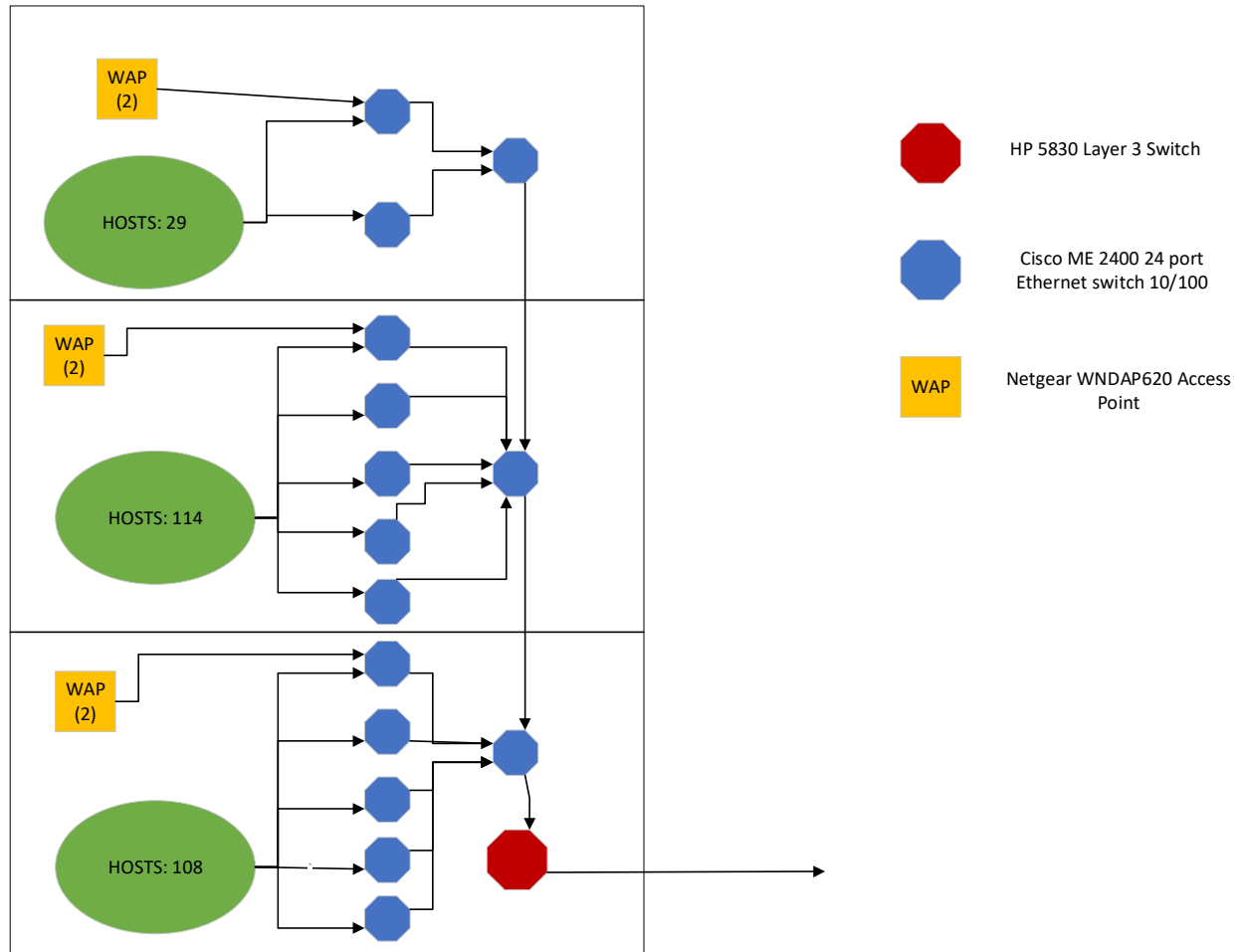
**Table 9: Host Requirements by Floor**

Floor	Employee Count	Host Count	Ft of UTP Cable	# of Switches
A1	92	108	4867.56	5
A2	97	114	5137.98	5
A3	24	29	1307.03	2
B1	50	59	2659.13	3
B2	50	59	2659.13	3
B3	50	59	2659.13	3
C1	50	59	2659.13	3
C2	50	59	2659.13	3
C3	50	59	2659.13	3
D1	59	70	3154.9	3
D2	60	71	3199.97	3
D3	60	71	3199.97	3
E1	23	27	1216.89	2
E2	40	47	2118.29	2
E3	35	41	1847.87	2

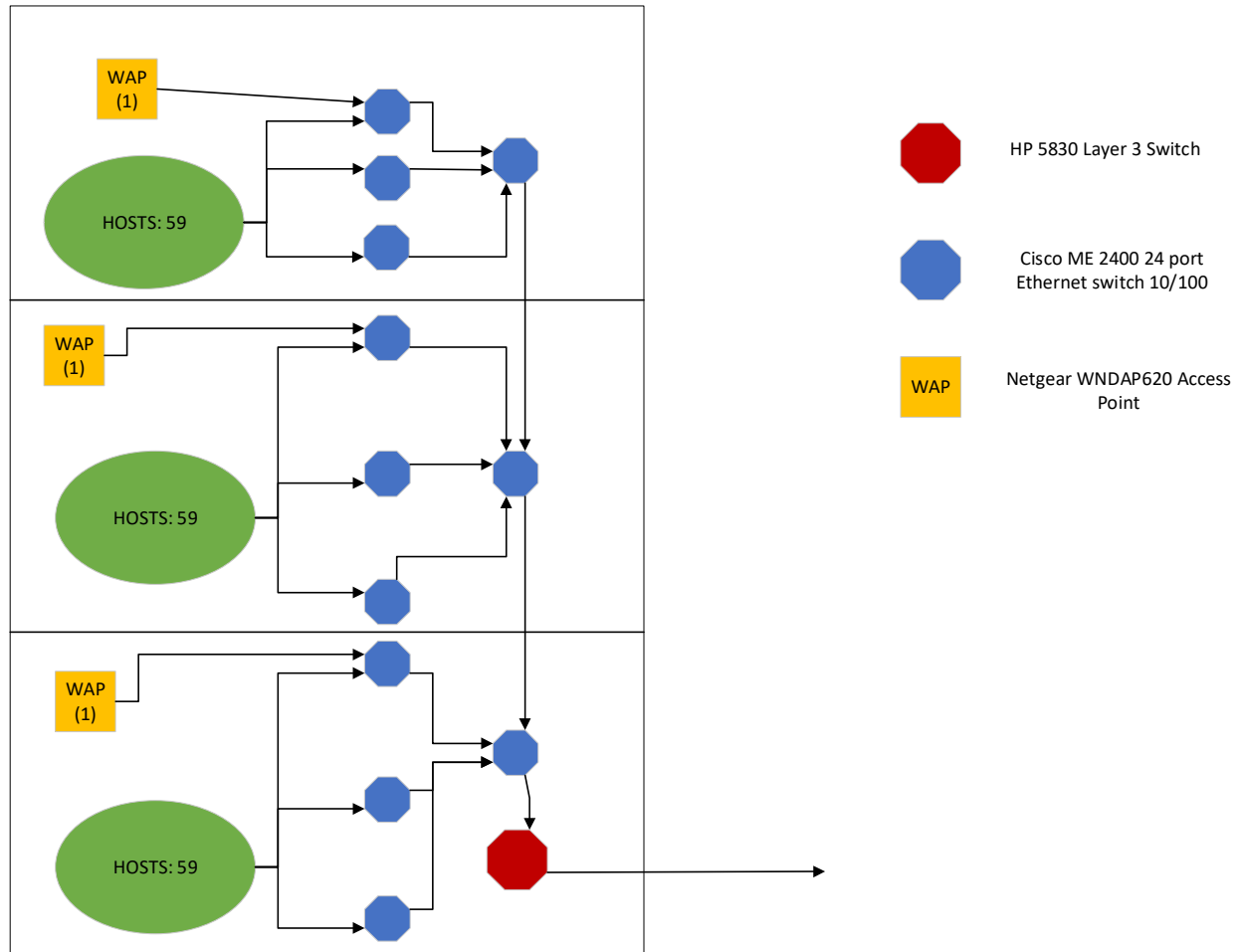
In order to begin drafting our internal hardware, we need to calculate the number of hosts per floor based on the number of employees. Like article 3, we can use the host-to-employee ratio to accurately estimate the number of hosts on each floor of each building. The switches utilized by ABC company and provided in the specifications support a total of 24 hosts per switch. Knowing the capacity of these switches in comparison to the number of hosts is vital in allocation regarding the proper number of switches per floor. Inside each building we will utilize UTP wiring to maintain cost-effectiveness while connecting all the hosts on each floor. We averaged our length of UTP for each host by dividing the diagonal length of the building in half, depicted in our calculations in Appendix A. We can take this rate, multiply it by the amount of hosts and receive a total length of required UTP per floor.

Figures 7 through 11 model the hardware we would introduce to each building. Each floor will contain enough switches to handle the specified number of hosts in table 9, as well as an additional one to aid in traffic. The introduction of these extra switches are important as they are being utilized to prevent having a single point of failure in our buildings. Our supplied WAN's can support a total of 64 hosts and was taken into consideration when deciding the amount of WANs per floor. The first floor of each building contains a layer 3 switch for connecting each building to the campus backbone and routing between them. Building E is of importance as it provides an extra layer 3 switch to connect the network to an internet service provider, serving as a gateway.

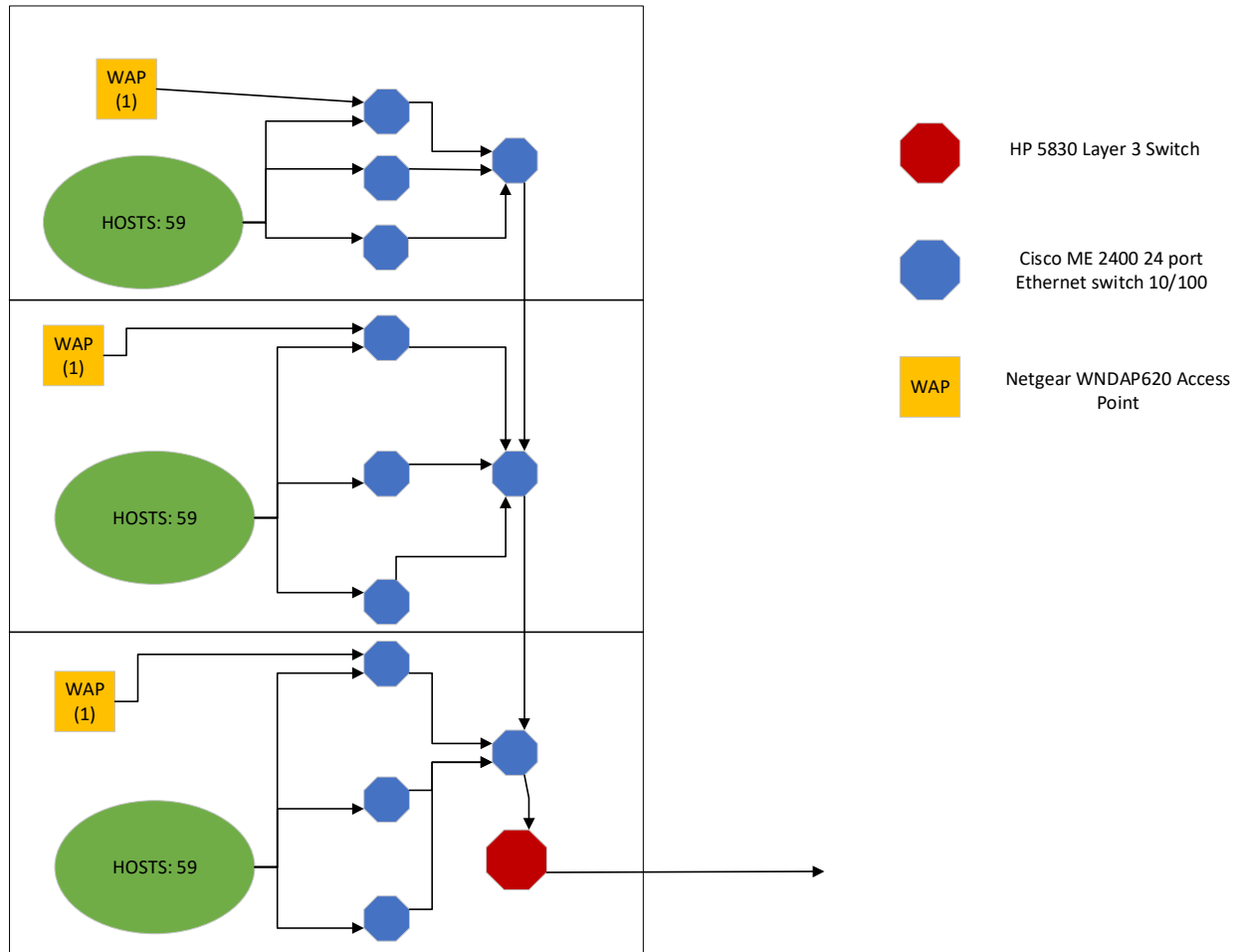
**Figure 7: Building A LAN**



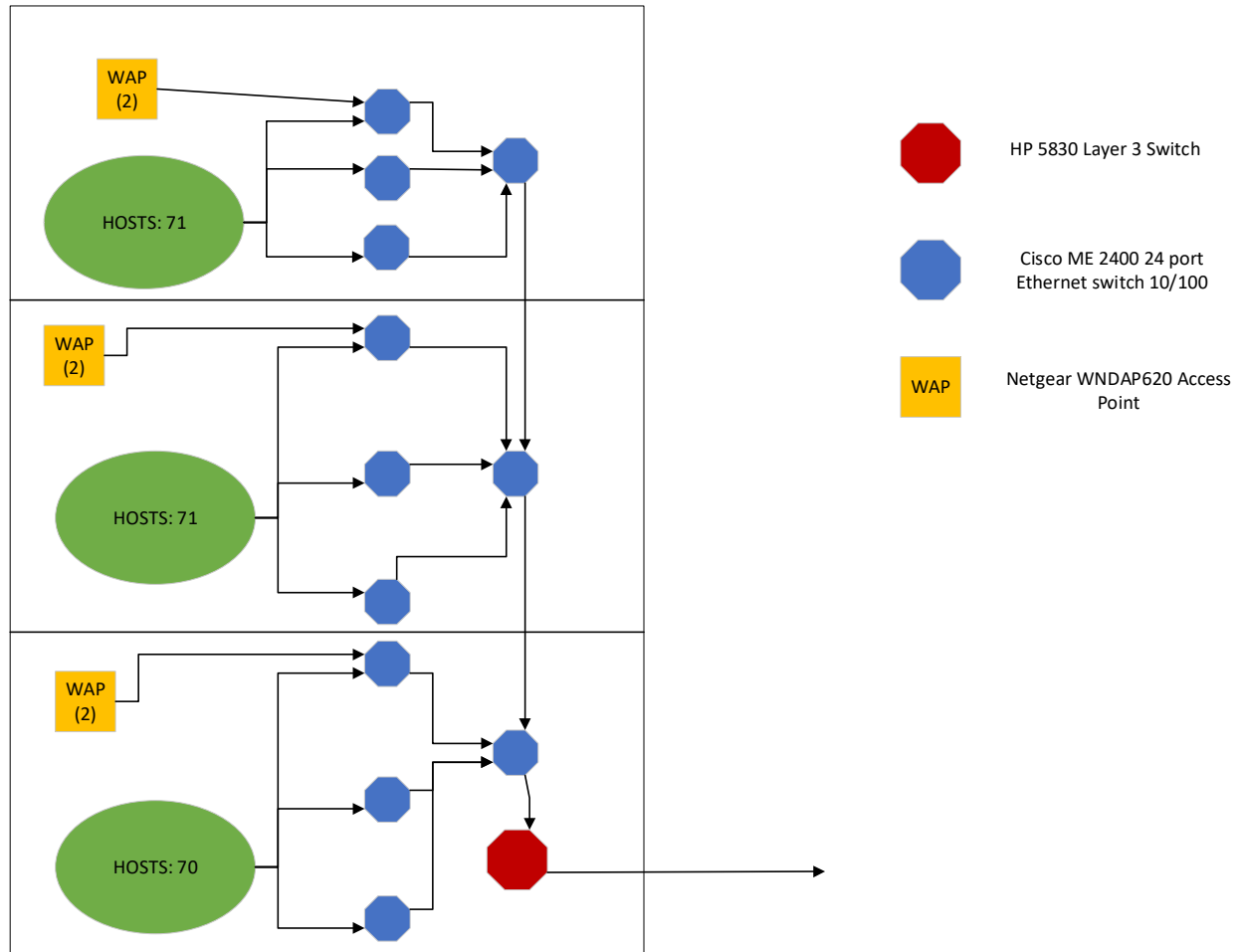
**Figure 8: Building B LAN**



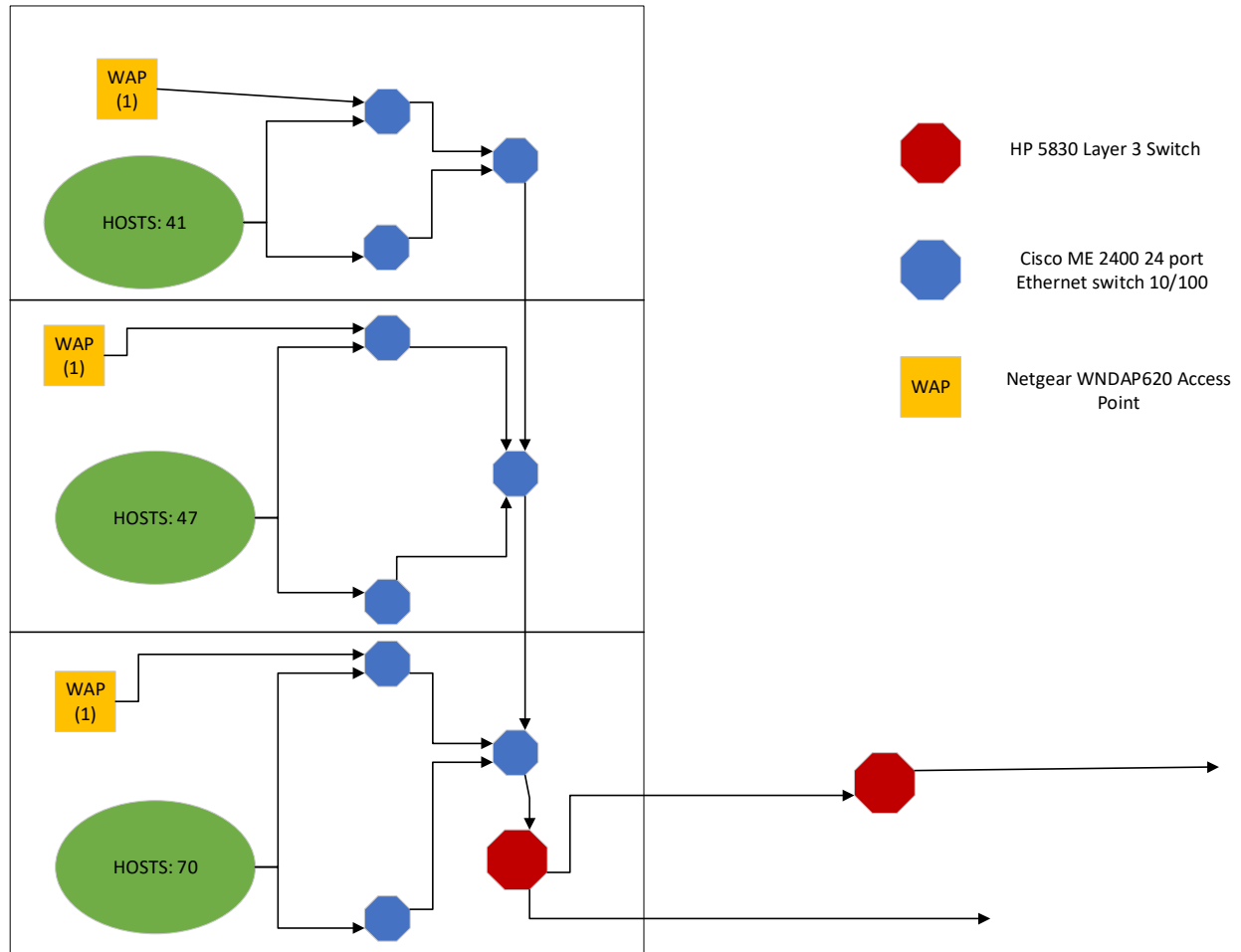
**Figure 9: Building C LAN**



**Figure 10: Building D LAN**



**Figure 11: Building E LAN**



## Article 6: BACKBONE NETWORK

**Figure 12: Network Backbone**

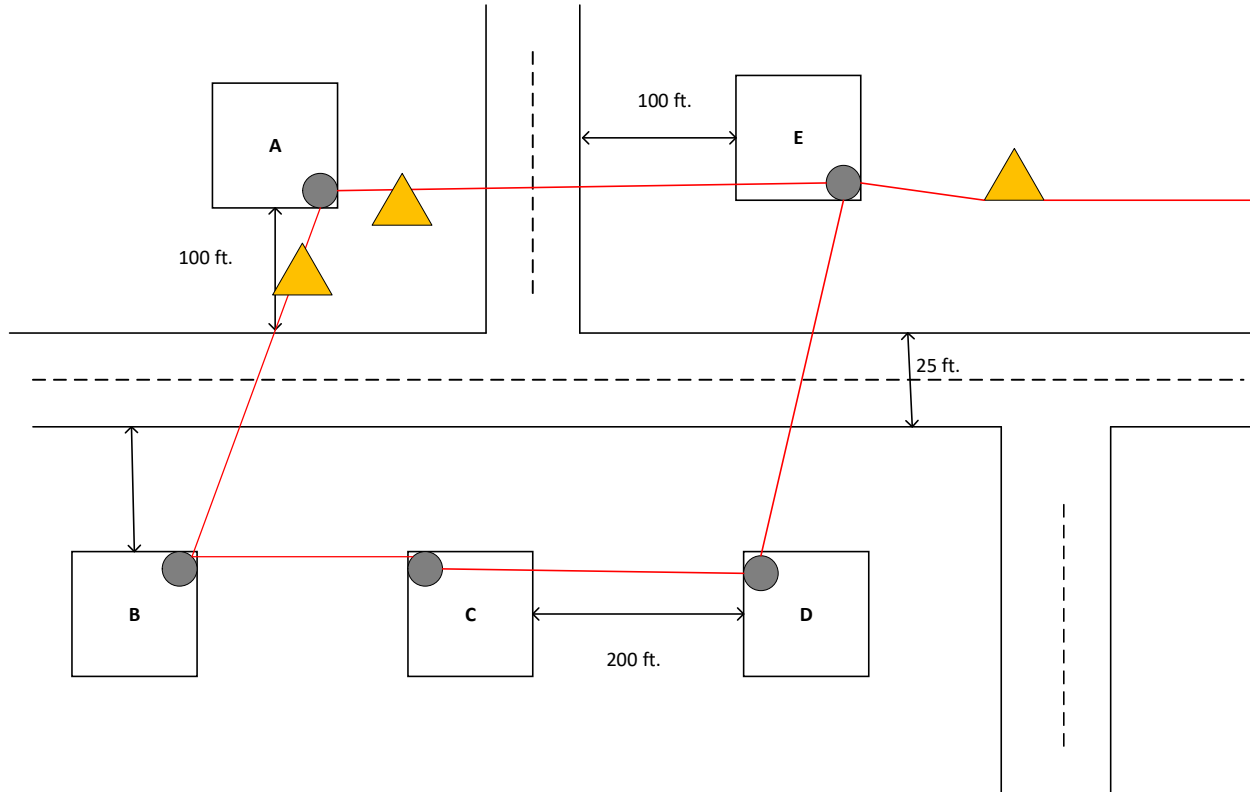


Figure 12 displayed above is the design for the network backbone of the ABC company campus. The backbone is a physical ring topology in order to prevent single points of failure, allowing the network to continue operating if one system fails. The layer 3 switches mentioned in article 6 are depicted as gray circles in the image above, connecting the campus backbone together. The backbone experiences significantly higher traffic loads than those seen in a LAN, and thus requires stronger wiring. Instead of the UTP wiring used in the LAN design, we will want to seek implementing fiber optic cabling to our backbone design. Fiber optics come at a higher price, but with the amount of traffic that will be sustained between buildings, will prove to be well worth the investment. We can calculate the amount of fiber optic cabling needed by measuring the distance between buildings it will be connected to. For this example, we assumed the space between the road, coupled with the roads distance would make up the length needed.

Furthermore, we can plan for the implementations of firewalls around our headquarters, building A, to protect it from any unwarranted communications. Another key area to place a firewall would be between building E and its connection to an internet service provider.



## Article 7: NETWORK COSTS

All costs associated with the networks implementation are found based on our calculations of hosts, wiring distances, and hardware. By using the provided costs we can accurately forecast the price of implementing a network to design for the expansion of ABC company. Tables 10 through 13 showcase various calculations and provide a grand total for ABC company to consider.

**Table 10: Price of Purchased Equipment**

Material and Installation Costs	
Fiber Optic Cable per ft	\$ 5.00
Installation Cost in Building per ft	\$ 20.00
Installation Cost in Ground per ft	\$ 100.00
UTP per foot	\$ 0.80
Installation Cost in Building per ft	\$ 2.00
Installation Cost in Ground per ft	\$ 50.00
Wired Installation Under a Road per ft	\$ 15,000.00
Hardware	
HP 5830 Layer 3 Switch	\$ 8,300.00
Cisco ME 2400 24 Port Ethernet Switch 10/100	\$ 327.00
Netgear WNDPAP620 Access Point	\$ 434.00

**Table 11: Backbone Network Associated Costs**

From	To	Underground Cable Length	Through Building Length	Under Road Cost	Underground Cost	Through Building Cost	Total Cost
A	E	225	0	\$ 15,000.00	\$ 23,625.00	\$ -	\$ 38,625.00
E	D	225	0	\$ 15,000.00	\$ 23,625.00	\$ -	\$ 38,625.00
D	C	200	75	\$ -	\$ 21,000.00	\$ 1,875.00	\$ 22,875.00
C	B	200	75	\$ -	\$ 21,000.00	\$ 1,875.00	\$ 22,875.00
B	A	225	0	\$ 15,000.00	\$ 23,625.00	\$ -	\$ 38,625.00
Total		1075	150	\$ 45,000.00	\$ 112,875.00	\$ 3,750.00	\$ 161,625.00

Table 12: Equipment Cost by Floor

Floor	UTP Needed	Switches Needed	Layer 3 Switches	Access Points Needed	UTP Cost	Switch Cost	Access Point Cost	Total Cost
A1	4867.56	6	1	2	\$ 13,629.17	\$ 10,262.00	\$ 868.00	\$ 24,759.17
A2	5137.98	6	0	2	\$ 14,386.34	\$ 1,962.00	\$ 868.00	\$ 17,216.34
A3	1307.03	3	0	2	\$ 3,659.68	\$ 981.00	\$ 868.00	\$ 5,508.68
B1	2659.13	4	1	1	\$ 7,445.56	\$ 9,608.00	\$ 434.00	\$ 17,487.56
B2	2659.13	4	0	1	\$ 7,445.56	\$ 1,308.00	\$ 434.00	\$ 9,187.56
B3	2659.13	4	0	1	\$ 7,445.56	\$ 1,308.00	\$ 434.00	\$ 9,187.56
C1	2659.13	4	1	1	\$ 7,445.56	\$ 9,608.00	\$ 434.00	\$ 17,487.56
C2	2659.13	4	0	1	\$ 7,445.56	\$ 1,308.00	\$ 434.00	\$ 9,187.56
C3	2659.13	4	0	1	\$ 7,445.56	\$ 1,308.00	\$ 434.00	\$ 9,187.56
D1	3154.9	4	1	2	\$ 8,833.72	\$ 9,608.00	\$ 868.00	\$ 19,309.72
D2	3199.97	4	0	2	\$ 8,959.92	\$ 1,308.00	\$ 868.00	\$ 11,135.92
D3	3199.97	4	0	2	\$ 8,959.92	\$ 1,308.00	\$ 868.00	\$ 11,135.92
E1	1216.89	3	2	1	\$ 3,407.29	\$ 17,581.00	\$ 434.00	\$ 21,422.29
E2	2118.29	3	0	1	\$ 5,931.21	\$ 981.00	\$ 434.00	\$ 7,346.21
E3	1847.87	3	0	1	\$ 5,174.04	\$ 981.00	\$ 434.00	\$ 6,589.04
Total	42005.24	60	6	21	\$ 117,614.67	\$ 69,420.00	\$ 9,114.00	\$ 196,148.67

Table 13: Total Equipment Cost

Cost	Total
Internal Equipment	\$ 196,148.67
Backbone Equipment	\$ 161,625.00
Total	\$ 357,773.67

## **Article 8: CONCLUSION**

Based on the expected growth of ABC company, they will require extensive expansion of physical location and building to maintain the changes. The design for the network is susceptible to flaws during implementation because of the lack of physical space located in each building when compared to the required space for employees and utilities. Although the network devices introduced may be able to handle a expansion across 5 years, the physical space will not be able to scale to meet the required needs. In fact, with their specifications for the present day there is not currently enough space to allow for all of their requirements.

Disregarding the requirements of physical space, the company is set for success with this design. Based on their current growth patterns they can remain keeping their security-intensive departments isolated from others without much detriment to the rest of the network. Since we are able to keep all these departments in one building, it allows security to be slightly easier as we have one major area to keep protected via firewalls. With this being said, a few firewalls does not entirely protect a system and security needs will need to be readdressed in the future. This design coupled with an increase to the physical location of ABC company's campus will allow a smooth expansion for the company at a desirable price.

## **Appendix A: CALCULATIONS**

### **Employee-to-Host Ratio**

$$348/389 = 89\%$$

### **Host-to-Employee Ratio**

$$389/348 = 117\%$$

### **Building Space**

$$75\text{ft} \times 50\text{ft} = 3,750 \text{ square feet per floor}$$

$$3,650 * 3 \text{ floors per building} = 11,250 \text{ total square feet per building}$$

$$11,250 * 5 \text{ total buildings} = 56,250 \text{ total square feet}$$

### **UTP Calculations**

$$\frac{\sqrt{50^2 + 75^2}}{2} = 90.14 \text{ Average UTP Length between Hosts}$$

### **Departmental Throughput Projections**

**Table 14 Interdepartmental Throughput – Present**

<b>Dept</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>A</b>
1	363.258	83.0304	10.3788	0	10.3788	5.1894	0	0	0
2		349.272	34.9272	17.4636	34.9272	0	349.272	0	349.272
3			153.664	3.8416	1.9208	0	0	0	1.9208
4				15.12	0.108	0.108	0.108	0.108	0.108
5					368.64	245.76	122.88	0	122.88
6						129.96	0	0	0
7							6.125	6.125	6.125
8								1.014	1.014
A									18.225

**Table 15 Interdepartmental Throughput – Year One**

Dept	1	2	3	4	5	6	7	8	A
1	406.849	92.995	11.21	0	11.625	5.813	0	0	0
2		426.112	37.722	19.20996	34.9272	0	366.7356	0	377.2138
3			165.958	4.149	2.075	0	0	0	2.074464
4				16.632	0.1188	0.1188	0.1134	0.11124	0.11664
5					434.9952	289.9968	129.024	0	132.7104
6						162.45	0	0	0
7							6.43125	6.30875	6.125
8								1.04442	1.04442
A									19.683

**Table 16 Interdepartmental Throughput – Year Two**

Dept	1	2	3	4	5	6	7	8	A
1	455.6708	104.155	12.107	0	13.02	6.511	0	0	0
2		519.857	40.74	21.13096	34.9272	0	385.0724	0	407.3909
3			179.235	4.481	2.241	0	0	0	2.240421
4				18.2952	0.13068	0.13068	0.11907	0.114577	0.125971
5					513.2943	342.1962	135.4752	0	143.3272
6						203.0625	0	0	0
7							6.752813	6.498013	6.125
8								1.075753	1.075753
A									21.25764

**Table 17 Interdepartmental Throughput – Year Three**

Dept	1	2	3	4	5	6	7	8	A
1	510.3513	116.654	13.076	0	14.583	7.293	0	0	0
2		634.226	44	23.24405	34.9272	0	404.326	0	439.9821
3			193.574	4.84	2.421	0	0	0	2.419655
4				20.12472	0.143748	0.143748	0.125024	0.118015	0.136049
5					605.6873	403.7915	142.249	0	154.7934
6						253.8281	0	0	0
7							7.090453	6.692953	6.125
8								1.108025	1.108025
A									22.95825

**Table 18 Interdepartmental Throughput – Year Four**

Dept	1	2	3	4	5	6	7	8	A
1	571.5935	130.653	14.123	0	16.333	8.169	0	0	0
2		773.756	47.52	25.56846	34.9272	0	424.5423	0	475.1807
3			209.06	5.228	2.615	0	0	0	2.613227
4				22.13719	0.158123	0.158123	0.131275	0.121555	0.146933
5					714.711	476.474	149.3614	0	167.1769
6						317.2852	0	0	0
7							7.444976	6.893741	6.125
8								1.141266	1.141266
A									24.79491

**Table 19 Interdepartmental Throughput – Year Five**

Dept	1	2	3	4	5	6	7	8	A
1	640.1847	146.332	15.253	0	18.293	9.15	0	0	0
2		943.983	51.322	28.1253	34.9272	0	445.7694	0	513.1952
3			225.785	5.647	2.825	0	0	0	2.822285
4				24.35091	0.173935	0.173935	0.137838	0.125202	0.158687
5					843.359	562.2393	156.8295	0	180.551
6						396.6064	0	0	0
7							7.817225	7.100554	6.125
8								1.175504	1.175504
A									26.7785

## Space Requirements by Department

**Table 20 Departmental Space Requirements – Present**

Dept.	Dept. Name	Present	Employees/Admin	Employee Sq. Ft	Support	Support Sq. Ft	Admin Sq. Foot
1	Marketing	56	50	9000	6	600	
2	Customer Support	64	57	10260	7	700	
3	Engineering	29	26	4680	3	300	
4	IT	27	24	4320	3	300	
5	Sales	9	8	1440	1	100	
6	Call Center	97	87	15660	10	1000	
7	Accounting	36	32	5760	4	400	
8	Finance	18	16	2880	2	200	
A	Administration	12	10	1800	2	200	3000
	<b>Totals:</b>	348	310	55800	38	3800	3000
				<b>Total Employees:</b>	<b>348</b>		
				<b>Total Sq. Ft</b>	<b>62600</b>		

**Table 21 Departmental Space Requirements – Year One**

Dept.	Dept. Name	Present	Employees/Admin	Employee Sq. Ft	Support	Support Sq. Ft	Admin Sq. Foot
1	Marketing	63	56	10080	7	700	
2	Customer Support	79	71	12780	8	800	
3	Engineering	32	28	5040	4	400	
4	IT	30	27	4860	3	300	
5	Sales	11	9	1620	2	200	
6	Call Center	122	109	19620	13	1300	
7	Accounting	38	34	6120	4	400	
8	Finance	19	17	3060	2	200	
A	Administration	13	11	1980	2	200	3300
	<b>Totals:</b>	407	362	65160	45	4500	3300
				<b>Total Employees:</b>	<b>407</b>		
				<b>Total Sq. Ft</b>	<b>72960</b>		

**Table 22 Department Space Requirements – Year Two**

Dept.	Dept. Name	Present	Employees/Admin	Employee Sq. Ft	Support	Support Sq. Ft	Admin Sq. Foot
1	Marketing	71	63	11340	8	800	
2	Customer Support	97	87	15660	10	1000	
3	Engineering	35	31	5580	4	400	
4	IT	33	29	5220	4	400	
5	Sales	13	11	1980	2	200	
6	Call Center	153	137	24660	16	1600	
7	Accounting	40	36	6480	4	400	
8	Finance	20	18	3240	2	200	
A	Administration	15	13	2340	2	200	3900
	<b>Totals:</b>	477	425	76500	52	5200	3900
				<b>Total Employees:</b>	<b>477</b>		
				<b>Total Sq. Ft</b>	<b>85600</b>		

**Table 23 Departmental Space Requirements – Year Three**

Dept.	Dept. Name	Present	Employees/Admin	Employee Sq. Ft	Support	Support Sq. Ft	Admin Sq. Foot
1	Marketing	80	72	12960	8	800	
2	Customer Support	119	107	19260	12	1200	
3	Engineering	38	34	6120	4	400	
4	IT	37	33	5940	4	400	
5	Sales	16	14	2520	2	200	
6	Call Center	192	172	30960	20	2000	
7	Accounting	42	37	6660	5	500	
8	Finance	21	18	3240	3	300	
A	Administration	17	15	2700	2	200	4500
	<b>Totals:</b>	562	502	90360	60	6000	4500
				<b>Total Employees:</b>	<b>562</b>		
				<b>Total Sq. Ft</b>	<b>100860</b>		



**Table 24 Departmental Space Requirements – Year Four**

Dept.	Dept. Name	Present	Employees/Admin	Employee Sq. Ft	Support	Support Sq. Ft	Admin Sq. Foot
1	Marketing	90	81	14580	9	900	
2	Customer Support	146	131	23580	15	1500	
3	Engineering	42	37	6660	5	500	
4	IT	41	36	6480	5	500	
5	Sales	19	17	3060	2	200	
6	Call Center	240	216	38880	24	2400	
7	Accounting	45	40	7200	5	500	
8	Finance	22	19	3420	3	300	
A	Administration	19	17	3060	2	200	5100
	<b>Totals:</b>	664	594	106920	70	7000	5100
				<b>Total Employees:</b>	<b>664</b>		
				<b>Total Sq. Ft</b>	<b>119020</b>		

**Table 25 Departmental Space Requirements – Year Five**

Dept.	Dept. Name	Present	Employees/Admin	Employee Sq. Ft	Support	Support Sq. Ft	Admin Sq. Foot
1	Marketing	101	90	16200	11	1100	
2	Customer Support	179	161	28980	18	1800	
3	Engineering	46	41	7380	5	500	
4	IT	46	41	7380	5	500	
5	Sales	23	20	3600	3	300	
6	Call Center	300	270	48600	30	3000	
7	Accounting	48	43	7740	5	500	
8	Finance	23	20	3600	3	300	
A	Administration	21	18	3240	3	300	5400
	<b>Totals:</b>	787	704	126720	83	8300	5400
				<b>Total Employees:</b>	<b>787</b>		
				<b>Total Sq. Ft</b>	<b>140420</b>		