

Case Study #2

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Executive summary:

For this network, the customer needed a nearly complete ground-up design of their network. This network contains new equipment (PC, Laptops, Infrastructure, and security devices) along with a host of software (Email, Storage, Network Monitoring, and security). The customer needs these basic services to be as reliable and functional as possible. We will be providing a cloud-based work environment centered around Microsoft Azure, this will provide AD, Storage, backups, email, notifications, and parts of security. Along with this cloud infrastructure, we will be providing a Full unified wired and wireless network to both buildings.

Introduction:

Assignment Outline -

There is a small government business. The business is trying to update its office and put in a network. They have five departments, three management staff, and some training providers in two buildings. They need a network to share information and documents over while that information must remain secure to government standards.

Project Outline -

This paper outlines the design of a network for a small business. This network is an improvement over a previous design for the same building. The myriad of necessary features has been satisfied as well as an improvement in security and network optimization. We have a cloud hybrid solution that maximizes security, accountability, and expandability as well as easing the onsite IT.

Requirements Analysis:

General Requirements -

This building had only a small network in accounting. The business needed to have Computers for employees and secure storage and transfer of confidential records. They are a government business and need their data to be secure but they also needed to be able to share between certain departments and better analyze data.

Hardware Requirements -

The company needed an entire network from scratch. They needed a desktop computer per employee as well as a laptop per employee. There were also 54 microcomputers to put in classroom labs. Each desktop and microcomputer needed a monitor and peripherals. We needed to design a network and purchase the hardware to put it in place so we had to buy switches, a support server, and access points to implement the network that they wanted. We planned all of the cat6 cables to run throughout the building as well as the fiber lines connecting our layer 3 switches and the fiber connection under the road to the other building. They wanted a lot of office printers and a larger printer/scanner/copier, to better fit in the budget not everyone could get individual printers but the people we didn't give a printer to are in extremely close proximity to the large communal printer. We mapped where there should be power drops, each power drop would have 4 connections and each internet drop would have 2 connections.

Software Requirements -

Since it is a government organization it needed a secure network and secure storage. the AZURE suite had all of the components needed to build a network that was secure and accessible. We have secure storage set up and backed up with separate storage for accounting for added security. AZURE also has an active directory so our network has security that ensures only people who are allowed to look at or edit something are allowed to view it. We also have office 365 for each person so that they have access to word processing, spreadsheet, and presentation software to aid in the recording of information, the analyzing of data, and the formation of presentations.

Network Structure:

Network Border -

The network border will serve as the networks connection to the WAN and as a direct link to the Azure ExpressRoute. For this topology we have chosen dual Watchguard Technologies Firebox M290 8 Port Firewalls with the optional SFP+ addon, these firewalls do double duty being both a capable network security device and a high-speed router. This device offers policy-based traffic management, DHCP, OSPF, BGP, Multi-WAN failover, jitter/latency measurement, cloud logs and management, DoS & DDoS protection, antivirus, and many other useful features. the M290 has a robust throughput capping out at 5.8Gbps with firewall only and 1.47Gbps with firewall, VPN, and antivirus active. With a throughput of 88.2Gbpms and the average business person's top data use being 8.6MBpm with an estimated 27 full-time employees that would only be 230.4MBpm or 0.22Gbpms, a fraction of the device's capability. Even factoring in customer traffic there should never be any bottlenecks. And with an MTBF of 623,087 hours, this gateway should rarely if ever fail.

Network Core -

In the core we have opted to use the Aruba 3810M 16SFP+ (JL075A) for various reasons, one being its ability to stack multiple 3810M devices this will allow for longevity of the device regardless of future expansion. With a throughput of up to 95.2 Mbps on a 64-byte packet and < 1.8-microsecond latency with a 64-byte packet on a 10Gbps link the data speeds should be more than sufficient for even the busiest days. Some other notable features are the device's ability to add roles to devices, these roles can be used to prioritize traffic, restrict traffic, and add security policies such as packet filtering, ClearPass policy manager which allows the network to unify all Aruba wireless and wired devices policy management systems. And with two of these devices, one always on standby in case of failure, the core should not only be secure but also highly reliable.

Network Access -

For the access layer, two devices were used, the Aruba 6100 24G PoE+ 4SFP+ (JL677A), and the Aruba 2530 8G PoE+ 2SFP+(J9780A) switches. To begin with, each floor of building 1 has an Aruba 6100 switch to support the wired devices on each floor. we went with the 6100 due to its 4 SFP+ modules allowing for 10Gbps inter-switch networking for the highest throughput, along with its ample 95.2Mpps throughput and 1.5(1 Gbps) 1.8(10 Gbps) microsecond latency these should be more than sufficient for there use case. For building two we have opted to use the smaller Aruba 2540, this device will give POE+ to all POE devices in building two along with extending the LAN to the branch with little to no latency. The 2540 has a throughput of 4.1 Mpps and a latency of 1.3 microseconds at 1Gbps, due to the low number of systems in building two a more expensive and capable device would be wasted. that being said the 2530 is still a capable device bringing all of the Aruba software that the 6100 and the 3810M provide such as ClearPass.

Network WLAN -

The Wireless LAN or WLAN is a central part of this network which is why we chose four Aruba AP-505 which are dual radio, POE, and wifi 6 (802.11ax) access points. These APs will be advertising a public guest network, an employee network, and a hidden network for internal wifi devices. The guest network will have traffic rules set through ClearPass to tunnel all traffic directly to the Border blocking all internal connections, the employee network will be more relaxed allowing access to network printers and internal services but each employee will have user roles placed on them to restrict their network connections and privileges such as being limited to sending to only some printers or blocking certain external sights, and the hidden internal network will connect to the lab PCs. AP-505's supports up to 16 BSSIDs and a maximum of 256(512 total) clients per radio at 1.2Gbps(5GHz) and 287~574Mbps(2.4GHz) wireless data transfer rate. Along with excellent performance, each AP-505 serves as a policy enforcement firewall giving an added level of security from any malicious party trying to leverage the wireless network.

Servers and Services -

We will have two Dell PowerEdge R240 set to failover in case of failure, they are also located on different floors and on different switches in case a critical device fails. The servers will be running a VoIP service, print server and queue, log collection(Greylog or other solution), and some on-prem storage for buffered cloud media. The R240 is a cheap lightweight system with Dell iDRAC for out of band management along with more than sufficient power for the needs of the company.

Security and Network Management -

As mentioned above we will have two Watchguard Technologies Firebox M290 Firewalls protecting our network along with the AP-505 firewall capabilities protection from internal threats. Within the network, we decided to leverage Aruba's Central cloud management solution. Central allows the system administrator to aggregate all Aruba devices into one Network management tool, Central allows for streamlined onboarding by giving remote configuration capabilities, Central has AI Insights which diagnoses and repairs common or simple issues automatically, along with AI automated diagnostic collection allowing for faster and more precise errors even going as far as contacting Aruba support to diagnose and inform. Central monitors and visualizes all device data such as network health, application visibility, UCC analytics(VoIP), and client health. With Aruba Central and Azure Active Directory, all facets of the network can be monitored, secured, and administrated from only two platforms.

Client Systems -

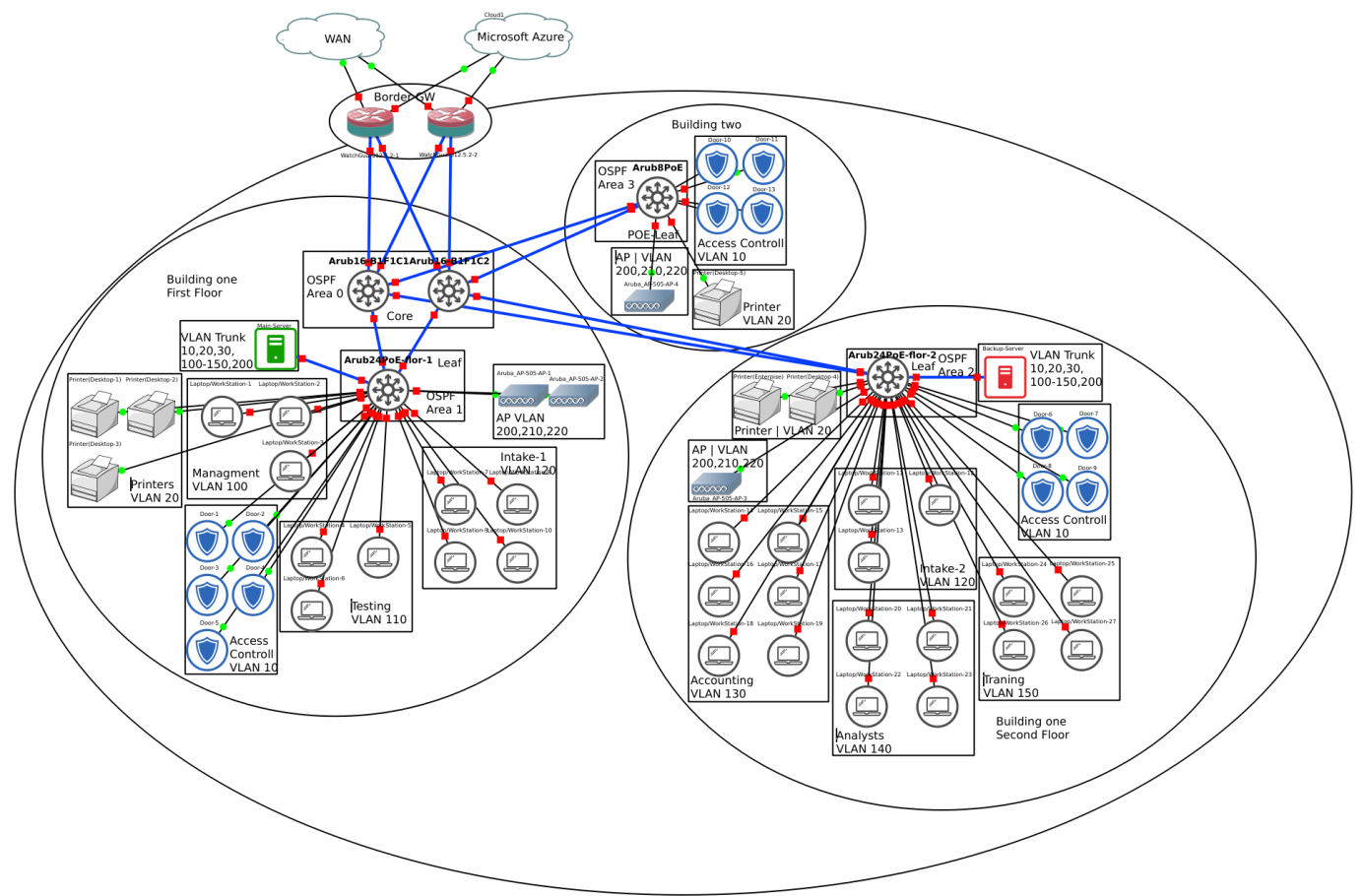
Each computer lab/classroom will have 12 Micro computers. the micro computers have the micro computer, a keyboard and mouse, and a monitor. the micro computers are wireless and connect to the wireless access points. The micro computers are connected to the monitors and keyboards physically and then to power so if needed they can be moved around. The micro pc has an i9-10900T, 256GB SSD and 8GB of ram.

Employee Systems -

Each Employee of the full-time staff will have a laptop and an office with a dock for the laptop, a phone, a ubikey, an access pass, a wireless keyboard and mouse, and a monitor. The Laptop dock allows them to connect their laptop to the wired internal network and use it as a desktop when they do not need to be moving around. The ubikey is an advanced form of access control that is a physical 2-factor authentication that keeps data and devices secure. The access pass will give them access to the rooms that they are allowed to be in with the door access control locks. Every Employee will have access to a shared printer on their floor in an easy-to-reach area to print, scan, and copy documents. they can also access cloud storage and their email to securely store and share information.

Network Maps:

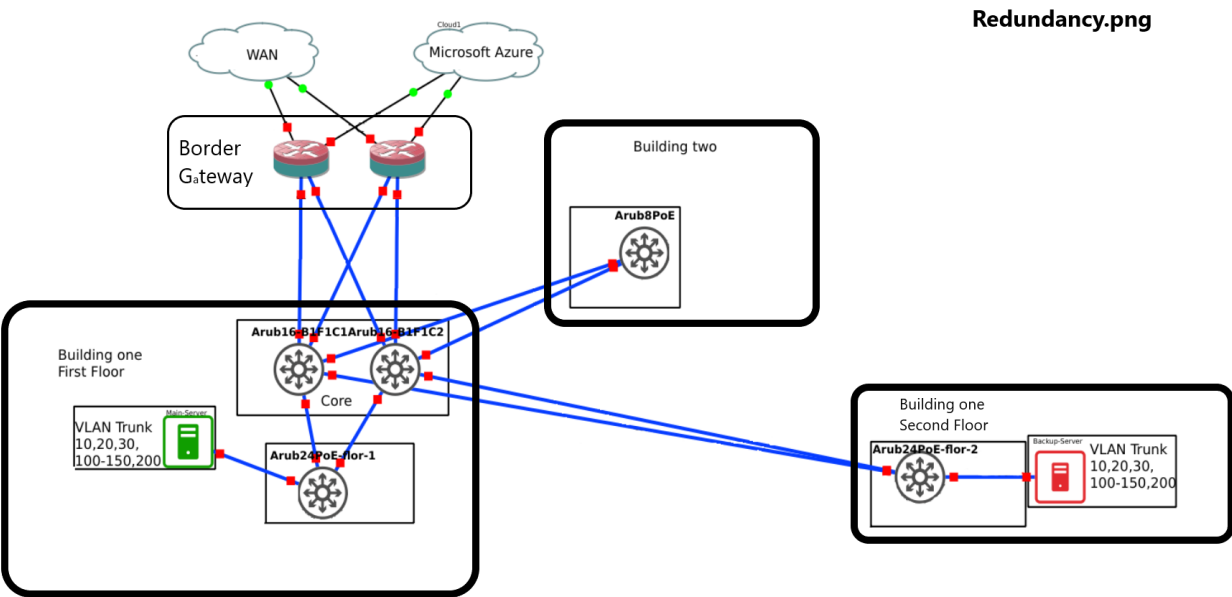
Logical -



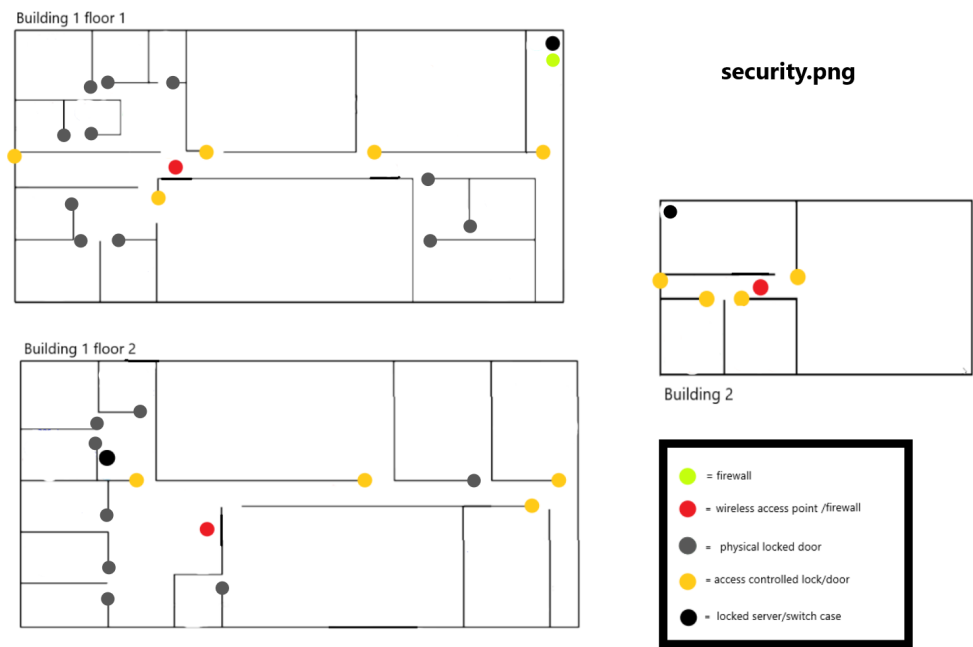
Physical with Devices -



Redundancies -



Security Devices -



Budget and Justification:

Justification -

The network we designed though over budget is easily managed and administrated, secure, deliver the quality of service desired, has high uptime, and can be accessed remotely. Our network is also very conducive to collaborative work by allowing employees to move from office to common space or home without any complicated backup systems, this also streamlines the physical security of each office since no critical equipment should be stored there. A large part of the cost of this network is the access control system, the reason why we have allocated such a large amount of resources to this system is because we believe that in a facility with many non-employee individuals physically securing assets is imperative. Moving away from the physical we find the Cloud platforms, mainly Azure and Central, Azure is the main work environment for all employees doing everything from authentication, user management, GPO(Group Policy), storage, email, and office 365. on the other hand Aruba Central provides network management, visualisation, monitoring, automatic repair, automatic diagnostic, and streamlined onboarding.

Total Cost -

Total First Month in USD = \$4,309.56

Total for reocuring payments per year in USD = \$51,714.68

Total OTC (One Time Cost) in USD = \$118,140.66

First Month + OTC in USD = \$122,450.22

General BOM -

Amount	Product Name	Manufacturer	Description	Single Unit Cost in USD	Billing Period	Cloud Y/N	Expense Per Month in USD	Expense Per Year in USD	OTC in USD
9	Central - device/year	HPE / Aruba		\$11.60	Monthly	Y	\$104.40	\$1,252.80	N/A
4	AP-505	HPE / Aruba	Secure Wi-Fi 6 (802.11ax) access points for indoor environments such as mid-sized offices, schools, or retail spaces where fewer people are on the network at the same time.	\$506.00	One Time	N			\$2,024.00

Amount	Product Name	Manufacturer	Description	Single Unit Cost in USD	Billing Period	Cloud Y/N	Expense Per Month in USD	Expense Per Year in USD	OTC in USD
1	2530 8G PoE+ (J9780A)	HPE / Aruba	The Aruba 2530 Switch Series provides cost-effective, reliable and secure access layer connectivity for enterprises, branch offices and small and midsize businesses. These fully managed switches deliver Layer 2 capabilities with enhanced access security, traffic prioritization, sFlow, and IPv6 host support. Right size deployment is available with a range of Gigabit and Fast Ethernet models including compact and fanless models which are ideal for use in quiet work spaces. PoE+ models deliver up 370W to power access points, IP phones and cameras.	\$792.00	One Time	N			\$792.00
2	6100 24G PoE 4SFP+ (JL677A)	HPE / Aruba	The Aruba CX 6100 Switch Series is a modern family of entry level access switches ideal for branch offices, mid-market enterprise, and SMB networks. Designed for reliable, simple, and secure access, the Aruba CX 6100 switches provide a convenient wired access solution for enterprise networks supporting IoT, mobile, and cloud applications.	\$2,406.49	One Time	N			\$4,812.98

Amount	Product Name	Manufacturer	Description	Single Unit Cost in USD	Billing Period	Cloud Y/N	Expense Per Month in USD	Expense Per Year in USD	OTC in USD
2	3810M 16SFP+ (JL075A)	HPE / Aruba	The Aruba 3810 Switch Series provides performance and resiliency for enterprises, SMBs, and branch office networks. With HPE Smart Rate multi-gigabit ports for high-speed 802.11ac devices, this advanced Layer 3 switch delivers a better application experience with low latency, virtualization with resilient stacking technology, and line rate 40GbE for plenty of back haul capacity. The Aruba 3810 is easy to deploy and manage with advanced security and network management tools like Aruba ClearPass Policy Manager, Aruba AirWave and cloud-based Aruba Central.	\$4,524.12	One Time	N			\$9,048.24
27	HP wireless keyboard and mouse	HP	A wireless keyboard and mouse	\$20.00	One Time	N			\$540.00
54	ThinkCenter M70q Tiny	Lenovo	A 1 Litre enterprise-level powerhouse with mainstream performance and productivity, the ThinkCentre M70q Tiny desktop strikes a perfect balance between performance and footprint.	\$478.00	One Time	N			\$25,812.00
27	ThinkPad L14 AMD (14")	Lenovo	Laptop with a Ryzen 3 Pro 4450U 256GB SSD and 8GB ram	\$593.55	One Time	N			\$16,025.85
27	ThinkPad Ultra Docking Station	Lenovo	A docking station for ThinkPad Notebook laptops	\$199.99	One Time	N			\$5,399.73
3	6U Net Rack	NavePoint	A server rack with a lock	\$222.44	One Time	N			\$225.44
1	18U Rack Enclosure	NavePoint	A server rack with a lock	\$866.49	One Time	N			\$866.49

Amount	Product Name	Manufacturer	Description	Single Unit Cost in USD	Billing Period	Cloud Y/N	Expense Per Month in USD	Expense Per Year in USD	OTC in USD
27	Office 365 with Enterprise Outlook	Microsoft	Microsoft 365 is a suite of apps that help you stay connected and get things done.	\$22.00	Monthly	Y	\$594.00	\$7,128.00	
1	Azure	Microsoft	Microsoft Azure, often referred to as Azure, is a cloud computing service operated by Microsoft for application management via Microsoft-managed data centers.		Monthly	Y	\$2,961.16	\$35,533.88	
2	Firebox M290 Firewall - 8 Port	Watchguard Technologies	The Firebox M290 and M390 firewalls are specifically engineered to defend all types of small businesses against attacks that are no less fierce than those targeting larger organizations.	\$1,232.39	One Time	N			\$2,464.78
27	CP-7841-K9	Cisco	A POE VOIP Phone	\$165.00	One Time	N			\$4,455.00
8	HL-L2325DW	Brother	A desk-friendly, compact printer with a 250-sheet capacity tray connects with ease via wireless networking or Hi-Speed USB 2.0 interface and helps save paper with automatic duplex (2-sided) printing. It also prints crisp black and white documents at up to 26ppm	\$99.99	One Time	N			\$799.92
1	Versalink C405DNM	Xerox	VersaLink C405 Color Multifunction Printer, Prt/Cpy/Scn/Fax, Ltr/Lgl, Up To 36ppm, 2-Sided Prt, USB/Ethernet, 550-Sht Try, 150-Sht Multi-Purpose Try, 50-Sht DADF (single-Pass Duplex), 110V	\$695.00	One Time	N			\$695.00

Amount	Product Name	Manufacturer	Description	Single Unit Cost in USD	Billing Period	Cloud Y/N	Expense Per Month in USD	Expense Per Year in USD	OTC in USD
81	E205W-1600 20"	Sceptre	The Sceptre e205w-1600 monitor is the way to go. 1600 x 900 resolution delivers vivid colors and sharp images on a 19.5" diagonal corner to corner inch screen. A 5 millisecond response time displays action sequences with the highest Degree of clarity. Enjoy HDMI, and VGA inputs to connect all video and gaming devices. Viewing Angle = 170 degree (Horizontal) / 160 degree (Vertical)	\$116.00	One Time	N			\$9,396.00
2	Tripp Lite SMART1500LCD UPS	Tripp Lite	Provides reliable 1500VA/900W power protection for your desktop computer, network workstation, audio/video components or media center. Protects against surges, line noise, blackouts and brownouts.	\$248.71	One Time	N			\$250.71
2	EMC PowerEdge R240	Dell	An entry-level 1U rack server designed for web hosting and multi-purpose applications.	\$1,445.99	One Time	N			\$2,891.98
2	16TB Exos X18	Seagate	A 16TB HDD	\$339.97	One Time	N			\$679.94
3	YubiKey 5 NFC FIPS - 10 Pack	Yubico	A hardware based authentication solution that provides superior defense against phishing, eliminates account takeovers, and enables compliance requirements for strong authentication. This series of security keys are FIPS 140-2 validated (Overall Level 2, Physical Security Level 3.) and meet authenticator assurance level 3 (AAL3) of NIST SP800-63B guidance.	\$550.00	One Time	N			\$1,650.00

Amount	Product Name	Manufacturer	Description	Single Unit Cost in USD	Billing Period	Cloud Y/N	Expense Per Month in USD	Expense Per Year in USD	OTC in USD
5	1000ft Shielded Gray Cat6	cablewholesale	Our bulk 1000ft solid Cat6 shielded Ethernet cable is perfect for in-wall installations or installs in a busy electronic environment. Shielded cables are designed to prevent Electro-Magnetic Interference, ensuring the best signal possible. This is a gray, shielded, solid cable. The individual conductors are 23AWG (American wire gauge) solid pure copper for permanent installations. Our Cat6 Ethernet cable exceeds the EIA/TIA-568-C standard. Comes on a convenient spool.	\$234.52	One Time	N			\$1,172.60
578	Fiber Optic cable & Install / per foot		Fiber optic cable capable of transmitting Ethernet frames at a rate of 10 gigabits per second	\$3.00	One Time	N			\$1,734.00
4536	Cat 6 installation & keystone's / per foot		The installation of keystone drops and the cat 6 cabel runs between them	\$1.50	One Time	N			\$6,804.00
20	Inter Campus Tunnling / per foot		A tunnel underground between two buildings for fiber optic cabel	\$200.00	One Time	N			\$4,000.00
13	Door Acess Control		Kisi provides your office with a seamless access control experience. The installation of electrified locks and hardware is often the largest line item when getting started with Kisi.	\$1,200.00	One Time & Monthly	N	\$650.00	\$7,800.00	\$15,600.00

Azure BOM -

Service type	Use	Region	Description	Estimated monthly cost
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Service type	Use	Region	Description	Estimated monthly cost
Storage Accounts	Accounting	East US	File Storage, Transaction Optimized Performance Tier, General Purpose V2, LRS Redundancy, 2 TB of Data at-rest, 1 TB Snapshots, 1 x 10,000 Write Transactions, 1 x 10,000 List Transactions, 1 x 10,000 Read Transactions, 1 x 10,000 Other Operations, 1 Additional Sync Server(s)	\$189.35
Azure Backup	Accounting Backup	East US	Azure Files, 1 Instance(s) x 2 TB, LRS Redundancy, Low Average Daily Churn, 1 TB Average monthly snapshot usage data	\$121.75
Storage Accounts	Company wide	East US	File Storage, Transaction Optimized Performance Tier, General Purpose V2, LRS Redundancy, 6 TB of Data at-rest, 2 TB Snapshots, 1 x 10,000 Write Transactions, 1 x 10,000 List Transactions, 1 x 10,000 Read Transactions, 1 x 10,000 Other Operations, 4 Additional Sync Server(s)	\$511.55
Azure Backup	Company Wide Backup	East US	Azure Files, 1 Instance(s) x 7 TB, LRS Redundancy, Low Average Daily Churn, 1 TB Average monthly snapshot usage data	\$72.80
Azure ExpressRoute			ExpressRoute, Zone 2, Premium, Metered; 50 Mbps Circuit X 1 circuit, 1 TB in Additional Outbound Data Transfer; Global Reach Add On:	\$206.20
Microsoft Sentinel		East US	Logs ingested - 7 GB Basic logs per day, 3 GB Analytics logs per day; Azure Monitor Retention - 3 months of Data Retention, 0 months of Data Archive; Azure Monitor Data Restore - 500 Basic log queries per day, 1000 GB data scanned per query, 2000 GB Data Restored, 0 days data restored; Azure Monitor Search Queries and Search Jobs - 0 queries per day, 0 GB data scanned per query of Search Queries, 0 queries per day, 0 GB data scanned per query of Search Jobs	\$585.50
Azure Active Directory (Azure AD)		East US	Premium P1 - 19 users, Premium P2 - 10 users, Enterprise tier, User forest - 100 Hours, Resource forest - 50 Hours.	\$264.00
Azure Cost Management and Billing			No charge for managed Azure spend. Additional premium capabilities are available at no cost through December 2018 when they will become paid features. 1% of managed spend for AWS and Google Cloud Platform.	\$0.00
Notification Hubs		East US	Basic tier, 1 million additional pushes	\$10.00
Support			Support	\$1,000.00

Scalability:

This network utilizes almost all of the current spine switches so if expansion were wanted there would need to be another switch added. Adding another switch is easy as the core has more than enough ports to expand with and OSPF would just have another zone added to it. It is feasible to add another close building or to expand a building to have another floor and easily integrate it into the network, expanding to the new space. Extra storage space is easy to get as the Azure cloud is able to be expanded at will with a small cost increase. you could also easily connect to new locations with the azure cloud system being able to be expanded to other buildings.

Optimizations Suggested:

As for optimizations,

- We recommend the hiring of full time System administrators to maintain the network
- Adding a reboot to restore software such as deep freeze to all lab PCs
- Add some Azure analytical compute to streamline analytical work

Summary:

This network is a 3 tiered closs with ospf. The network has a server and a backup server that host a print server and a call server. There is a link to the Azure cloud that handles storage, backup, and active directory. The office 365 provides email and many applications used for daily operation. Each Employee has a VOIP phone, a laptop, a security badge, and a ubikey to keep the building secure and to be able to bring work around with them securely. Each floor has an easily accesses printer and documents can be scanned and copied. Offices are secured and the buildings are only

accessible to people who are allowed in. The classrooms have computers to help facilitate learning and make it easy to complete and turn in assignments. The network can be expanded to more floors or buildings or even to a new location far away.

Appendix A Q&A:

Customer Had no Follow up questions at time of interview.

Appendix B Cost Analasys Sources:

Product Name	Manufacturer	Source
Central - device/year	HPE / Aruba	Quote
AP-505	HPE / Aruba	https://www.arubanetworks.com/products/wireless/access-points/indoor-access-points/500-series/
2530 8G PoE+ (J9780A)	HPE / Aruba	https://www.amazon.com/HP-J9780A-ABA-2530-8-POE-Ethernet/dp/B00DD661BK
6100 24G PoE 4SFP+ (JL677A)	HPE / Aruba	https://www.alphatechserve.com/jl677a-hewlett-packard-network-switch.html?msclkid=a699eefa4e881eba3a09
3810M 16SFP+ (JL075A)	HPE / Aruba	https://buy.hpe.com/us/en/networking/switches/fixed-port-l3-managed-ethernet-switches/3800-switch-products/a
HP wireless keyboard and mouse	HP	https://www.hp.com/us-en/shop/pdp/hp-wireless-keyboard-and-mouse-300?&a=1&jumpid=cs_con_nc_ns&utm_r PLA_Accessories&utm_content=sp&adid=535139517283&addisttype=u&3ML04AA%23ABL&cq_src=google_ads SIIPMvE_pz0OHYFozpue2oaAtiIEALw_wcB&gclsrc=aw.ds
ThinkCenter M70q Tiny	Lenovo	https://www.lenovo.com/us/en/p/desktops/thinkcentre/m-series-tiny/thinkcentre-m70q/wmd00000405?orgRef=ht
ThinkPad L14 AMD (14")	Lenovo	https://www.lenovo.com/us/en/p/laptops/thinkpad/thinkpadl/thinkpad-l14-(amd)/20u5s0nt00?orgRef=https%253
ThinkPad Ultra Docking Station	Lenovo	https://www.lenovo.com/us/en/p/accessories-and-software/docking/mechanical-docks/40aj0135us
6U Net Rack	NavePoint	https://navepoint.com/navepoint-6u-600mm-depth-wallmount-networking-cabinet-pro-series/
18U Rack Enclosure	NavePoint	https://navepoint.com/navepoint-18u-838mm-mid-depth-perforated-networking-cabinet/
Office 365 with Enterprise Outlook	Microsoft	https://www.microsoft.com/en-us/microsoft-365/compare-microsoft-365-enterprise-plans
Azure	Microsoft	https://azure.microsoft.com/en-us/pricing/calculator/
Firebox M290 Firewall - 8 Port	Watchguard Technologies	https://www.newegg.com/p/0E6-003P-00209?item=9SIA24GGZ77940&source=region
CP-7841-K9	Cisco	https://www.serversupply.com/NETWORKING/TELEPHONY%20EQUIPMENT/IP%20PHONE/CISCO/CP-7841-K9_2619
HL-L2325DW	Brother	https://www.brother-usa.com/products/hll2325dw
Versalink C405DNM	Xerox	https://www.absolutetoner.com/collections/high-quality-multifunction-copier-printer/products/xerox-versalink-c40
E205W-1600 20"	Sceptre	https://www.amazon.com/Sceptre-E205W-1600-Monitor-Speakers-Metallic/dp/B00S8W8QMG/ref=sr_1_12?gclid=C qjIwsGxjXGxP1hj62LxoCH5UQAuD_BwE&hvadid=557425881260&hvdev=c&hvlocphy=9005677&hvnetw=g&hvq
Tripp Lite SMART1500LCD UPS	Tripp Lite	https://www.tripplite.com/smartpro-lcd-120v-1500va-900w-line-interactive-ups-avr-2u-rack-tower-lcd-usb-db9-se
EMC PowerEdge R240	Dell	https://www.dell.com/en-us/work/shop/povw/poweredge-r240?gacd=9650523-1033-5761040-266691960-0&dgc t5QOWcuv4GvNKRxeJowxqStXPGGqTujLARoCdLIQAvD_BwE&gclsrc=aw.ds&nclid=9uXcXHNcwGBQpCOY83PsrVPI
16TB Exos X18	Seagate	https://www.seagate.com/products/enterprise-drives/exos-x/x18/
YubiKey 5 NFC FIPS - 10 Pack	Yubico	https://www.yubico.com/product/yubikey-5-nfc-fips-10-pack/

Product Name	Manufacturer	Source
1000ft Shielded Gray Cat6	cablewholesale	https://www.cablewholesale.com/products/bulk-cable/cat-6-cable-bulk/product-10x8-521nh.php
Fiber Optic cable & Install / per foot		https://spendonhome.com/fiber-optic-cable-installation-cost/
Cat 6 installation & keystone's / per foot		https://www.fixr.com/costs/hardwired-computer-network
Inter Campus Tunnling / per foot		https://anchorfoundationrepair.net/blog/average-cost-under-slab-tunneling/
Door Acess Control	Kisi	https://www.getkisi.com/blog/breakdown-of-access-control-system-installation-costs