

# E&T 5<sup>th</sup> Floor Layout

**By:**

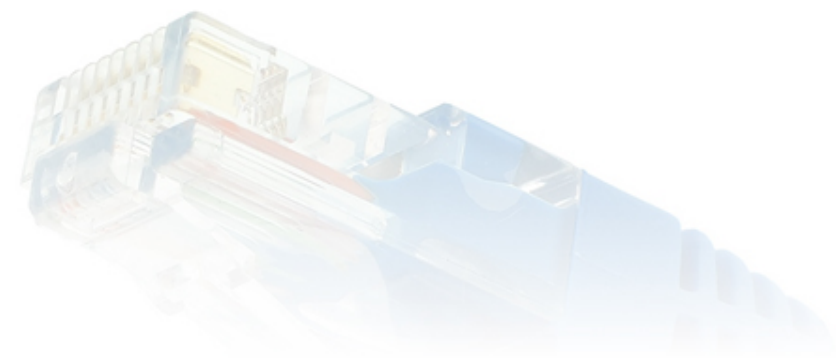
David Rong

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## EXECUTIVE REPORT

- This report describes the proposed changes being made to an existing network design which will be implemented at California State University - Los Angeles's, Engineering, and Technology Wing-A 5th floor. This project is estimated to start on March 1st, 2017 and be completed by May 18,2017 with a requested budget of \$300,000.

We begin our project by analyzing the weaknesses of the current network infrastructure and found that some technologies such as the computers were outdated, some computers were still using windows XP. We also found a lack of security features for the floor, so we installed some security cameras in order to protect the new equipment.

After conducting much research into the current infrastructure, we have recommended a new logical design that will effectively boost productivity of the university's faculty and staff. The brand-new equipment will be installed across 32 rooms broken up into 27 offices, 3 classrooms, 2 printer rooms. After careful consideration, we have chosen equipment which will meet the new industry standards. Upon implementation and deployment of the proposed network, network engineers will conduct rigorous testing, to ensure the correct functionality of the network; and to ensure that the design meets all university and departmental requirements.

## PROJECT GOAL

- The goal for this project is to construct changes to an existing network infrastructure for California State University - Los Angeles's engineering & technology building wing-A 5th floor. Our given budget for this project has been determined to be \$300,000. With these funds, we plan to upgrade the current network infrastructure as well as make upgrades to equipment. By implementing upgrades and infrastructure changes we project that this project will increase the efficiency and capabilities of the university faculty and staff that occupy the 5th floor.

## PROJECT SCOPE

- This project is intended to make changes to an existing network infrastructure at California State University - Los Angeles's, engineering and technology building wing-A 5th floor. The new network infrastructure will reach up to 32 rooms that will comprise of offices, class rooms, and printer rooms. The changes made to the network infrastructure will affect faculty, staff and students that occupy this space.

## EXISTING NETWORK INFRASTRUCTURE

- The current network design 5th floor of the Engineering and Technology building was unacceptable for the current networking standards. The 5th floor was suffering from numerous roaches and rats that disconnected and ripped apart cables and wires. The switches were not enough for the whole floor, the switches were only placed in a few rooms and was insufficient

for today's standards. Upon arrival of the floor, the staff complained that there was barely any maintenance done in the floor and had very bad connections to the network. We noticed that the computers being used were outdated, the current models used were windows XP. The last issue we found was the lack of security on this floor, we noticed that there are no security cameras.

## DISTRIBUTION OF WORK

Member Name	Percent Contribution	Activities Completed by the member
Robert Solorio	20.00%	1. Created Document 2. Created Logical design 3. Distribution of work
Taron Saraksyan	20.00%	1. Project Scope 2. Implementation plan
Jose Sanchez	20.00%	1. Created Physical design 2. Budget and expense report
David Rong	20.00%	1. Executive Report 2. Project goal
Puzant Yedalian	20.00%	1. Business & Technical Goals 2. Results of network design

## DESIGN REQUIREMENTS

### **Business Goals:**

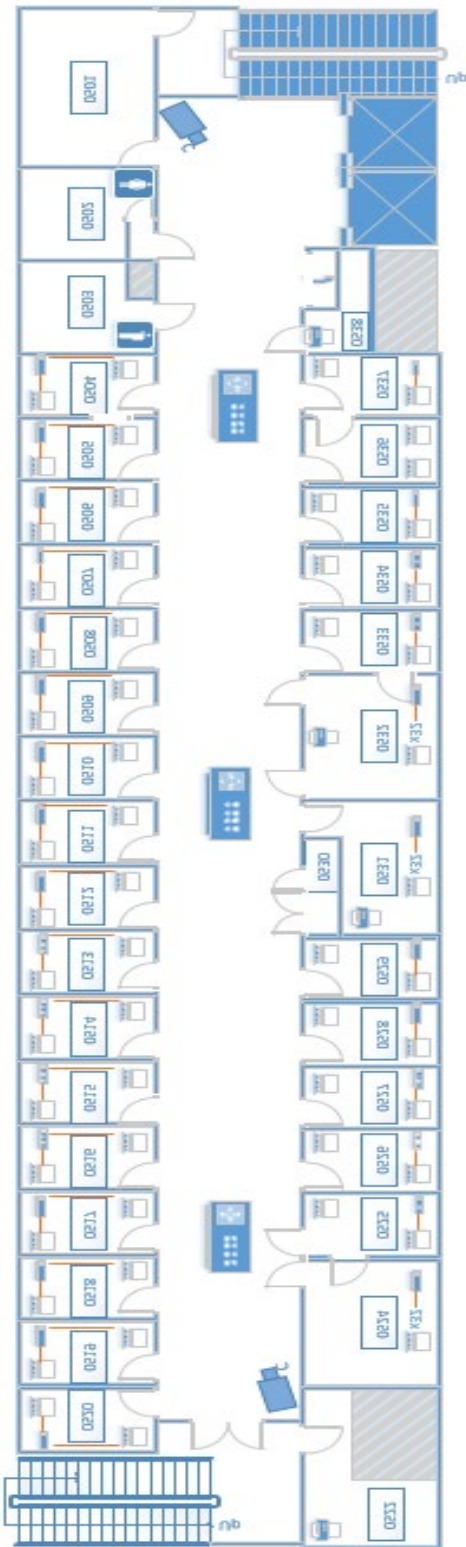
- The network changes we plan to make will support students, faculty and staff by providing an improvement to network connectivity and provide higher availability. By providing a newer and better infrastructure we should expect to see some improvements in efficiency.

### **Technical Goals:**

- **Usability**
  - Users of the network should not struggle to gain access; the network needs to make the user's job easier. Furthermore, the network infrastructure must provide secure wired, as well as wireless, LAN connectivity. This is essential, given that the network will serve the demands of an increasing number of IP devices, e.g., computers, PDAs, surveillance cameras, smartphones, and so on.
- **Security**
  - Security is essential to the effective operation of the network. Access to applications, and networks, must be open and ubiquitous, yet remain secure and controlled. In addition to (effectively) handling guest users and unmanaged devices, the network must also support unmanageable devices, application access control, visibility, and monitoring. A few security components and policies are listed below:
    - Policies that ensure Quality of Service, or QoS
    - Mitigating DoS (denial of service) and DDoS (distributed denial of service) attacks/threats
    - Ensuring that the organization meets various compliance requirements

- **Availability**
  - Network downtime is, perhaps, an organization's biggest detriment to both efficacy, as well as efficiency. The network infrastructure on the 5th floor must provide 99.99% reliability; and rival the level of service provided by (PSTN) public switched telephone networks. High availability is of the utmost importance, and should be addressed throughout the LAN design. To reduce downtime, and therefore productivity costs, network equipment must be cost-effective, feature rich, and highly reliable. Furthermore, an optimized, and "always-on," network is essential to the efficacy of emerging technologies.
- **Performance**
  - The network should reliably deliver applications and provide adequate (up to standard) response times from any host to any host. Furthermore, it will require high-quality voice and streaming video; as well as provide LAN-like application performance, at all times, to wireless hosts. We are to provide a network that offers a response time of approximately 1/10th of a second or less for interactive applications.
- **Manageability**
  - Network failure will occur from time to time, as this is inevitable. For this reason, troubleshooting should be easy. That is, finding and fixing problems should not be too time consuming or complex.
- **Adaptability**
  - Network needs to be scalable to meet the following demands: (1) future increase in the number of hosts, (2) expanded usage of multimedia, as well as network intensive, applications.
- **Affordability**
  - The network design and implementation shall not exceed the university's specified budget of \$250,000. The network should support a significantly higher number of maximum hosts with the planned upgrades. The hardware and equipment purchased is within our desired budget.

## LOGICAL DESIGN



### Offices:

Rooms - 27  
Computers - 54  
Switches - 27

### Class Rooms:

Rooms - 3  
Computers - 96  
Printers - 2  
Switches - 3

### Printer Rooms:

Rooms - 2  
Printers - 2

### Hall:

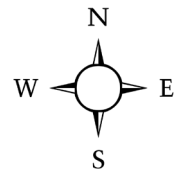
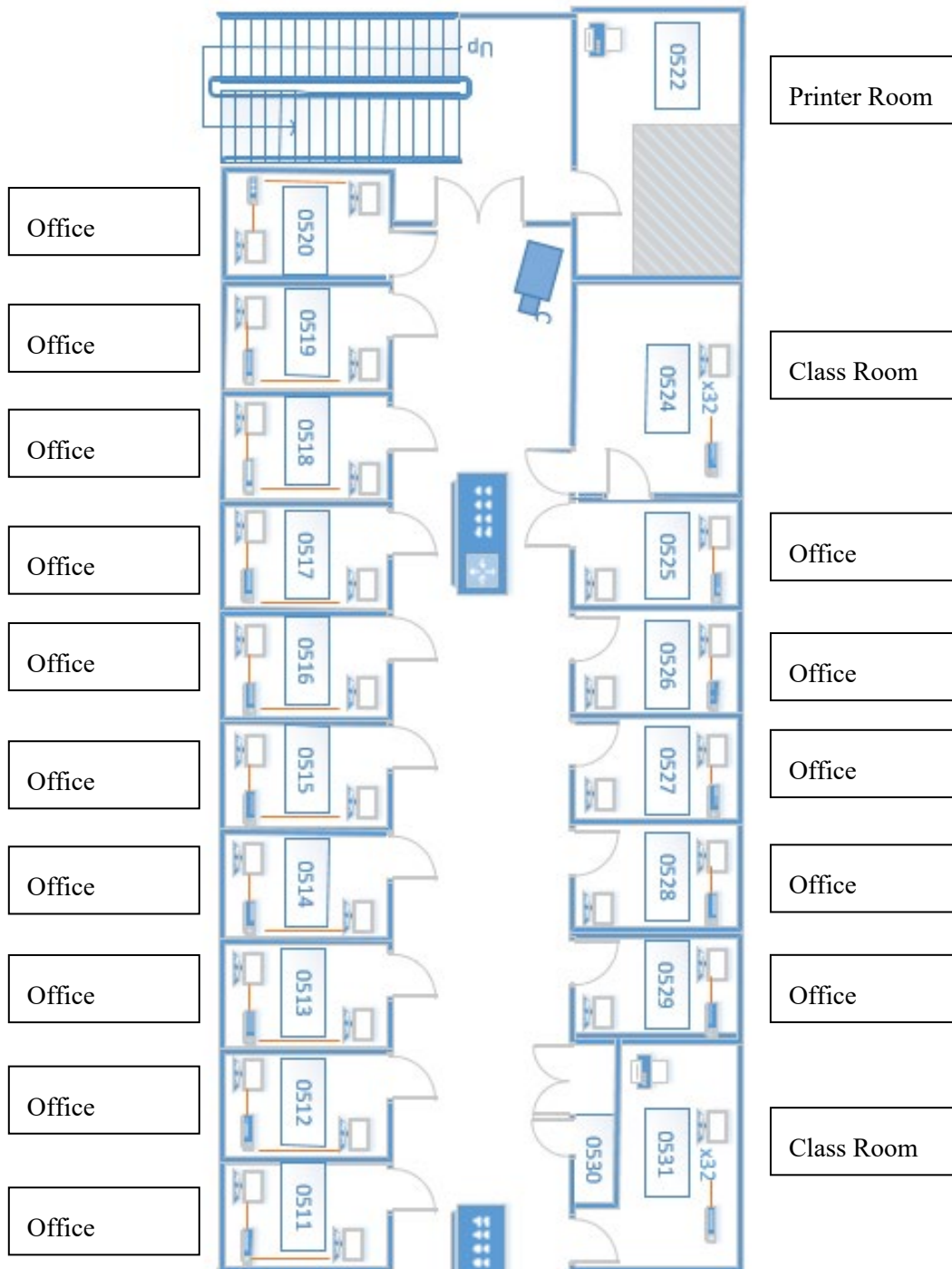
Modems - 3  
Security Cameras - 2

### Room Number Room Area

0501	231	0532	339
0502	209	0533	166
0503	164	0534	159
0504	143	0535	136
0505	162	0536	205
0506	167	0537	169
0507	160	0538	70
0508	165	H-5A	1884
0509	166		
0510	166		
0511	166		
0512	159		
0513	169		
0514	166		
0515	166		
0516	168		
0517	144		
0518	150		
0519	151		
0520	150		
0522	196		
0524	318		
0525	148		
0526	168		
0527	165		
0528	165		
0529	168		
0530	31		
0531	277		

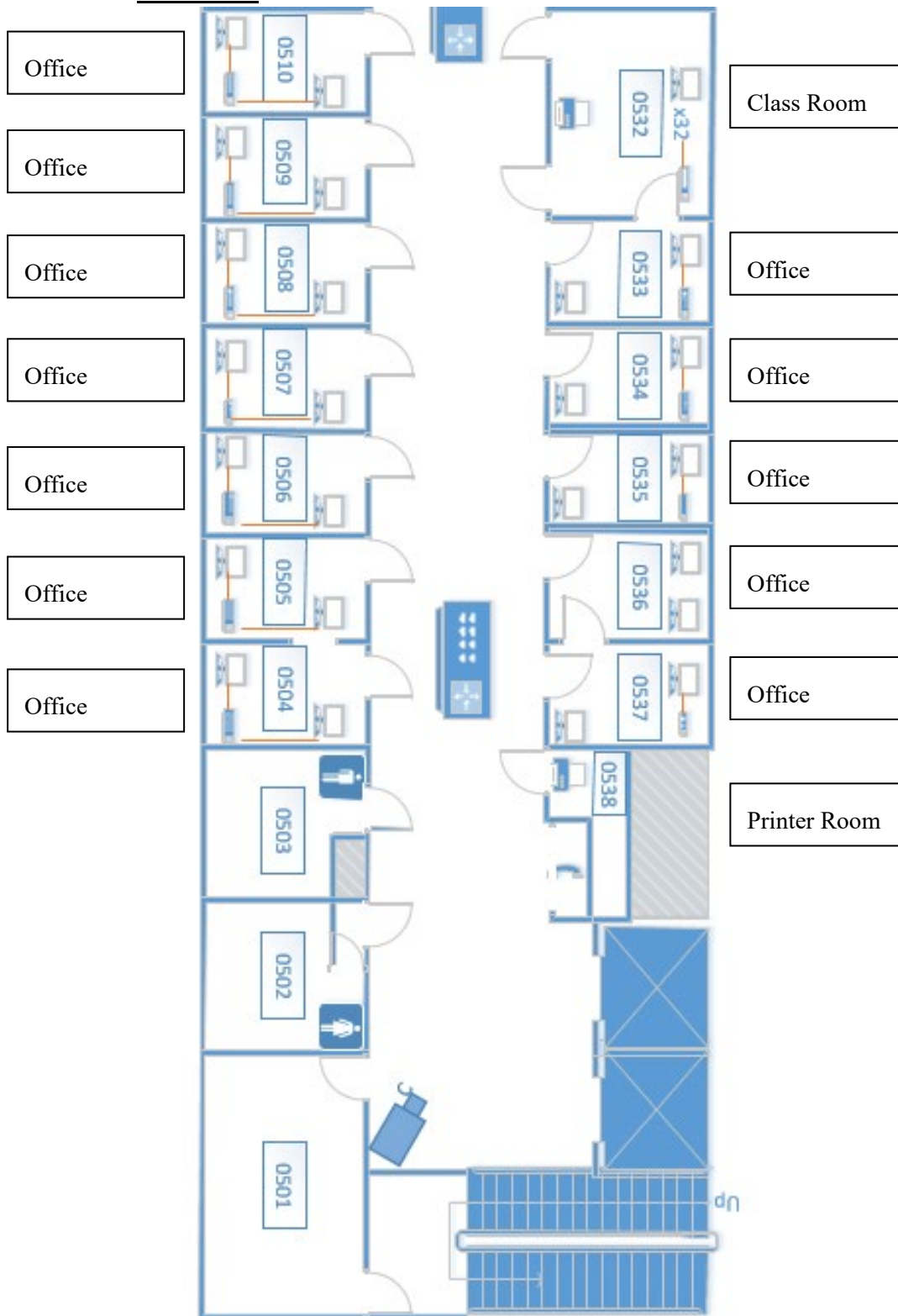
Room area is measured in square feet.

**North Side:**

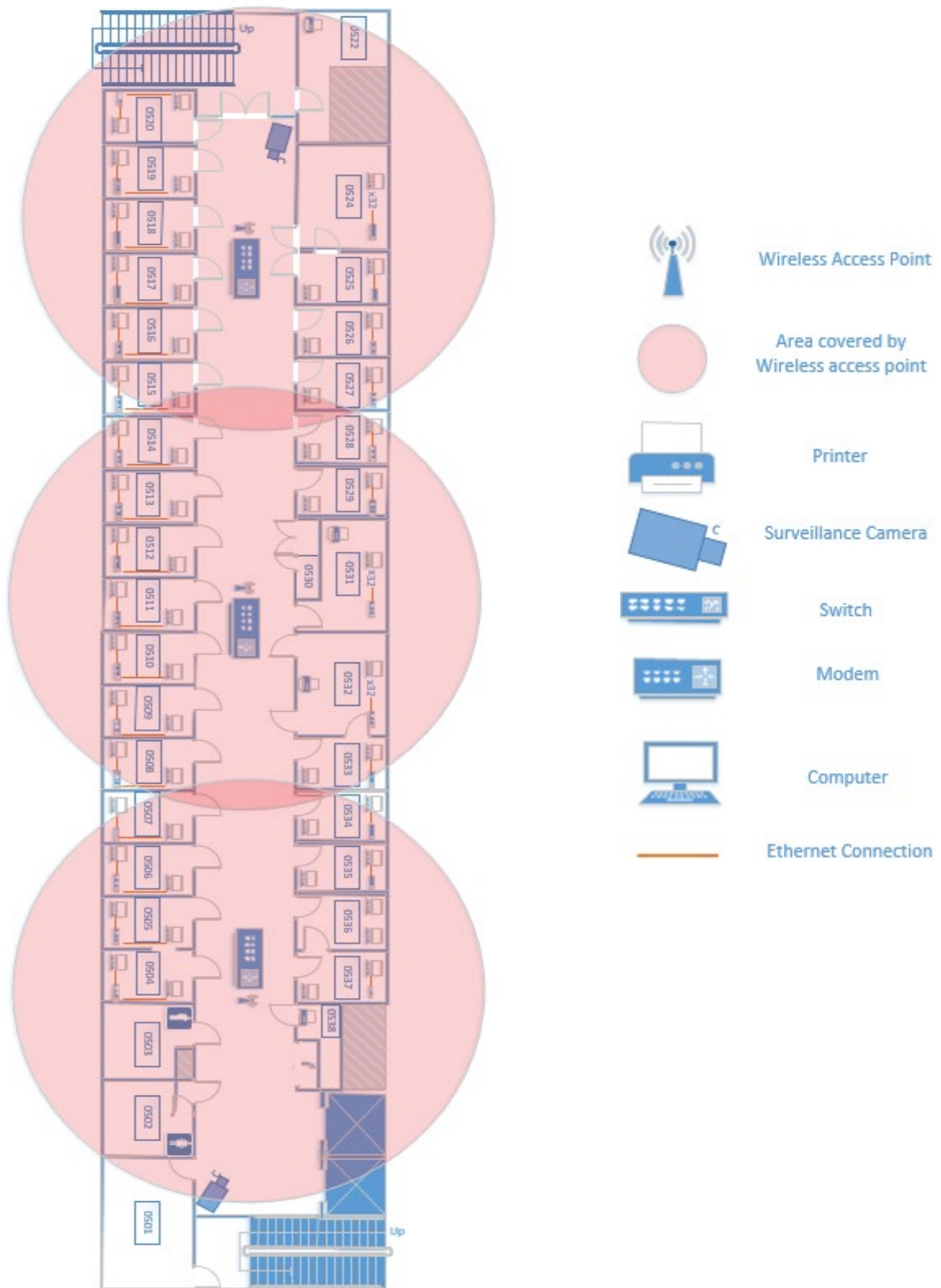




**South Side:**



## Wireless Access Points:





## PHYSICAL DESIGN

### **Computers:**

- HP EliteDesk 800 G3 Small Form Factor PC
  - The computers offer great specs that should provide students and faculty great performance capable of lasting many years. The computers will come loaded with Windows 10 Pro(64bit), Intel Core i7 – 7700 with Intel HD Graphics 630, 1 stick of 8GB DDR4 Ram(4 upgradeable slots), and 512GB SATA SSD(upgradeable M.2 slot). I/O ports include USB 2.0/3.1 ports, USB Type C, SD card reader, audio jack, RJ-45, VGA, DisplayPort, and HDMI. Standard HP keyboard and mouse will be included. The machines are small form factor, so they will take up minimal space and be unobtrusive to the user. Each computer will cost \$1,142 and will include a 3 year warranty that covers parts, labor, and onsite service.  
(<http://store.hp.com/us/en/pdp/hp-elitedesk-800-g3-small-form-factor-pc-%28energy-star%29-p-1ny40ua-aba--1>)

### **Monitors:**

- HP EliteDisplay S240n 23.8-inch Micro Edge Monitor
  - HP monitor that will deliver full HD 1920 x 1080 @60Hz. This monitor will be more than capable to deliver all the student's needs, whether it be graphic design or data input for coding. Included ports are DisplayPort, HDMI, and USB Type C with Thunderbolt. Each monitor will cost \$279 and will include 1 year warranty.  
(<http://store.hp.com/us/en/pdp/hp-elitedisplay-s240n-238-inch-micro-edge-monitor>)

### **Security Software:**

- Kaspersky TOTAL Security for Business
  - This software will include an antivirus and firewall for the protection of each individual computer that is being installed. This is enterprise type software that does not need to be managed locally. Each license will cost \$51 and will be active for 1 year. (<http://www.avdefender.com/Total-Business-Security.asp>)

### **Printers**

#### **Lab Printer:**

- HP Color Laser Jet Pro M452nw
  - The labs will have a color laser jet printer that can be connected to the network. The printers is capable of holding up to 300 sheets of paper at once and have an recommended monthly print value of about 4,000 sheets. They are more than capable of handling all of the students needs. Printer uses four toner cartridges: Black(CF410A), Cyan(CF411A), Magenta(CF413A), and Yellow(CF412A) that will be purchased by the University as needed. Each printer will cost \$399.99 and include a 1 year warranty. (<http://store.hp.com/us/en/pdp/hp-color-laserjet-pro-m452nw>)

#### **Office Printer:**

- HP Laser Jet Pro M102w
  - This is a standard black and white laser office printer that will be able to take care of all the staff needs. Prints at 23 pages per minute and has a tray capacity of 150 pages. Has wireless printing capabilities, but will not be implemented at this moment. This printer uses one black cartridge(CF217A) that the University will purchase as they need them. Each printer will cost \$160 and include a 1 year warranty. (<http://store.hp.com/us/en/pdp/hp-laserjet-pro-m102w-printer>)

### **Printer Room:**

- HP LaserJet Enterprise 700 color MFP M775f
  - This floor houses two printer rooms. Each room will be equipped with a color multifunction printer that will be used by staff/faculty to print color pages and when they need to print large amounts of black and white copies. Supports 8.5x14 and 11x17 paper, scan documents to email, duplex, USB Reader, print rate of 30 pages per minute in both B/W and color. Both machines will be hardwired to the network for convenience. The University will purchase the following replacement toners: Black(CE340A), Cyan(CE341A), Yellow(CE342A), Magenta(CE343A). Classroom 0524 will use this printer as its primary printing source. Each printer will cost \$5550 and will include a 1 year, next day service warranty. (<http://store.hp.com/us/en/pdp/hp-laserjet-enterprise-700-color-mfp-m775f>)

## **Switches**

### **Lab Switch:**

- D-Link DGS-1210-48 Web Smart Gigabit Switch With 4 Combo SFP Slots
  - 48 port switch that can handle the 32 computers in each lab and other equipment connected to the network. Each will cost \$359 and will include a lifetime warranty or up to 5 years after it is discontinued. (<https://www.neweggbusiness.com/product/product.aspx?item=9b-33-127-490>)

### **Office Switch:**

- TP-LINK TL-SG1008D 10/100/1000Mbps Unmanaged 8-Port Gigabit Desktop Switch
  - 8 port switch for 2 computers and a printer. The extra ports will be used with future equipment. Each switch will cost \$20 and will include a 2 year warranty. (<https://www.neweggbusiness.com/product/product.aspx?item=9b-33-704-043>)

### **Wireless Access Points:**

- UniFi ACHD Routers
  - The UniFi ACHD are up to current standards and support 802.11ac, 500+ users at once, Power over Ethernet, 4x4 dual band radios with speeds up to 2.53 Gbps, and can be monitored with proprietary software. Each access points has a cost of \$350 and will include a 1 year warranty. (<https://unifi-hd.ubnt.com/>)

### **Security Cameras:**

- Ubiquiti UniFi Video Camera UVC-NVR + IP Camera G3-DOME
  - Security cameras that can record up to 1080p and save the video feed to a 500GB Network Video Recorder. All mounting hardware is included in this bundle. Total cost is \$1,009 and will include a 1 year warranty. (<https://www.neweggbusiness.com/product/product.aspx?item=9b-0xp-000a-000y9>)

### **Cables and hardware as needed:**

- Cables and related hardware will be provided by the networking company at no charge to the University.

## NETWORK DESIGN TESTING

- Following the successful implementation of the proposed 5th floor network, it is critical to ensure that network requirements are met. Network personnel must monitor, test, and manage performance of the network. The following are the types of tests we will be conducting; to determine the (1) performance (measured in terms of throughput, delay, delay variation, response time and efficiency), (2) availability, as well as (3) security of the network. A few of the key areas our tests will address are outlined below:

### **Application Response-Time Testing:**

A measurement of performance (from a client's point of view) used to determine the wait time when a client is engaged in typical activity that contributes to network traffic, i.e., opening an application, opening files, reads, writes, searches, closes, etc. Simulation tools will be used to generate the type of activity, or behavior, that users will engage in. Test will start with a predetermined number of users, as well as actions, and will be gradually increased (both users and actions) in an effort to reveal any increases in response time (delays) due to additional network load.

### **Throughput Testing:**

A measurement of throughput for a particular, or multiple, applications in kilobytes or megabytes per second. Through the use of a switching device, i.e., a router or a switch, we will also be measuring throughput in terms of packets per second. As is the case with application response-time testing, we will start with a few users/actions and gradually increase (both users and actions).

### **Availability Testing:**

With this procedure, we will run tests against the network (for ~72 hours) under medium to heavy load. We will monitor and record the rate of failures/errors.

### **Regression Testing:**

It is critical to ensure that all applications (and components) that functioned properly before the implementation of the new network, do so after the new network has been established. Here, we will not be testing any new features that have been implemented by the new network design, but we will simply focus on existing applications. The series of tests conducted here must be comprehensive, and therefore will be automated to facilitate this.

### **Security Testing:**

Extensive security testing will be conducted by our team of security experts that specialize in areas such as: firewalls, intrusion detection systems, operating systems, and various networking protocols, i.e., TCP/IP. The following are the types of security tests that will be conducted against the network (It is important to note: many of these testing techniques will be used together for a more comprehensive assessment of the security of the network).

- Vulnerability Scanning
- Network Scanning
- Penetration Testing
- Integrity Checkers
- Virus Detection
- War Driving
- War Dialing
- Log Review
- Password Cracking

## RESULTS OF NETWORK DESIGN TESTING

- The following section will highlight some possible problems that may be encountered during the testing phase:

### Dead Drop:

- **Symptoms:** A device, i.e., computer, access point, printer, is connected to the wall jack, however the connection is not active. The link light on the switch port (or the network adapter) has not been activated.
- **Possible Causes:** Dead drops are a result of a connection that is not patched through to the wall jack. In many cases, only those connections that are actively used are patched. Network jacks may not be tested thoroughly after renovation or, perhaps, the switch port may have been administratively disabled.
- **Resolution:** We can resolve this by making sure that the switch port is active, and the connection has been properly patched. Connectivity tests need to be conducted anytime a new piece of equipment has been added to an office (or classroom).

### Unable to Obtain IP Address:

- **Symptoms:** Network seems to be down, and we may receive a message (from the operating system) that the DHCP server failed to issue an IP address.
  - **Possible Causes:** DHCP did not deliver an IP address. Some reasons for this may be: (1) DHCP may have run out of addresses, (2) server may be down, (3) client may be configured to use a static IP (instead of DHCP), (4) client's request for an address never reached DHCP server.
  - **Resolution:** First, is this a widespread problem? That is, does the problem affect a single device or multiple? If the problem plagues a single user, NIC settings should be verified (to ensure it is configured to use DHCP). Next, we should check other devices on the same VLAN to ensure they are able to receive addresses. If they can't, it's possible that the router is not forwarding DHCP requests to the server. If the problem is prevalent across several subnets, the problem is likely the server itself. That is, the DHCP service may not be running.
- As we can see from these examples we may encounter many problems, we have resolutions ready for some problems we may face.

## IMPLEMENTATION PLAN

- Design:

Process	Dates
Discussion of the network design issues and requirements, Project was officially assigned.	March 1, 2017

Determine requirements of project and take inventory of the number of rooms, measurements of rooms, location of equipment, and more.	March 15th
Creation of blueprint design.	March 16 - 30th
Network design blueprint was approved & contract with Tyrone's Construction was signed.	March 31st

- **Construction:**

Process	Dates
Tyrone's Construction sends notice that construction is complete and is ready for design implementation.	March 31st
Office switches, office printers and related hardware were ordered and shipped.	April 3rd - 5th
The Wireless Access Points and Security Cameras were ordered and shipped.	April 4th - 6th
The Lab printers, printer room printers and Lab Switches were ordered and shipped.	April 7th - 10th
The Monitors and Desktop Computer were ordered and shipped.	April 11th - 17th
Arrival and Installation the wireless access and cables/related hardware.	April 17th - 21st
Arrival and Installation of network switches and security cameras.	April 24th - 28th
Arrival and Installation of computers monitors	May 1st - May 5th
Arrival and installation of Printers.	May 8th - 12th
Network/Equipment Test Conducted	May 15th - 17th
Completion of the 5th Floor	May 18, 2017

## NETWORK APPLICATIONS

- Students, faculty, and staff will utilize the network to conduct web research; using Mozilla Firefox or Microsoft IE, to access information, and use other typical web services. Network will also facilitate the extensive use of email, by students, faculty, and administrative staff. Furthermore, network must allow students to complete schoolwork in an efficient manner to write papers, and other school related documents. Work is saved to file servers, and printed on one of the available printers on the 5th floor. It is important to note; students and faculty use the network to access the online library card catalog. Our research has also revealed that administrative staff, and faculty, use the college management system to keep track of student records.

## BUDGET & EXPENSES

ITEM	PART NAME	COST	QUANTITY	TOTAL	ITEM URL
Desktop Computer	HP EliteDesk 800 (1NY40UA#ABA)	\$1,142	150	\$171,300	<a href="#">Link To Item</a>
Monitor	HP EliteDisplay S240n	\$279	150	\$41,850	<a href="#">Link To Item</a>
Security Software	Kaspersky Total Security for Business	\$51	150	\$7,650	<a href="#">Link To Item</a>
Printer (Lab)	HP Color LaserJet Pro M452nw	\$400	2	\$800	<a href="#">Link To Item</a>
Printer (Office)	HP LaserJet Pro M102w	\$160	13	\$2,080	<a href="#">Link To Item</a>
Printer (Printer Room)	HP LaserJet Enterprise 700 color MFP M775f	\$5450	2	\$10,900	<a href="#">Link To Item</a>
Switch (Lab)	D-Link DGS-1210-48 Gigabit Switch	\$359	3	\$1,077	<a href="#">Link To Item</a>
Switch (Office)	TP-LINK TL-SG1008D 8-Port Gigabit Switch	\$20	13	\$260	<a href="#">Link To Item</a>
Wireless Access Point	UniFi AP ACHD	\$350	3	\$1,050	<a href="#">Link To Item</a>
Security Cameras	UniFi Video Camera G3 Dome	\$1,009	1	\$1,009	<a href="#">Link To Item</a>



Cables and Related hardware	Provided	\$0	--	\$0	
					Total Equipment Amount: \$237,976
Project Design	Analyze, Blueprints, Meetings, Planning, Troubleshoot	\$15,500		\$15,500	
Labor Rate	\$90hr * 6hr per day	\$540	37days	\$19,980	
					Total Design & Labor Amount: \$35,480
					Grand Total: \$273,456

## APPENDIX

- "HP EliteDesk 800 G3 Small Form Factor PC (ENERGY STAR)." HP EliteDesk 800 G3 Small Form Factor PC (ENERGY STAR) | HP® Official Store. N.p., n.d. Web. 18 May 2017.
- "HP EliteDisplay S240n 23.8-inch Micro Edge Monitor." HP EliteDisplay S240n 23.8-inch Micro Edge Monitor | HP® Official Store. N.p., n.d. Web. 18 May 2017.
- "HP Color LaserJet Pro M452nw." HP Color LaserJet Pro M452nw | HP® Official Store. N.p., 28 Oct. 2016. Web. 18 May 2017.
- "HP LaserJet Pro M102w Printer." HP LaserJet Pro M102w Printer | HP® Official Store. N.p., 11 Mar. 2017. Web. 18 May 2017.
- "HP LaserJet Enterprise 700 Color MFP M775f." HP LaserJet Enterprise 700 Color MFP M775f | HP® Official Store. N.p., n.d. Web. 18 May 2017
- "Kaspersky Total Security for BusinessOur Ultimate Security and Systems Management Solution." AVDefender.com. N.p., n.d. Web. 18 May 2017.
- "NeweggBusiness - D-Link 52 Port Gigabit Web Smart Switch including 4 SFP Ports."Newegg Business - Business IT Products, Small Business Solutions, Office Supplies and More. N.p., n.d. Web. 18 May 2017.
- "NeweggBusiness." Newegg Business - Business IT Products, Small Business Solutions, Office Supplies and More. N.p., n.d. Web. 18 May 2017.
- "UniFi AP HD." UniFi AP HD. N.p., n.d. Web. 18 May 2017.
- "NeweggBusiness - Ubiquiti UniFi Video Camera UVC-NVR + IP Camera 5-PACK UVC-G3-DOME-5." Newegg Business - Business IT Products, Small Business Solutions, Office Supplies and More. N.p., n.d. Web. 18 May 2017.
- Please reference the following link for video of our initial walk through:  
<https://www.youtube.com/watch?v=8te9c594CLQ&feature=youtu.be>