

**Network Design Proposal**

**February 4, 2022**

[Executive Summary 3](#_Toc849091851)

[Introduction 4](#_Toc1145923695)

[Assumptions 4](#_Toc2116417210)

[Scope 4](#_Toc1121538845)

[Objectives 4](#_Toc1592370288)

[Benefits 4](#_Toc1426525916)

[Proposed Solution 5](#_Toc2041920509)

[ISP 5](#_Toc1972271484)

[Network Topology 6](#_Toc1789312875)

[Protocols 7](#_Toc684092816)

[Communication media 7](#_Toc1798719583)

[Software Recommendations 8](#_Toc302702982)

[Software for all Employees 8](#_Toc1134543314)

[Software for Servers 8](#_Toc1558906486)

[Operating Systems 8](#_Toc640795063)

[Hardware recommendations 9](#_Toc562085658)

[Hardware for staff 9](#_Toc531944836)

[Printers /Copiers 9](#_Toc1819670124)

[Laptops 9](#_Toc1693125970)

[Monitor 9](#_Toc497423637)

[Hardware for network 9](#_Toc1281226305)

[Additional Recommendations 10](#_Toc1532224105)

[Data backup 10](#_Toc305693329)

[Remote Access 11](#_Toc1454449798)

[Scalability 11](#_Toc559268905)

[High Availability 11](#_Toc1421222079)

[Security 11](#_Toc407668814)

[Physical Diagram 12](#_Toc728602778)

[Devices List 12](#_Toc288634098)

[Estimated total cost 14](#_Toc967224472)

[Estimated Project Plan 15](#_Toc747266417)

[Future Expansion Plans 15](#_Toc156942555)

[References 16](#_Toc1062439017)

# Executive Summary

This proposal holds the network solution of Rest & Relax Designs Pte Ltd. The network design focuses mainly on being cost-effective with added recommendations to strengthen the company’s security posture, up-time, and future expansion. Regarding the company’s ISP, M1’s plan should be considered as it allows for future expansion without the hassle of changing ISP due to the lack of IP addresses and incurring a larger fee for additional IP addresses. Open-source software and services have also been recommended to allow the company to strengthen its security for free, however, it will require a lot of effort to set up. This leads to the concern of having only 2 IT staff, it is suggested to have 5 IT staff for 90 employees or at least 3 contracted IT staff to ensure the workload for the first few months is not overwhelming. The total cost of the network design roughly equates to $207697.78 which is well within the budget of 5% of the estimated revenue that should be spent on IT for the next 3 years. The network design will also require 10 weeks (about 2 and a half months) to get everything up and running and tested, details are provided below.

# Introduction

Rest & Relax Designs Pte Ltd is a company with a staff strength of 90. To design the network, the following must be accounted for:

* The interior designers can access each other’s work.
* Directors and employees should be able to access their designs and documents from home.
* Staff need a facility to print out their designs, bills, invoices, etc.
* Interior designers will not always be in the office.
* Wiring through the walls across unit #07-124 and #08-124

## Assumptions

A quarter of the Interior designers would work remotely. Interior designers often work remotely, either to supervise on-site, meeting clients, suppliers, or working from home. Certain projects can be done individually by interior designers instead of working a team. This means that the total number of interior designers working in the office would be around 50.

It is also assumed that each unit's size is 1000sqft, with dimensions of 50ftx20ft, and has an average height of 4.27m (Skydeck Chicago, n.d.)

## Scope

The scope of this project is to design a network for Rest & Relax Designs Pte Ltd with services in the following areas:

* File and Print services
* Internet access
* Remote access to office network
* Security
* Data Backup
* Network Scalability
* High Availability/Fault tolerance

## Objectives

To help design a robust network for the company with data security in mind, especially with the designs and documents as they should only be accessible to the employees.

## Benefits

The benefits of having a network in the company

|  |
| --- |
| **File Sharing**  Interior Designers share their CAD designs with their coworkers and the directors can check for quality. Directors are also able to check their documents.  **Resource Sharing**  Allows the use of printers and desktops without incurring the full cost of buying for every individual.  **Remote Access**  Due to the COVID-19 outbreak, working remotely has become the norm, so for everyone to work, laptops with remote access to company files will be needed.  **Centralized Administration**  All network traffic will go through a single point allowing for monitoring of logs for security. Also, allows services to check for authentication (2FA).  **Backups**  Having a network in the company allows for easier backups as everything can be handled by the IT staff.  **Internet**  Having easily accessible internet access is especially important in any company, as it will be used for research. |

# Proposed Solution

## ISP

It is recommended that the broadband plan has speeds of 1gbps, this is to support the substantial number of users in the network. The broadband plan should also be static broadband as it would provide convenient remote access for employees to work remotely. Thus, the following two ISP has been identified as a suitable choice for the network

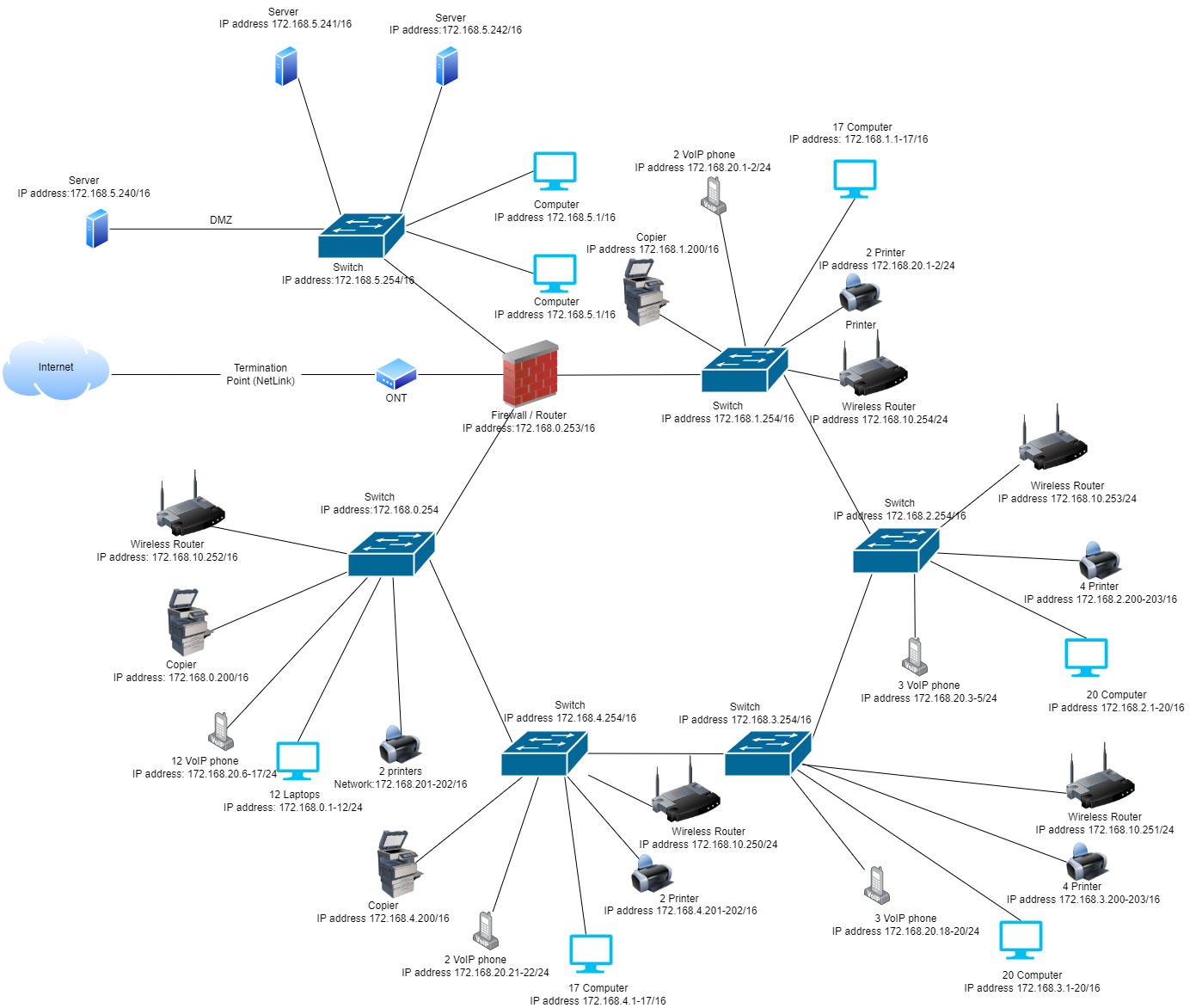
|  |  |
| --- | --- |
| ViewQwest   * Speed:1Gbps * Static broadband * Cost: $321/month   Add-ons   * 1 Static IPv4 Addresses * 3 Months SecureNet Biz * **99.95%** Network Availability * Managed Router * Modem Rental * **WAIVED** One-time Charges * Additional 8 Static IP for $50/month | M1   * Speed:1Gbps * Static broadband * Cost: $348/month   Add-ons   * 8 Static IPs * Managed FortiGate 61E * FortiGuard Global Threat Intelligence * Managed Access Control List * Weekly Security Report |

It is recommended to use M1’s broadband plan as the network’s rather than ViewQwest, this is because M1 provides 8 static IP addresses, and offers security features such as a firewall, managed access control list, and weekly security reports on the current affairs of the cybersecurity landscape.

\*In the proposed solution, the offered FortiGate will not be used however, should the FortiGate be used, it should be placed in front of the router-cum-firewall.

## Network Topology

The network topology used will be a dual ring topology which will provide sufficient redundancy without the complexity & cost of a mesh topology.



## Protocols

It is recommended to use the following protocols based on the TCP/IP protocol suite

Application Layer

|  |  |
| --- | --- |
| SMTP | This allows employees to transmit emails between computers |
| IMAP | This allows employees to retrieve emails on multiple devices |
| DNS | This translates domain names to IP addresses |
| HTTP | This allows browsers and servers to communicate by allowing encrypted data from browsers or servers to be sent between them |
| DHCP | This automatically assigns devices an IP address |
| SMB | A network file sharing protocol that allows employees to read and write files to request services from server programs in a computer network. |
| LDAP | This is used for directory services authentication and allows employees to authenticate through the Active Directory server. |
| Kerberos | A computer network security protocol which authenticates service requests between the Active Directory Server and the employee’s computer. |
| AppSocket | The AppSocket protocol will be used for employees to send print jobs to the printer. |

Application Layer & Transport Layer

|  |  |
| --- | --- |
| RPC | It is used to allow communication between processes from different machines. |
| Syslog | Used to send logs to the log server. |
| VoIP | This enables the use of VoIP phones; however, it depends on the model of the IP phone of what protocol it might use with VoIP. |
| TLS | encrypts data that is sent over the Internet or network (HTTPS, syslog over SSL, etc.). |

Transport Layer

|  |  |
| --- | --- |
| TCP / UDP | This allows network communication by sending packets over the internet. |

Network Layer

|  |  |
| --- | --- |
| ICMP | This allows network monitoring and management. |
| ARP | This allows communication between different networks. |

Communication media

|  |  |
| --- | --- |
| Multimode fiber optic cables  Multimode fiber optic cables are used to connect routers in units #08-123 and #08-125 together, and routers in units #06-123 and #07-125 together.  Fiber optic cables is the most suitable choice because the cable will run through a unit not owned by Rest & Relax Designs Pte Ltd, the fiber optic cables will be used for security purposes as they are immune to EFI and RFI and, more resistant to eavesdropping.  It is recommended to use multimode instead of single-mode fiber optic cables, as single-mode fiber optic cable is mostly used for long distances, allowing us to reduce some costs. | Cat6 Shielded Twisted Pair Cables  Cat 6 STP cables are used to connect routers in units #08-123, #07-123, #06-123 together and units #07-125, #06-125 together. They are also used to connect devices in a unit to the switch.  STP cables are the most suitable choice because the cables are the most cost-effective as they will run through the company only and thus eavesdropping is not a concern. However, there will be EMI and RFI and shielding it reduces the interferences hence, STP cable is the most suitable.  It is recommended to use category 6 instead of other STP categories as it supports speeds up to 1Gbps, this is more than enough for our current proposed network. |

## Software Recommendations

### Software for all Employees

|  |
| --- |
| * SpamTitan ($5557.80/3y) (Not necessary but highly recommended)   SpamTitan is an advanced email protection solution that blocks malicious email threats.   * Hard Configurator   Hard Configurator is a GUI (Graphical User Interface) to manage Software Restriction Policies (SRP) and harden Windows   * NXLog   NXLog is an open-source log collection tool   * Sysmon   Sysmon is part of the Sysinternals software package, now owned by Microsoft which enriches the standard Windows logs by producing more in-depth logs. |

### Software for Servers

|  |
| --- |
| * Printer associated software   This software will be used to manage the printers   * VoIP Phones associated software   This software will be used to manage the VoIP Phones   * Graylog   Graylog centrally captures, stores, and enables real-time search and log analysis.   * Samba   Allow employees to upload files and store them on the Linux server. |

### Operating Systems

|  |
| --- |
| * Linux   Ubuntu, Debian, or Redhat can be used. I highly suggest that the IT staff set up the system based on their own comfort with the OS to ensure that all the settings are done correctly.   * Windows (Server)   Windows Server 2019 should be used as it is relatively new while still having some age to ensure that any bugs have been smoothen out.   * Windows 10   Windows 10 should be given out to the employee as Windows 11 is still relatively new and is in its testing phase. |

## Hardware recommendations

### Hardware for staff

#### Printers /Copiers

|  |
| --- |
| Canon Pixma TS307 printer and MB2720 3-in-1 printer/copier It is strongly recommended to provide employees with printers. A large printer should be available on each level, while small printers are to be placed at locations where it is far from the large printers as well as for C-level printing confidential documents. A copier should at least be placed on every floor, as it is unconventional to have employees to either go up or down to print. It is also recommended to have copiers instead of printers as a designer may need to print a lot of paper without taking a long time.  Each director and CEO should be assigned a printer, this is because directors and CEOs often have confidential documents.  A printer should also be assigned in units without a copier, it is to be shared among other employees. This is to ensure that every employee has convenient access to a printer. |

#### Laptops

It is also recommended to provide laptops instead of desktops, as this will allow staff to work remotely without having to use their own devices and ensure that the devices used will be protected by the company’s security policies.

|  |
| --- |
| **Lenovo ThinkPad E15Laptop**  Laptops for Interior designers and IT staff laptop should have at least 16GB of RAM, 512GB SSD, 15.6-inch FHD IPS (1920 x 1080) display a graphics card that has 4GB of video RAM a CPU with speeds of 3 GHz and above and battery life that lasts up to 10-hour This will ensure the IT staff is equipped with laptops that will be able to run various cybersecurity and networking tools (Kinton, 2022) and ensure every interior designer is equipped with a laptop that can support the design software required to do their jobs |
| **ASUS VivoBook 14 laptop**  CEO, directors and deputy directors and office administrators' laptops does not need to have high performance, as office administrators use applications that are not resource-intensive while CEO, directors, and deputy directors would usually use the laptops for general use, such as using email or Microsoft office applications |

#### Monitor

|  |
| --- |
| **Hopcd monitors**  All the laptops should also have an HDMI port or something of equivalence (USB to HDMI), to allow a second monitor to be connected, this would enable employees to be more productive. |

### Hardware for network

|  |
| --- |
| The proposed network consists of 6 switches, 5 routers, 1 optical network terminal, 22 VoIP phones, 3 servers and 1 firewall. |

|  |  |
| --- | --- |
| **Optical network terminal**  The ONT is connected to the termination point (NetLink Trust), to provide internet access from the ISP to the rest of the network. | **D-Link Wireless AC3200 router**  The wireless routers are used to supply wireless internet access to employees’ personal devices such as their phones; the router should support at least 1gbps, which is the bandwidth speed of the broadband plan. It should also have VLAN capabilities for future expansion plans. |
| **FS 48 port ethernet / Netgear 8 port L2 switches** Switches are placed at each unit to connect the employees' laptops and other devices such as routers, printers, copiers, and VoIP phones to the network.  Switches used in each unit must have enough ports to support all the wired devices in the unit, it should also have extra ports and VLAN capabilities for future expansion plans. | **ProLiant ml30 gen10 tower servers**  3 servers are found at unit #07- 123, they consist of 2 Linux servers and a Windows server. The first Linux server is used to host and serve VPN services to employees, the 2nd Linux server will serve as the file, mail, and logging server and lastly the windows server will serve as the AD and as well as host the VOIP phones and printers.  Tower servers would be the most ideal choice as only 3 servers are used, hence not much space will be occupied by the servers, moreover, tower servers are generally cheaper as compared to rack servers |
| **NetGate 2100 firewall router**  It is recommended to use a firewall router to protect the network from outside threats. It should be connected to the ONT, this is to ensure that all incoming network traffic passes through the firewall before any other devices in the network | **Grand stream's GXP1628 VOIP phone**  It is recommended to provide VoIP phones to office administrators. This is because VoIP phones have features such as being able to support multiple calls simultaneously and forwarding calls that would be useful for office administrators. Moreover, VoIP phones have low hardware, software, and communication costs. (Techadvisory, 2014) |

Additional Recommendations

### Data backup

|  |  |
| --- | --- |
| **Wasabi Technologies**  Wasabi’s cloud storage will allow the company to back up all the files to the cloud at a cost of $8.12/month per TB. This is more important than any other security software and must be implemented. Any ransomware attacks will bring down a company or cost a hefty fee if they do not have a backup to rely on. | **RAID 5 File Server**  File server should be configured to use RAID 5 to ensure that if a disk fails or corrupts, data can be recovered. |

### Remote Access

|  |
| --- |
| **OpenVPN**  OpenVPN will allow users to work remotely by logging in to the Active Directory server via LDAP and be securely protected by the company’s policies as well as having the traffic logged by the server. The cost of 90 employees is $384.82 monthly or $3688.31 yearly. |

### Scalability

|  |  |
| --- | --- |
| **8 static IP addresses**  With the 8 static IP addresses that are provided by M1, it allows the company to set up websites, multiple VPNs (Virtual Private Network) and services that require static IP addresses. | **Replaceable network devices**  Using a dual ring topology, it allows for easier scalability as replacing or adding a switch or router will not bring down the entire network. |

### High Availability

|  |
| --- |
| **Dual Ring Topology**  The dual ring topology provides some redundancy where if one node fails, the rest is still able communicate with other nodes. |

### Security

|  |  |
| --- | --- |
| **Email Protection Software**  Having an anti-spam solution like SpamTitan will block unsolicited emails, phishing attempts, spoofing and illicit content which will reduce the risk of getting hacked. However, email protection solutions can be expensive, so the alternative is to give employees security awareness training. | **Security Awareness Training**  Providing employees security awareness training such as Amazon’s free training (https://learnsecurity.amazon.com/) as well as testing your employees with simulated phishing attack through services like GoPhish (free) will reduce the risk of your employees being victims of malicious emails. |
| **Sysmon**  Since most of the employees will be using Windows, it will be best to enable Sysmon and send logs through NXLog to the centralized server. This will allow for any incident response after a breach. Having an in-house centralized logging server will be cheaper than out-sourcing. | **Hard configurator**  This software will be used with Windows group policies, having this software configured will make it so that sophisticated hacks will work partially or out-right block the attack as this software will block Tactics, techniques, and procedures (TTPs) used by hackers. |
| **DMZ**  DMZ provides security by keeping the Virtual Private Network (VPN) server out of the internal network and communications with the internal network should be tightly controlled using VLANs and firewalls. | |

## Physical Diagram

### 

Devices List

For consistency, workstations will be .1-199, printers will be .200-239, servers will be .240-249 and network devices will be .250-254.

Only printers, servers and network devices should have a static IP address.

The rest will change according to the DHCP on the router.

Class B addresses will be used to ensure that the VPN does not conflict with home networks.

**\*Most switches will not have an IP address, change according.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Unit | **#08-123** |  | Unit | **#08-125** |
| Device | Ip Address |  | Device | Ip Address |
| Switch | 172.168.1.254/16 |  | Switch | 172.168.2.254/16 |
| Wireless Router | 172.168.10.254/24 |  | Wireless Router | 172.168.10.253/24 |
| Copier | 172.168.1.200/16 |  | Printer | 172.168.2.200/16 |
| Printer | 172.168.1.201/16 |  | Printer | 172.168.2.201/16 |
| Printer | 172.168.1.202/16 |  | Printer | 172.168.2.202/16 |
| IP Phone | 172.168.20.1/24 |  | Printer | 172.168.2.203/16 |
| IP Phone | 172.168.20.2/24 |  | IP Phone | 172.168.20.3/24 |
| Computer x 17 | 172.168.1.1-17/16 |  | IP Phone | 172.168.20.4/24 |
|  |  |  | IP Phone | 172.168.20.5/24 |
|  |  |  | Computer x 20 | 172.168.2.1-20/16 |
|  |  |  |  |  |
| Unit | **#07-123** |  | Unit | **#07-125** |
| Device | Ip Address |  | Device | Ip Address |
| Firewall Router | 172.168.0.253/16 |  | Switch | 172.168.3.254/16 |
| Switch | 172.168.0.254/16 |  | Wireless Router | 172.168.10.251/24 |
| Wireless Router | 172.168.10.252/24 |  | Printer | 172.168.3.200/16 |
| Copier | 172.168.0.200/16 |  | Printer | 172.168.3.201/16 |
| Printer | 172.168.0.201/16 |  | Printer | 172.168.3.202/16 |
| Printer | 172.168.0.202/16 |  | Printer | 172.168.3.203/16 |
| IP Phone x 12 | 172.168.20.6-17/24 |  | IP Phone x 3 | 172.168.20.18-20/24 |
| Computer x 12 | 172.168.0.1-12/16 |  | Computer x 20 | 172.168.3.1-20/16 |
|  |  |  |  |  |
| Unit | **#06-123** |  | Unit | **#07-123** |
| Device | Ip Address |  | Device | Ip Address |
| Switch | 172.168.4.254/16 |  | Switch | 172.168.5.254/16 |
| Wireless Router | 172.168.10.250/24 |  | Linux Server (VPN) | 172.168.5.240/16 |
| Copier | 172.168.4.200/16 |  | Linux Server (Logging/File/Mail) | 172.168.5.241/16 |
| Printer | 172.168.4.201/16 |  | Windows Server  (AD/VoIP/Printer) | 172.168.5.242/16 |
| Printer | 172.168.4.202/16 |  | Computer | 172.168.5.1/16 |
| IP Phone | 172.168.20.21/24 |  | Computer | 172.168.5.2/16 |
| IP Phone | 172.168.20.22/24 |  |  |  |
| Computer x 17 | 172.168.4.1-17/16 |  |  |  |

## Estimated Total Cost

With the assumption that each unit length is 15.24m(50ft) and the height of a unit 2.6m (8.53ft). The fiber optic cables length should be at least 45.72m(150ft) and 48.32m(158.53ft)

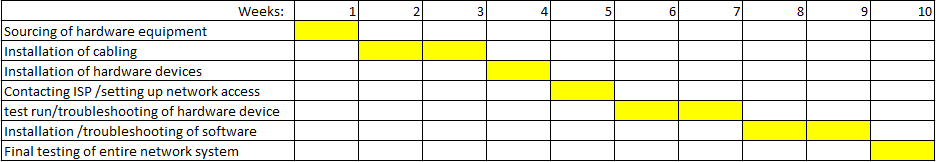
With the assumption that the height of each unit is 4.27m, there should be at least 21.35m of STP cables to connect the router together. With the assumption that each device connecting to the switch requires 20m of STP cables, there be at least 2220m of STP cables to connect the devices to the switch. Therefore, the estimated total length of STP Cables needed is 2,241.35m long.

\*Do note that the recommended length of Fiber Optic cables and STP cables is a general estimate, hence dictate accordingly the length of cables required.

|  |  |  |  |
| --- | --- | --- | --- |
| Name | No. Of devices | Price | Total |
| M1 static broadband plan | 1 | $348/m | $12,528(3 yrs) |
| Spam Titan | 90 | $1852.60/y | $5557.80(3 yrs) |
| Microsoft 365 Business Basic | 90 | $610.20/m | $21,967.2 (3 yrs) |
| Fiber Optic Cable | 2 | $39.32 | $78.64 |
| Cat 6 STP Cable(300m) | 7 | $280.47 | $1,963.29 |
| D-Link Wireless AC3200 Tri Band Gigabit Cloud Router | 5 | $295.89 | $1,479.45 |
| FS 48 port gigabit ethernet switch | 5 | $703 | $3515 |
| Netgear 8 port gigabit L2 switch | 1 | $138.94 | $138.94 |
| Grand stream's GXP1628 VoIP phone | 22 | $79 | $1189 |
| Canon’s Pixma TS307 Printers | 13 | $69 | $897 |
| MB2720 3-in-1 printer/copier | 2 | $516.40 | $1,032.8 |
| ProLiant ml30 gen10 tower server | 3 | $1345.49 | $4,036.47 |
| Lenovo ThinkPad E15 Gen 2 | 69 | $1,802.51 | $124373.19 |
| ASUS Vivo Book 14 laptops | 21 | $1,049.00 | $22029 |
| Hopcd Monitors | 90 | $129.46 | $6473 |
| NetGate 2100 Firewall Router | 1 | $349 | $349 |
| ***Total*** | | | ***$207697.78*** |

|  |  |
| --- | --- |
| Device | Source |
| Multimode Fiber Optic cable | [Amazon.com: 50 Meter Multimode Duplex Fiber Optic Cable (62.5/125) - LC to LC - Orange : Everything Else](https://www.amazon.com/Meter-Multimode-Duplex-Fiber-Optic/dp/B005518FL0?th=1) |
| Cat 6 STP Cable | [IO-E4241S-6CMR-1000B IO Audio Technologies | Cables, Wires | DigiKey](https://www.digikey.sg/en/products/detail/io-audio-technologies/IO-E4241S-6CMR-1000B/9103057) |
| Canon’s Pixma TS307 printer | [Canon Pixma TS307 (2321C012AB) : Amazon.sg: Electronics](https://www.amazon.sg/Canon-2321C012AB-Pixma-TS307/dp/B07PHRV4M4/ref=asc_df_B07PHRV4M4/?tag=googleshoppin-22&linkCode=df0&hvadid=389299352607&hvpos=&hvnetw=g&hvrand=6930654520431580052&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9062513&hvtargid=pla-830999347158&psc=1) |
| MB2720 3-in-1 printer/copier | [Canon Office and Business MB2720 Wireless All-in-one Printer, Scanner, Copier and Fax with Mobile and Duplex Printing : Amazon.sg: Electronics](https://www.amazon.sg/Canon-Business-MB2720-Wireless-Printing/dp/B01IIOMMRS/ref=asc_df_B01IIOMMRS/?tag=googleshoppin-22&linkCode=df0&hvadid=404959661997&hvpos=&hvnetw=g&hvrand=6930654520431580052&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9062513&hvtargid=pla-571069521116&psc=1) |
| Lenovo ThinkPad E15 Gen 2 laptops | [Lenovo 2021 Newest Thinkpad E15 Gen 2 Business Laptop, 15.6" Full HD Screen, Intel Core i5-1135G7 Processor,32GB RAM, 1TB PCIe SSD, Webcam, Wi-Fi 6, Zoom Meeting, Windows 10 Pro, Black, KKE Mousepad : Amazon.sg: Electronics](https://www.amazon.sg/Lenovo-Thinkpad-Business-i5-1135G7-Processor/dp/B097FF6D1W/ref=sr_1_83?crid=YDADEHAVVBLT&keywords=Lenovo+ThinkPad+P15s&qid=1643963537&sprefix=lenovo+thinkpad+p15s%2Caps%2C306&sr=8-83) |
| ASUS VivoBook 14 laptops | [ASUS VivoBook 14 X413EA-EB1322W | ASUS Store | Official ASUS Singapore Online Store](https://sg.store.asus.com/laptop/vivobook/vivobook-14/asus-vivobook-14-x413ea-eb1322w.html?utm_medium=merchantcenter&utm_source=google&camp=&adg=&gclid=Cj0KCQiAuvOPBhDXARIsAKzLQ8FU5tlLo9Brnk3hfLDkLuXMzGZ_BV6Lgn1AEYo4pfKVgcZAk-3Mv-AaAoqBEALw_wcB) |
| Hopcd monitor | [Hopcd 10.1-inch Computer Monitor,1080P Ultra Thin 16:9 WLED Backlit TFT LCD Display Monitor,VGA+HDMI+BNC+AV+USB Input / 130°(H) x 115°(V) Viewing Angle/3Wx2 Speaker Gaming Monitor(100-240V) : Amazon.sg: Electronics](https://www.amazon.sg/Hopcd-10-1-inch-Computer-Monitor-1080P/dp/B08HWCW61C/ref=sr_1_20?keywords=monitor&qid=1643650237&refinements=p_36%3A6879902051&rnid=6450031051&s=electronics&sprefix=moni%2Caps%2C338&sr=1-20) |
| Dlink Wireless AC3200 Tri Band Gigabit Cloud Router | [Dlink Wireless AC3200 Tri Band Gigabit Cloud Router, Red : Amazon.sg: Electronics](https://www.amazon.sg/Dlink-Wireless-AC3200-Gigabit-Router/dp/B00PVD3NB4/ref=asc_df_B00PVD3NB4/?tag=googleshoppin-22&linkCode=df0&hvadid=396170102331&hvpos=&hvnetw=g&hvrand=5943161560835778043&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9062515&hvtargid=pla-839155368225&psc=1) |
| FS 48 port gigabit ethernet L2switch | [FS 48-Port Gigabit Ethernet L2+ Fully Managed Switch - FS Singapore](https://www.fs.com/sg/products/72946.html?paid=google_shopping&gclid=Cj0KCQiA9OiPBhCOARIsAI0y71DL652IYlGheH7DVgs5B32JxPvfmf3cGL61f85GTTnCy2ZwPCpmSQkaAsaGEALw_wcB) |
| Netgear 8 port gigabit L2 switch | [NETGEAR 8-Port Gigabit Ethernet Plus Switch (GS108Ev3) - Managed, Desktop or Wall Mount, and Limited Lifetime Protection Plus 8 port | Lazada Singapore](https://www.lazada.sg/products/netgear-8-port-gigabit-ethernet-plus-switch-gs108ev3-managed-desktop-or-wall-mount-and-limited-lifetime-protection-plus-8-port-i1758429708-s8941260057.html?spm=a2o42.searchlist.list.12.7f956920Tekhax&search=1&freeshipping=1) |
| Grand stream's GXP1628 VOIP phone | [Grandstream GXP1628 Small to Medium Business HD IP Phone : Amazon.sg: Electronics](https://www.amazon.sg/Grandstream-GXP1628-Small-Medium-Business/dp/B00Y1EW6AS/ref=asc_df_B00Y1EW6AS/?tag=googleshoppin-22&linkCode=df0&hvadid=420603465835&hvpos=&hvnetw=g&hvrand=6116560819367768808&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9062513&hvtargid=pla-440010444946&psc=1) |
| ProLiant ml30 gen10 tower server | [Hpe ProLiant ML30 Gen10 E-2224 Black buy and offers on Techinn](https://www.techinn.com/en/hpe-proliant-ml30-gen10-e-2224/137819586/p?utm_source=google_products&utm_medium=merchant&id_producte=11860801&country=sg&gclid=Cj0KCQiA9OiPBhCOARIsAI0y71AODqCGxjsTU6JRgJawZDW-wkprxUuF7yuTUaF-2QfVSt8iegUDiPoaAnzZEALw_wcB) |
| NetGate 2100 Firewall Router | [Netgate 2100 BASE pfSense+ Security Gateway](https://shop.netgate.com/products/2100-base-pfsense) |

## Estimated Project Plan



## Future Expansion Plans

Zero Trust Network Architecture

Zero Trust Network Architecture is a security concept that requiring all users, whether in or outside the organization's network, to be authenticated, authorized, and continuously validated for security configuration and posture before being granted or keeping access to applications and data. This will improve the security of the company while allowing easy remote access to the company resources. <https://www.crowdstrike.com/cybersecurity-101/zero-trust-security/>

To achieve a ZTNA, a Software Defined Perimeter (SDP) software will be required, it is recommended to use a paid SDP service like Perimeter 81 as ZTNA is new so there is only a single option for open-source SDP which is Waverly Labs

There are multiple benefits of using SDPs (Software Defined Perimeter) over VPNs (Virtual Private Network) such as easier management, better security through isolation of connections.

https://www.cloudflare.com/learning/access-management/software-defined-perimeter/

Isolating the printers by creating VLANs per floor

As of now, creating VLANs will complicate the network and with 2 IT employees, it would not be advisable. However, when the company expands, it would be important to create VLANs to increase security, especially printers as they can be outdated and often vulnerable to attacks.

# References

Collins, T., 2020. *The Top 6 Benefits of Moving to a VoIP Telephone System*. [online] Atlantech.net. Available at: <https://www.atlantech.net/blog/the-top-6-benefits-of-moving-to-a-voip-telephone-system> [Accessed 23 December 2021].

Dezham, A., 2021. *How fast does your business internet need to* *be?*. [online] go.verizon.com. Available at: <https://go.verizon.com/resources/how-fast-does-your-business-internet-need-to-be/> [Accessed 21 December 2021].

Kinton, R., 2022. *10 Best Laptops* *For Cyber Security [For Professionals & Students]*. [online] Laptop251. Available at: <https://laptop251.com/best-laptops-for-cyber-security/> [Accessed 4 February 2022].

Murphy, D., 2017. *Three Pieces of Software You’ll Use in Office Administration*. [online] Available at: <https://www.iticollege.edu/software-used-in-office-administration/> [Accessed 15 December 2021].

Skydeck Chicago. (n.d.). *How Tall is a Storey in Feet? | Storeys to Feet*. [online] Available at: https://theskydeck.com/how-tall-is-a-storey-in-feet/.

Techadvisory.org. 2014. *Why businesses should use VoIP*. [online] Available at: <https://www.techadvisory.org/2014/04/why-businesses-should-use-voip/> [Accessed 23 December 2021].

Urban Redevelopment Authority. 2021. *Urban Redevelopment Authority*. [online] Available at: <https://www.ura.gov.sg/Corporate/Guidelines/Development-Control/Residential/Flats-Condominiums/Building-Height> [Accessed 15 December 2021].