Client Network Proposal

Table of Contents

Executive Summary

Below is an executive summary of the quote you issued to our company for a potential new network design. The executive summary is an overall abstract section detailing an overview of the report and designs made. It can also be useful for understanding how the design was completed and what interests were more important than others in regards to design and implementation. We strive for excellence and quality impact by putting our clients' needs first.

We have implemented many new network designs in the past and have a high success and recommendation rate for which continues to bring new us new clients and overall growth to our company. We factor in various options and opinions from clients to ensure we create the best possible network design that suits our client's needs.

A good network design is useful but also crucial to ensure information travels smoothly and successfully across a network.

There are many different types of network designs, however, we have put together one of the best case network designs with your business needs at heart as well as making sure performance is good using fibre optic cables to transmit data close to the speed of light and reducing the number of hardware switches needed to reduce overall cost.

Communication can be a major part and key to success and there is no difference when it comes to digital communication. To transmit information you first need to have a network, a robust system that deals with everything being sent across the internet.

We aim to design and build an efficient and successful network, covering all options crucial with various successful factors implemented, such as structure, cost, efficiency, routing, IP assigning, scalability, and availability.

Every paramount option will be taken into account, from the types of cabling to cost and performance. We understand as a business owner it is important to keep control of everything and at the same time ensure that work goes ahead smoothly, this is an important part and we make sure to take it extremely seriously when designing new networks.

We outcompete most of our competitors since we often use decomposition to break complex problems and tasks up into tangible smaller steps to ensure that each task is worked on at a time, resolving to a better overall solution.

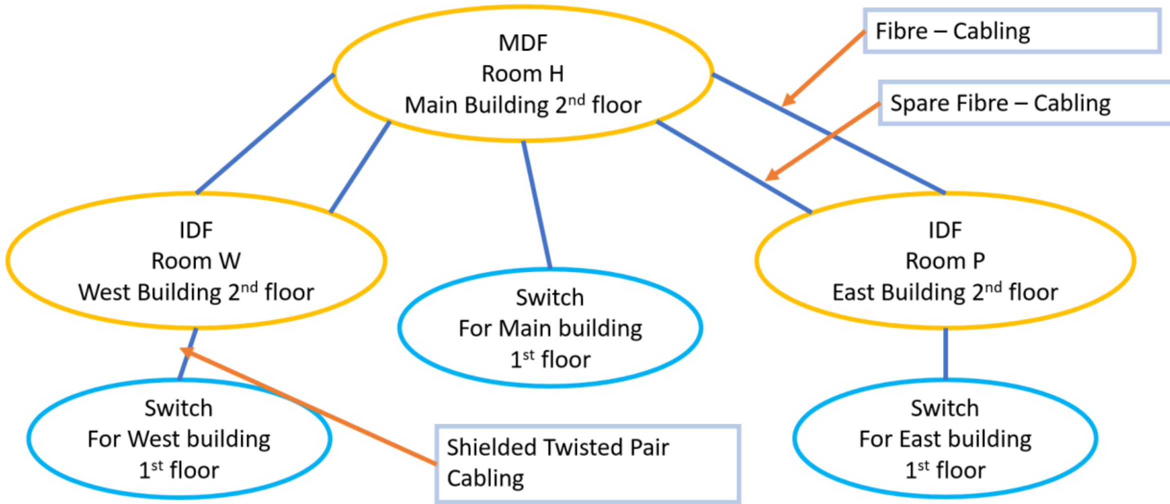
We are aware that every business owner also wishes to make sure a solution is worthwhile and not overspent for, which is why we take into account the cost and try to limit it as much as possible to be better for the client without reducing the impacting performance of the network design.

We have taken opportunities to reduce cost as much as possible and took other measures in order to raise performance to make data transmission even faster which a lot of rival competitors seem to overlook.

Designs and implementation of a physical and logical topology for the network will be made as well as layer 2 LAN topology, layer 3 topology and IP/subnet addressing. These decomposed projects, once concatenated together, serve to provide your company with a commercial-grade network design that is not only efficient but also well respected.

We hope to have you join our client base so we can help make better solutions and improve the overall digital world through the design and implementation of new network designs of the highest standard.

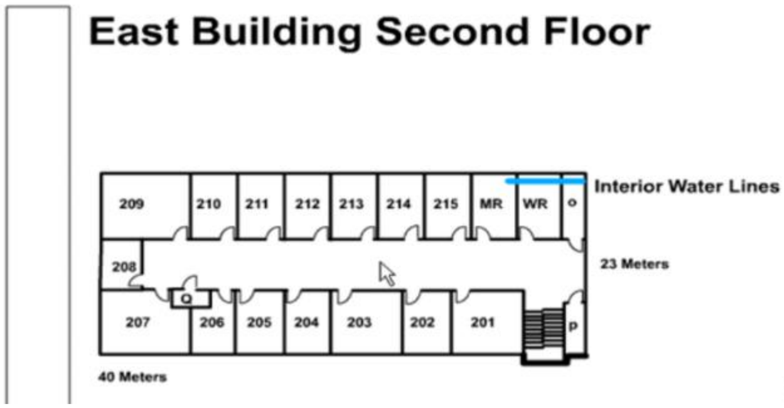
2. Layer 1 Logical Design



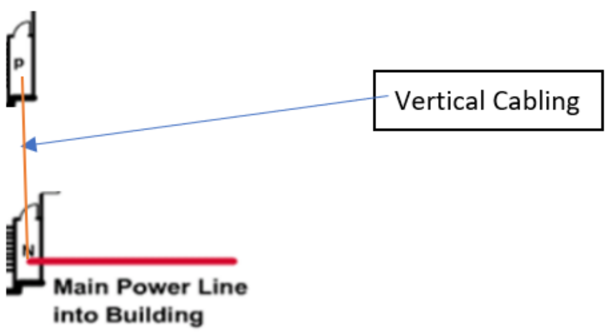
2. Layer 1 Structured Cabling

The **MDF** is going into H. Room H uses florescent lighting which produces less heat compared to incandescent lighting. Another reason why I picked this room was because of the electrical outlets in the room. The room has five electrical outlets which are plenty and would prove to be very useful in the future.

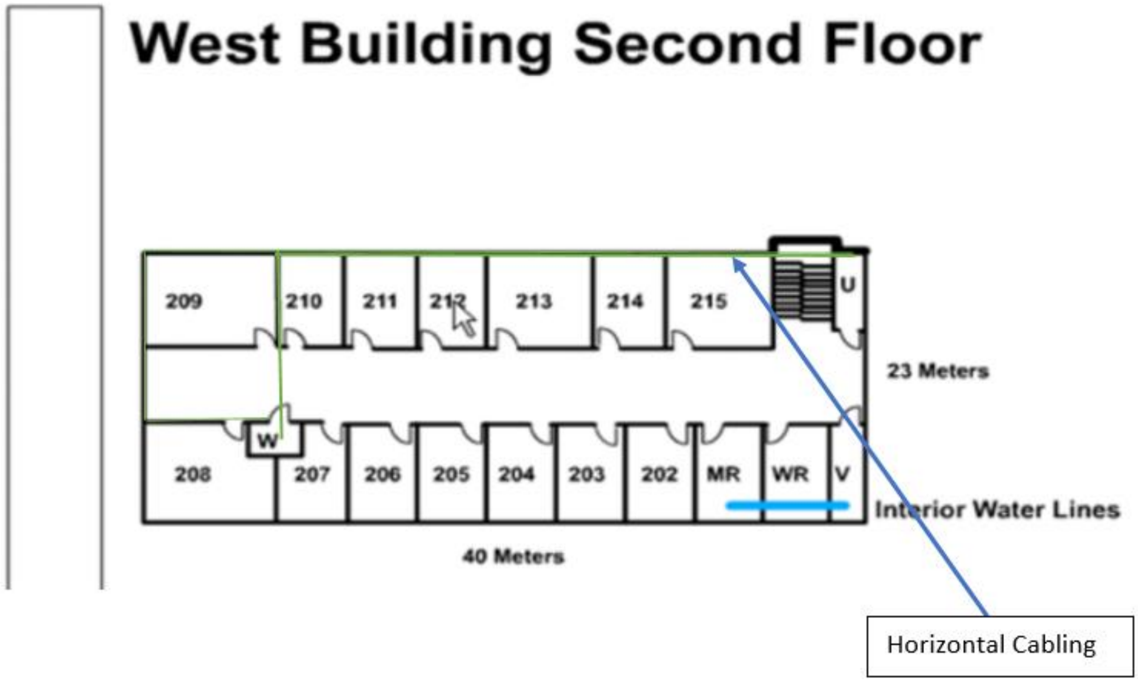
https://www.broadbandbuyer.com/products/22979-esscable-urt-650/
The estimated cost of cable: £8.61
Required cable length: 41 m required



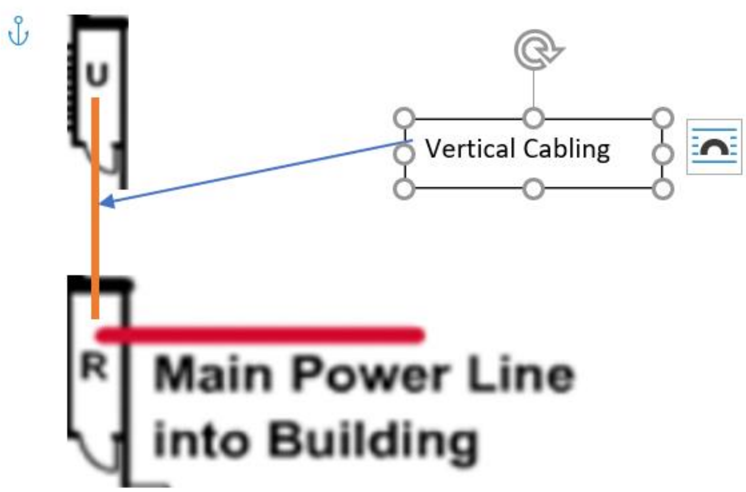
The location of the **IDF** is going to be in room P. Room P uses fluorescent lighting which produces less heat compared to incandescent lighting. Another reason why I picked this room was because of the electrical outlets in the room. The room has five electrical outlets which are plenty and would prove to be very useful in the future. Another reason why I chose this was because the room was within proximity to the main below that was below in room N, on the first floor.



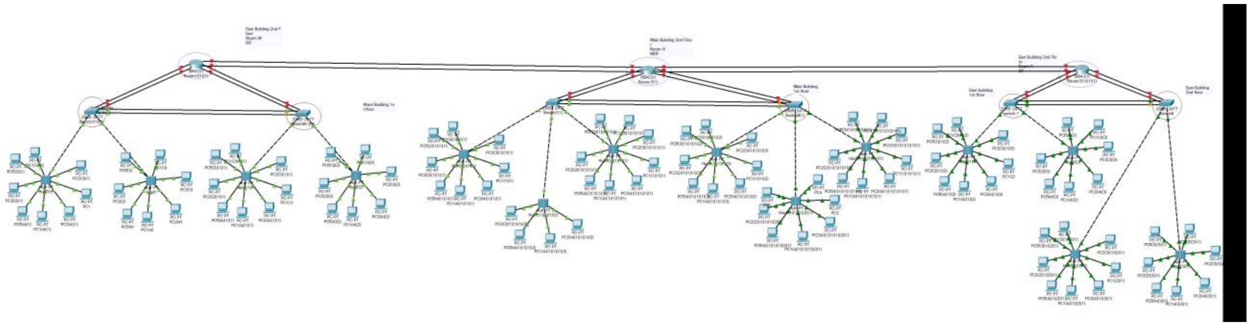
https://www.broadbandbuyer.com/products/15613-esscable-urt-610k/
Cost of the cable: £2.08
Required length: 6.6m x 2 = 12.12m



The location of the **IDF** is going to be in room W, as the other 2 rooms have asbestos within them, which has a negative impact on the health. In addition, the room has no water lines going through the building which makes the room feel more secure as well as the addition of the lockable door.



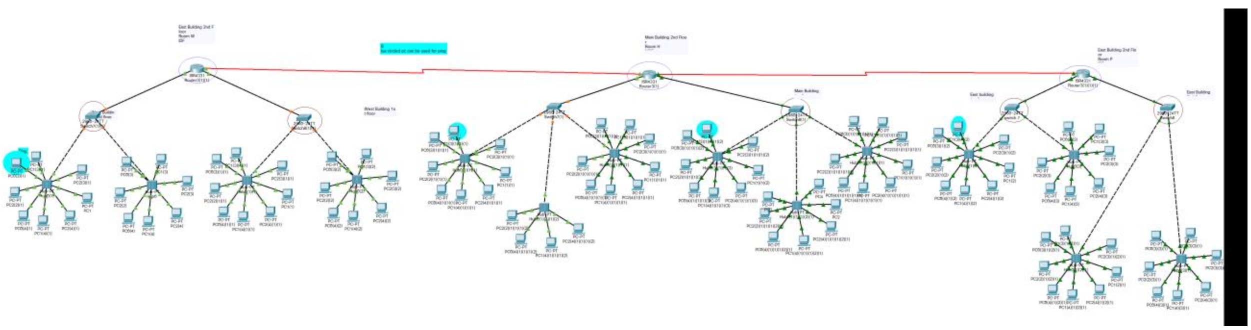
3. Layer 2 LAN topology



Hubs are used to create the star topology. Each department is has a switch (Layer 2). All the hubs are connected to the respective switch in each department. To the expansion of end devices, new hubs will be added and will be connected to the switch. 23 hub can be connected to a 24-T switch which means 23 * 8 = 184 end devices. We can add more switches if we need more end devices in a single department than that.

Total 6 switches are used as one for each department.

4. Layer 3 topology



VLSM

For the departments: (LAN)

Subnet Name	Needed Size	Allocated Size	Address	Mask	Dec Mask	Assignable Range	Broadcast
A	16	30	192.10.33.64	/27	255.255.255.224	192.10.33.65 - 192.10.33.94	192.10.33.95
B	16	30	192.10.33.96	/27	255.255.255.224	192.10.33.97 - 192.10.33.126	192.10.33.127
C	21	30	192.10.33.32	/27	255.255.255.224	192.10.33.33 - 192.10.33.62	192.10.33.63
D	24	30	192.10.33.0	/27	255.255.255.224	192.10.33.1 - 192.10.33.30	192.10.33.31
E	16	30	192.10.33.128	/27	255.255.255.224	192.10.33.129 - 192.10.33.158	192.10.33.159

F	16	30	192.10.33.160	/27	255.255.255.224	192.10.33.161 - 192.10.33.190	192.10.33.191

For routers: (WAN)

G	2	2	192.10.33.192	/30	255.255.255.252	192.10.33.193 - 192.10.33.194	192.10.33.195
H	2	2	192.10.33.196	/30	255.255.255.252	192.10.33.197 - 192.10.33.198	192.10.33.199

Above are the subnetting tables used in Lan and Wan connections. Lan connections are with giga-Ethernet ports of a router connected to the switch. While Wan connections are with serial ports of a router connected to other serial ports of the router. Rip v2 protocol is implemented as routing protocol as rip v1 doesn't support VLSM. You can ping from the PCs that are circled in sky-blue in Step3 topology. There are assigned respective Ip addresses.

5. IP Addressing

Overview

The available class C IP address range of 196.10.33.0 to 196.10.34.0, allows 256 hosts and 254 usable hosts due to 196.10.33.1 being reserved for the router and 196.10.33.255 being reserved for the broadcast address.

IPv4 Addressing

The area between the host and the physical link is called an interface as seen on the OSI model. A router has several links connected; therefore a router has multiple IP addresses, an IP address is correlated with an interface instead of a host. IPv4 addresses are exactly 32-bits long (consisting of 4 bytes) with a max of 2^32 addresses. They are written often in decimal, dotted notation and separated by a period within each. Example: 193.32.216.9 === 11000001 00100000 11011000 00001001 and the same is done for the subnet mask address.

A subnet is the part of a network connected to end systems and routers. A subnet can use the placeholders of x.x.x.x/y where the /y is a CIDR notation, the leftmost y bits of the 32-bit quantity defines the subnet address. Subnets can also be calculated by the IP address for the network and the subnet mask address for the host.

Below is data regarding some of the Class C IP address information about the network consolidated into key points.

A	B	C	D	E	F	G	H
Class	Leading Bits	net number bit field	size of rest bit field	Number of networks	addresses per network	start address	end address
C	110	24	8	2,097,152 (2^21)	256 (2^6)	196.10.33.0	196.10.34.0

How the IP addresses will be distributed

Range: 196.10.33.0 and 196.10.34.0

Since the range allows for 256 addresses between the given IP block range, this would allow 128 hosts per network.

Subnets are calculated by using the subnet mask address in binary, the given subnet address is 255.255.255.0 which correlates to 11111111.11111111.11111111. 00000000 in binary. Taking this binary and increasing the 4th (last) octet allows the calculation of subnet answers to be expressed.

The number of subnets is calculated by 2x where x is the number of bits changed in the last octet, therefore as the answer is 1 bit the calculation is performed as 2^1 = 2 subnets needed.

To calculate the number of hosts available on each subnet we use the equation of 2y where y is the number of remaining, untouched bits (also known as the zeros), in the given calculation from the subnet mask we can show that 2^7 = 128 hosts per subnet, giving the subnet range of 0-127 due to the IP addresses starting at zero, overall making 128 hosts in total.

Two of these 128 hosts are reserved for the router default gateway and the broadcast address to speak to all other hosts within the network subnet. Concluding with (128-2) 126 available hosts and IP addresses.

The valid IP range of the subnet can be given through the previously calculated values. Since the subnet range is 0-127 this gives a total host value of 128 as previously calculated, which resolves to the actual IP range of 196.10.33.0 and 196.10.33.128 per subnet, since there are two subnets this equals out to (128*2) = 256 which is the maximum address for the range of 196.10.33.0 and 196.10.34.0.

Worst Case Switches

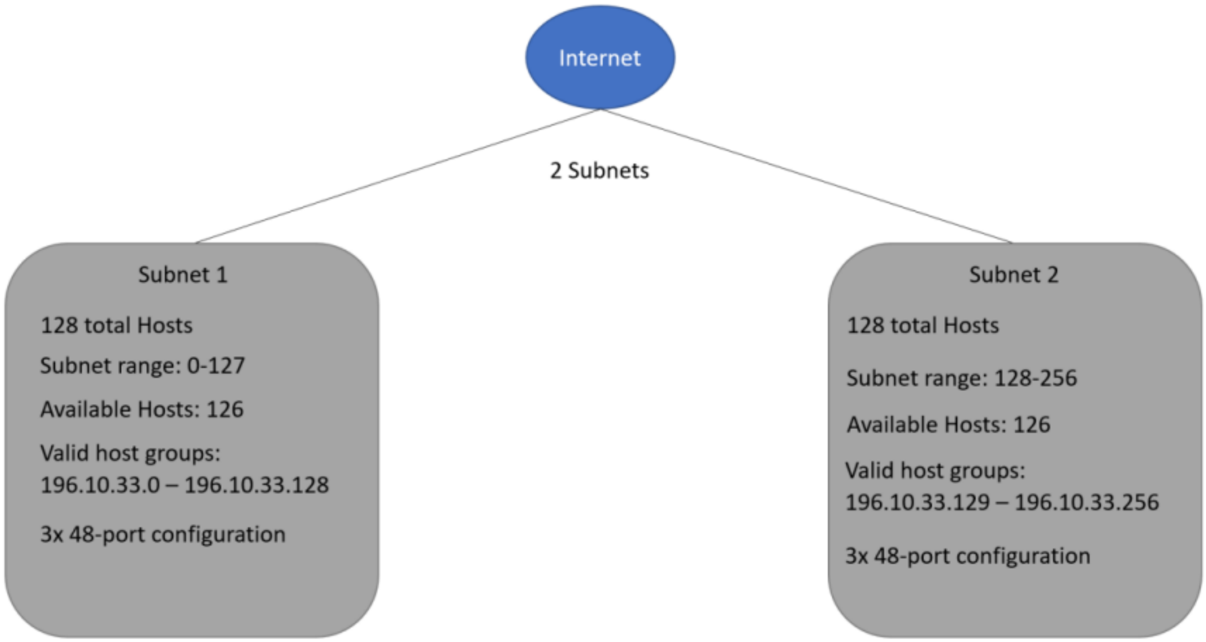
Switches come in 5, 8, 10, 16, 24, 28, 48, and 52-port configurations. Each switch requires the usage of one port to make the network connection, always leaving n-1 for ports on switches.
If using port-8 configuration switches, for example of 50 devices would require 7 switches (7*8= 56 devices). Having 7 switches of a low ort configuration would not be cost-effective so we devised a better solution.

Best Case Switches

A better alternative is to conclude with having three port-48 configuration switches, one in each department (each floor) and connect all devices between them to the internet. This would reduce the need for 14 port-8 configuration switches, more cost-effective and less maintenance for each of the switches.

Since there are 128 total hosts per subnet, using 48 port configuration switches only requires (128/48) 2.6 switches, rounded up is three for each subnet, reducing the overall cost to implement and purchase more switches of a lower port configuration.

A visualisation Diagram can be seen below of all detailed information based on the subnetting and configuration switches



6. Appendix

Title of Task	Student Name	Student ID
Layer 1 Logical Design	Yaaseen Inayat	001117573
Layer 1 Structured Cabling	Yaaseen Inayat	001117573
Layer 2 LAN Topology	Zakaria Baksh	001102163
Layer 3 Topology	Zakaria Baksh	001102163
IP Addressing	Cameron R Noakes	001106490
Executive Summary	Cameron R Noakes	001106490
Report Documentation	Tharshan Vijayakumaran	001112250