NEW ERA UNIVERSITY COLLEGE

Faculty of Computer Science & Information Computing Technology

Department of Information Computing Technology

Course code and Subject

TNWK213 & Networking ASSIGNMENT

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INTRODUCTION

The objective of this network design project is to establish a comprehensive and reliable Local Area Network （LAN） for a company campus comprising two buildings, each with two floors. The network must ensure seamless internet connectivity and efficient internal communication for all devices within the buildings. This project will involve planning and implementing a robust network topology, selecting and configuring appropriate network devices, and ensuring secure and efficient connections between the buildings.

Background

The company campus consists of two office buildings, each with two floors. The network design needs to cater to the specific requirements of an office environment, providing reliable internet access, facilitating internal communication, and supporting various office devices such as computers, printers, and VoIP phones. The network must be scalable, secure, and capable of handling the data traffic generated by the office activities.

Objectives

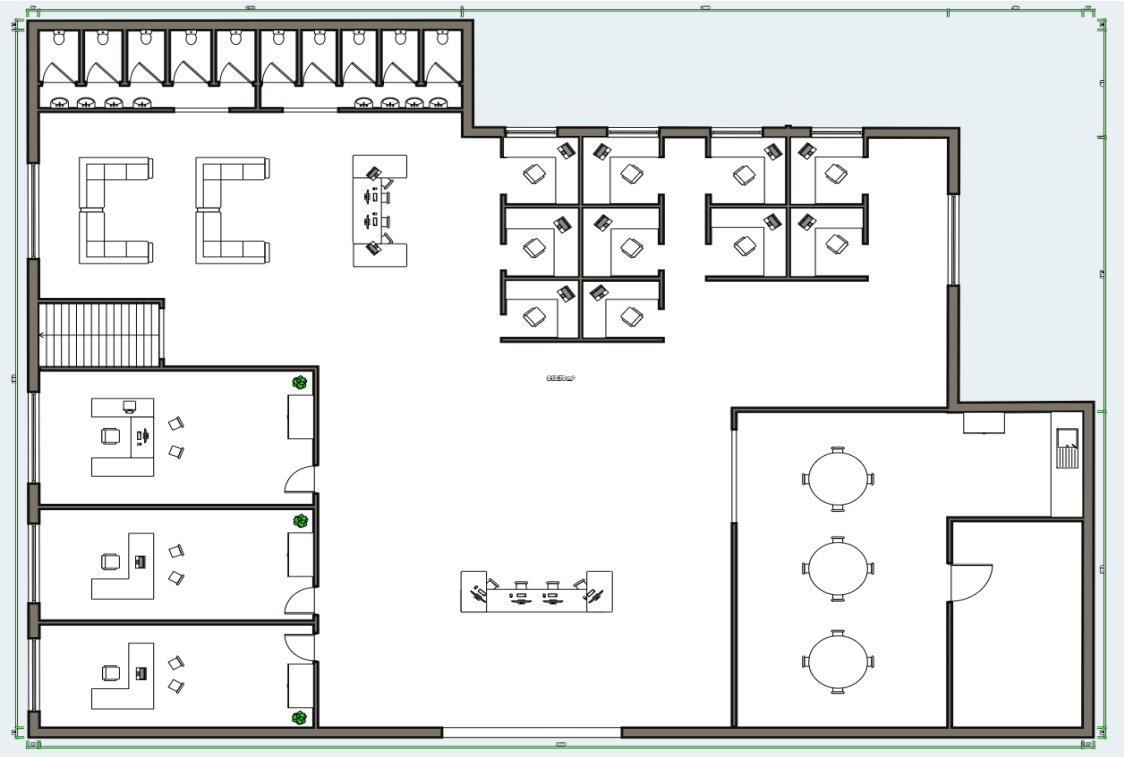
1. **Network Connectivity**: Ensure that every device within the buildings can connect to the internet and communicate efficiently with other devices on the network.
2. **Network Topology:** Design a LAN topology that connects the buildings and supports efficient data flow and scalability.
3. **Device Setup:** Set up and configure network devices, including switches, routers, and access points, to provide comprehensive coverage and high performance.
4. **Inter-building Connections:** Establish high-speed, reliable connections between the buildings to enable seamless communication and data transfer.
5. **Security and Redundancy:** Implement security measures and redundancy to protect the network from failures and unauthorized access.

FLOOR PLAN LAYOUT

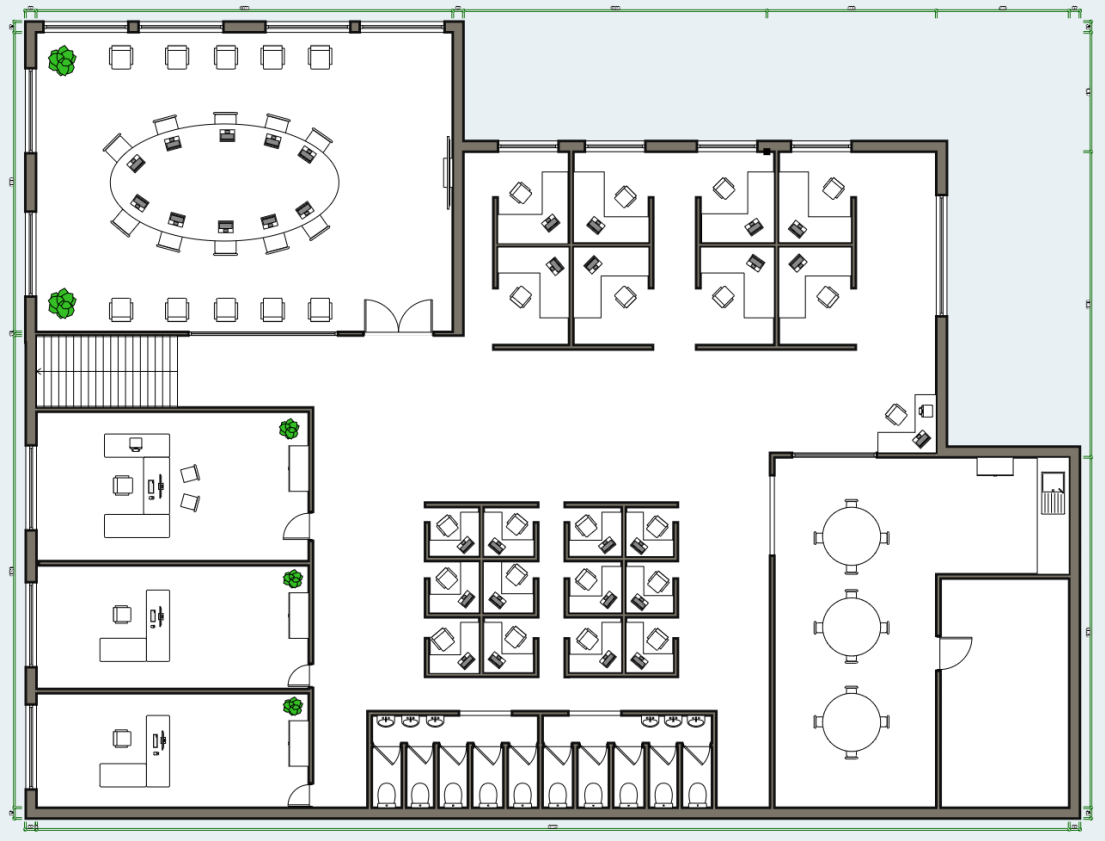
2.0 FLOOR PLAN LAYOUT

2.1 Floor plan and legend

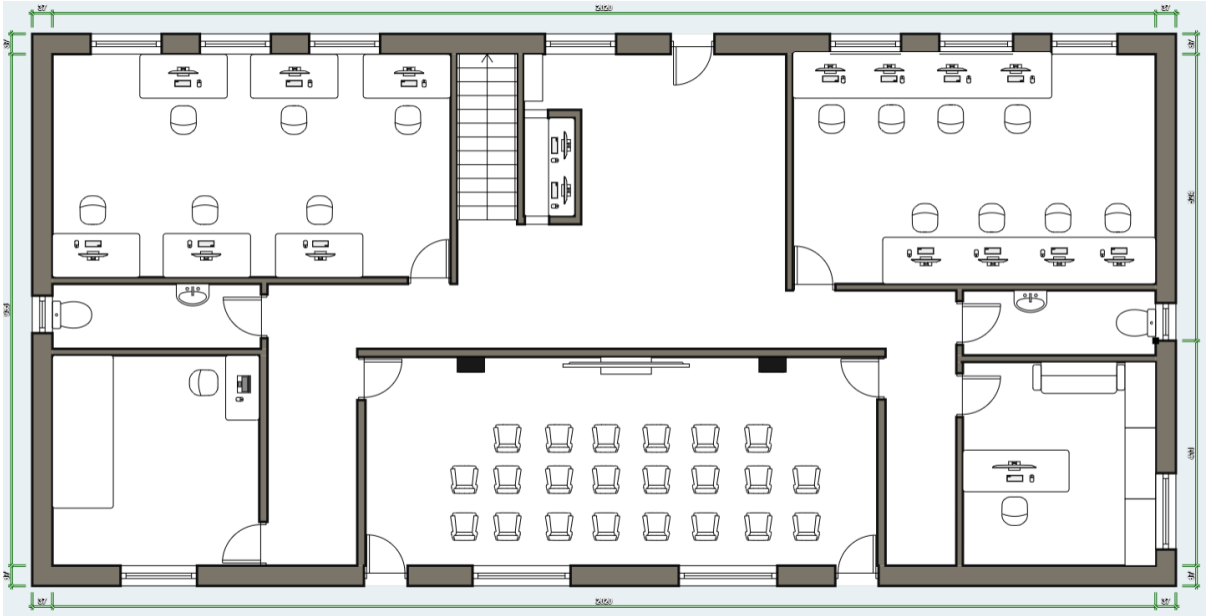
Office 1st floor (Block A)



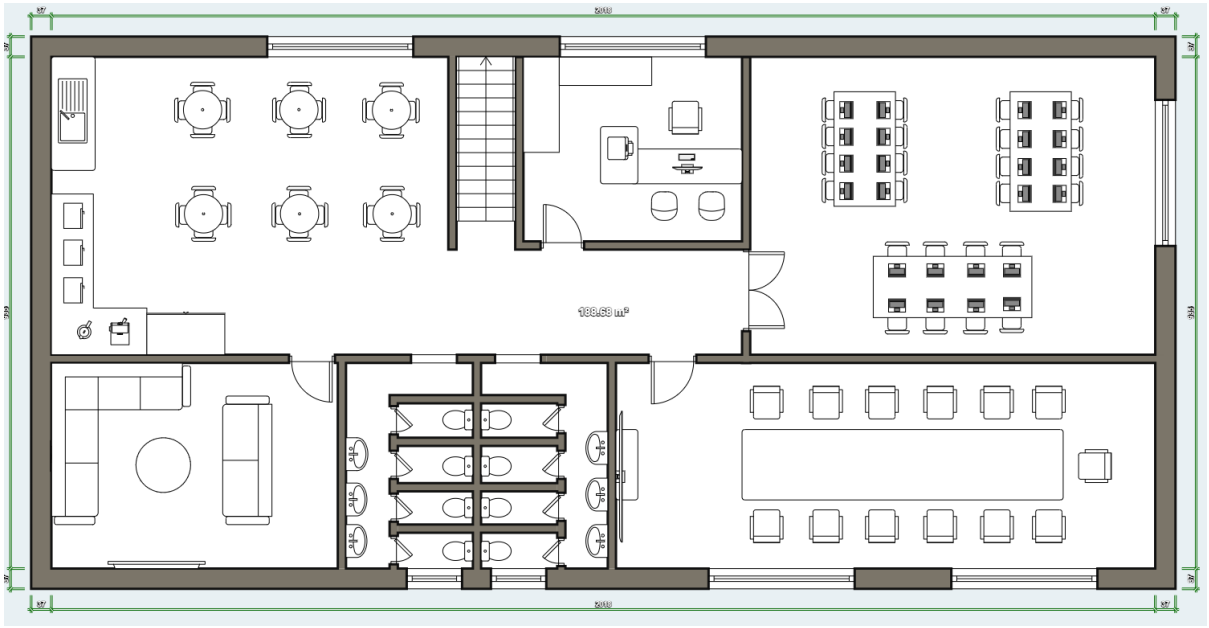
Office 2nd floor (Block A)



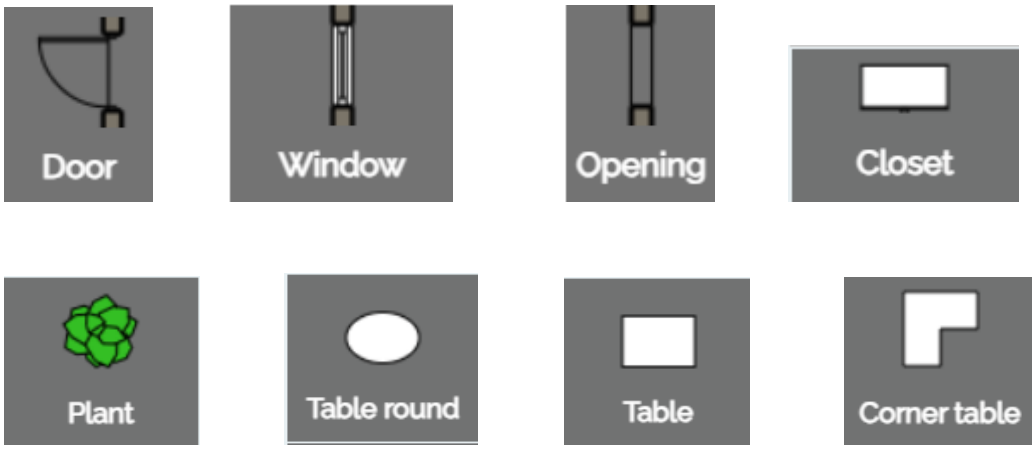
Office 1st floor (Block B)



Office 2nd floor (Block B)



Legend:


Door
Window
Opening
Closet
Plant
Table round
Table
Corner table

2.2 Justification of Floor Plan Design

Rationale for Floor Plan Design

The proposed floor plan design consists of two different buildings: we chose two office buildings, each with two floors. Enough to allocate all the required facilities, namely meeting rooms, toilets, offices, staff and server rooms.

Rationale for Block A floor plan for the first floor. The decision to allocate the first floor for reception and offices was made for good reasons. The reception is an essential space for any corporate establishment. Placing them on the first floor allows for easy access for guests and employees, reduces the need to climb stairs, and facilitates movement within the building. The first floor office also features a wall-less design in the center, ensuring that employees do not have to walk through the entire building to reach their workspace. It fosters a sense of community among employees and promotes interaction between employees in different job positions. In addition to this, the server room in the first floor links the first and second floors.

The reason for placing it on the first floor is to facilitate future maintenance. Allocating the second floor of Building 1 for meeting rooms and offices is a logical choice. The first floor is used to serve guests while the second floor is focused on the company itself (work handovers, company orders, etc.). Placing the meeting room on the second floor minimizes the impact of vibration or other floor activities that may occur.

Block B Floor Plan The grounds are located on the first floor. Placing the front desk on the first floor ensures easy access for everyone, including visitors from outside the institution. Large windows, natural light, and comfortable seating areas can be integrated to create an environment conducive to office work. In addition, there is a showroom on the first floor for staff to display and discuss the company's work progress. Offices and Server Room Designating the first floor of Block B as offices and server rooms is a practical choice. Offices usually house administrative staff, faculty, and other support staff. Placing these functions on the second floor allows for easy access for staff and separates common spaces such as administrative activities. In addition, there are small cafeterias, lounges, and meeting rooms on the second floor that allow employees and bosses to take a break, eat, and hold meetings.

4.0 NETWORK DEVICES

1.Router

Motorola MB8600 vs MB8611

Product Name	Motorola MB8600	Motorola MB8611
Size	7.88 × 7.25 × 2.25 inches	7.88 × 7.25 × 2.25 inches
DOCSIS Technology	3.1 and 3.0 services	DOCSIS 3.1 services
Downstream speed	3.8Gbps	1 Gbps
Upstream	1 Gbps	800 Mbps
Channel	32 × 8 / 2 × 2	32 × 8 / 2 × 2
RAM	512MB	512MB

Price	$149.99	$127.00

In evaluating the Motorola MB8600 and MB8611 modems, we chose the MB8611 for its advanced DOCSIS 3.1 technology and more affordable price. While the MB8600 offers higher current-speed performance with downstream speeds of up to 3.8 Gbps and upstream speeds of 1 Gbps, the MB8611 provides DOCSIS 3.1 support at a lower cost of $127.00 compared to the MB8600's $149.99. The MB8611's lower downstream speed of 1 Gbps and upstream speed of 800 Mbps are offset by its future-proofing capabilities and better value, making it the preferred choice for those seeking the latest technology at a reduced price.

2.Switch

S3150-8T2FP and the S3410-10TF-P

Product Name	S3150-8T2FP	S3410-10TF-P
Forwarding Performance	15 Mpps	30 Mpps
Switching Capacity	20 Gbps	40 Gbps
Port Quantity	8 x 10/100/1000BASE-T RJ45, 2 x 1G SFP	10 x 10/100/1000BASE-T RJ45, 2 x 1G SFP
Gigabit Ports	2 x 1G SFP	2 x 1G SFP
Wireless/Wired	Wired	Wired

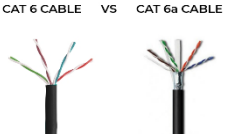
Price（USD）	US$299.00	$369.00
Total Number of IPv4 Routes	128	64
MAC Address	8K	16K
ARP Table	384	1000

When choosing between the S3150-8T2FP and S3410-10TF-P switches, the S3410-10TF-P stood out for its higher performance, so we chose the S3410-10TF-P as the switch. It offers a forwarding rate of 30 Mpps and a switching capacity of 40 Gbps, which is significantly better than the 15 Mpps and 20 Gbps of the S3150-8T2FP. In addition, the S3410-10TF-P includes more ports (10 Gigabit Ethernet vs. 8) and supports larger MAC address tables (16K vs. 8K) and ARP tables (1000 vs. 384). While the S3410-10TF-P is priced at $369.00 and the S3150-8T2FP is priced at $299.00, the S3410-10TF-P's enhanced performance and more robust connectivity options make it the best choice for demanding network environments.

3.Cabling

Cat6 – Has a speed up to 1.000 Mbit/s, 250MHz

Cat6a – Has a speed up to 10.000 Mbit/s, 500MHz

Feature	Cat6	Cat6a
Speed	Up to 1 Gbps	Up to 10 Gbps
Frequency	250 MHz	500 MHz
Maximum Length 	100 meters	100 meters
Shielding	Unshielded or Shielded	Usually Shielded

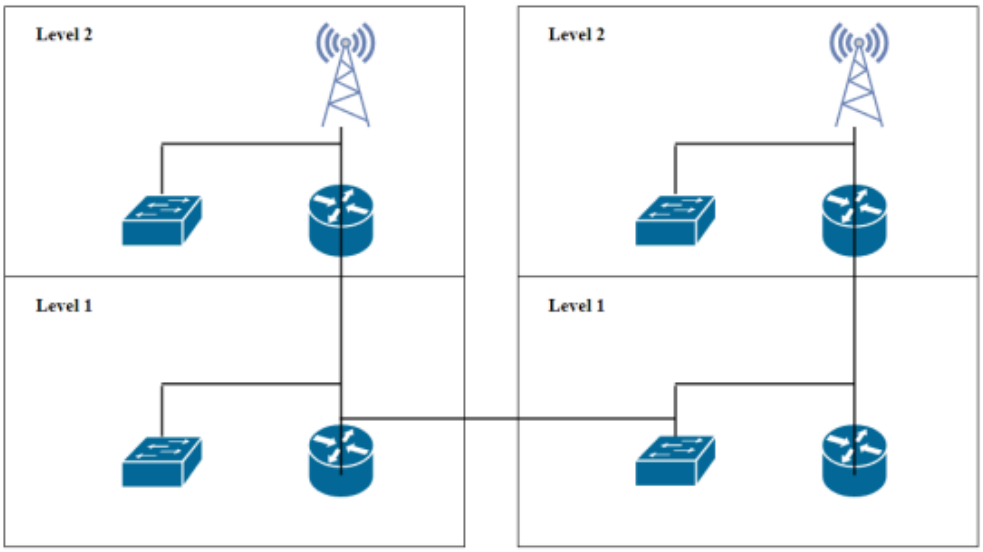
Use Case	General office use, suitable for most applications	High-performance applications, data centers, and environments with higher electromagnetic interference
cost	$0.20 to $0.40 per foot	$0.30 to $0.60 per foot

Given the notable distinctions in specifications and intended uses between Cat6 and Cat6a cables, we opted for Cat6 cabling. Cat6 can handle lengths of up to 100 meters and supports speeds of up to 1 Gbps at a frequency of 250 MHz, making it appropriate for regular office use. It is available in both unshielded and shielded variants, and its prices range from $0.20 to $0.40 per foot. By contrast, Cat6a provides a major improvement, with frequencies of 500 MHz and speeds of up to 10 Gbps. While Cat6a likewise has an upper limit of 100 meters, it usually has shielding to improve signal integrity. The price increase for this improved capability is between $0.30 and $0.60 per foot. All things considered, Cat6a provides extremely high performance at a pricing point, while Cat6 is still reasonably priced for typical office settings.

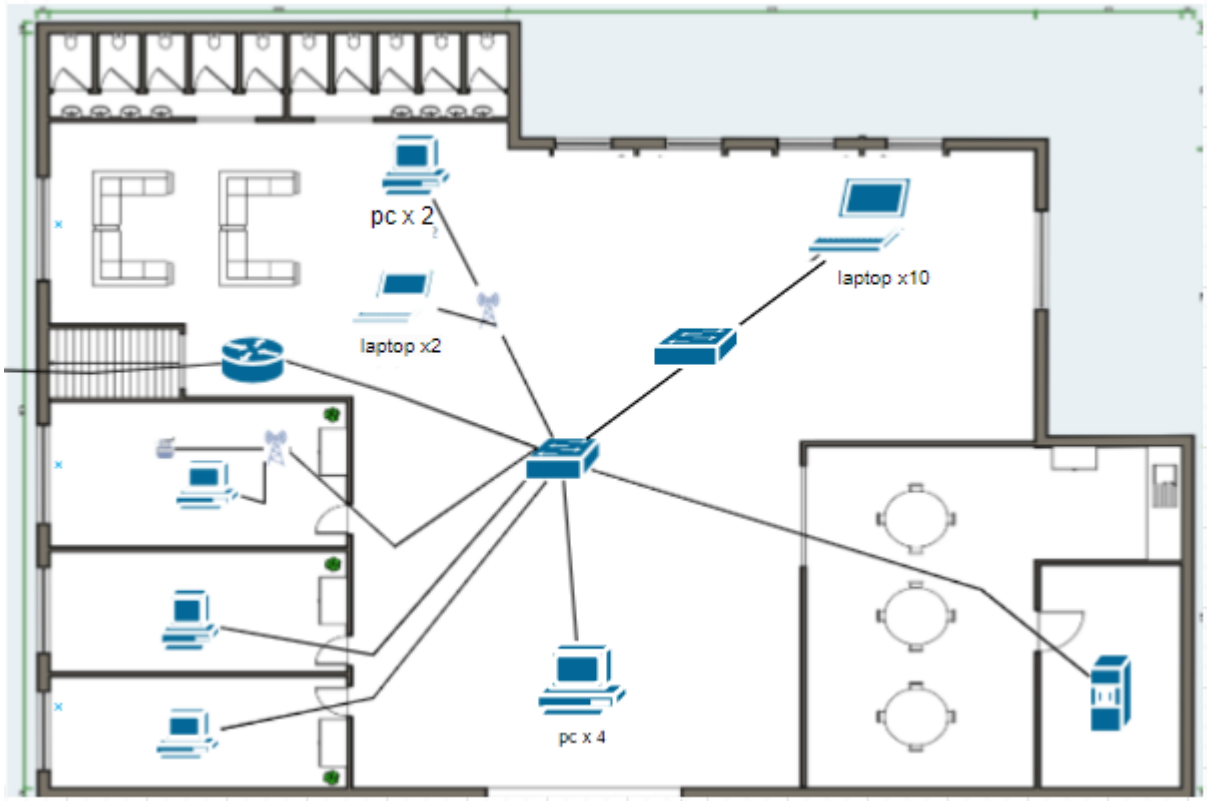
NETWORK DESIGN

4.1 Side View of Network Diagram

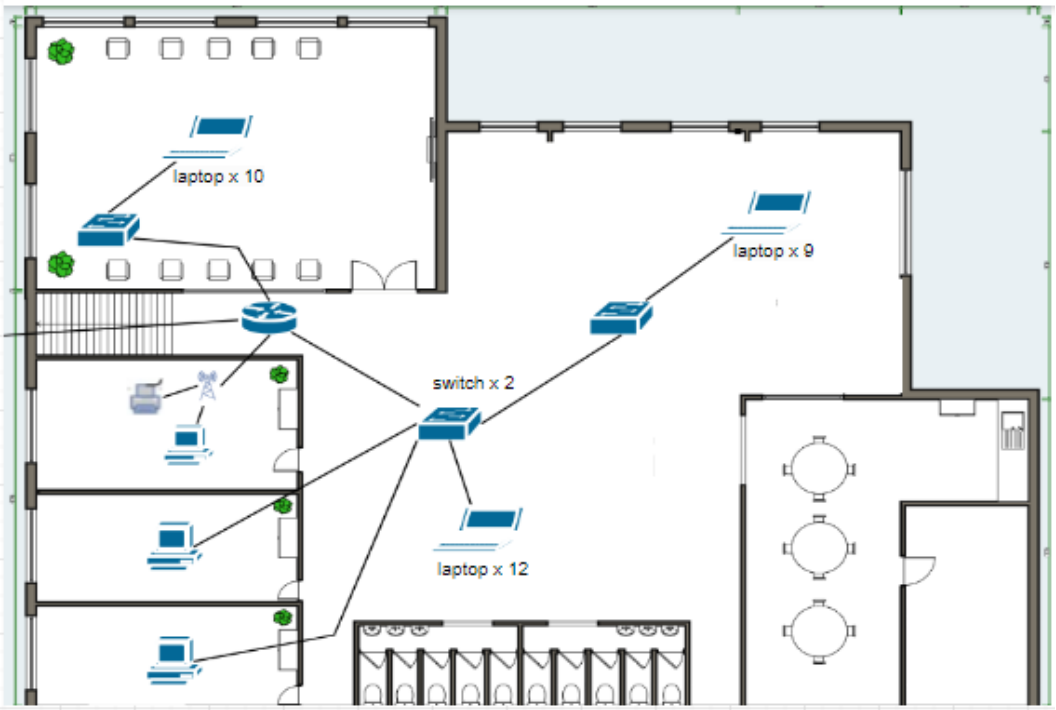
Building 1 Building 2



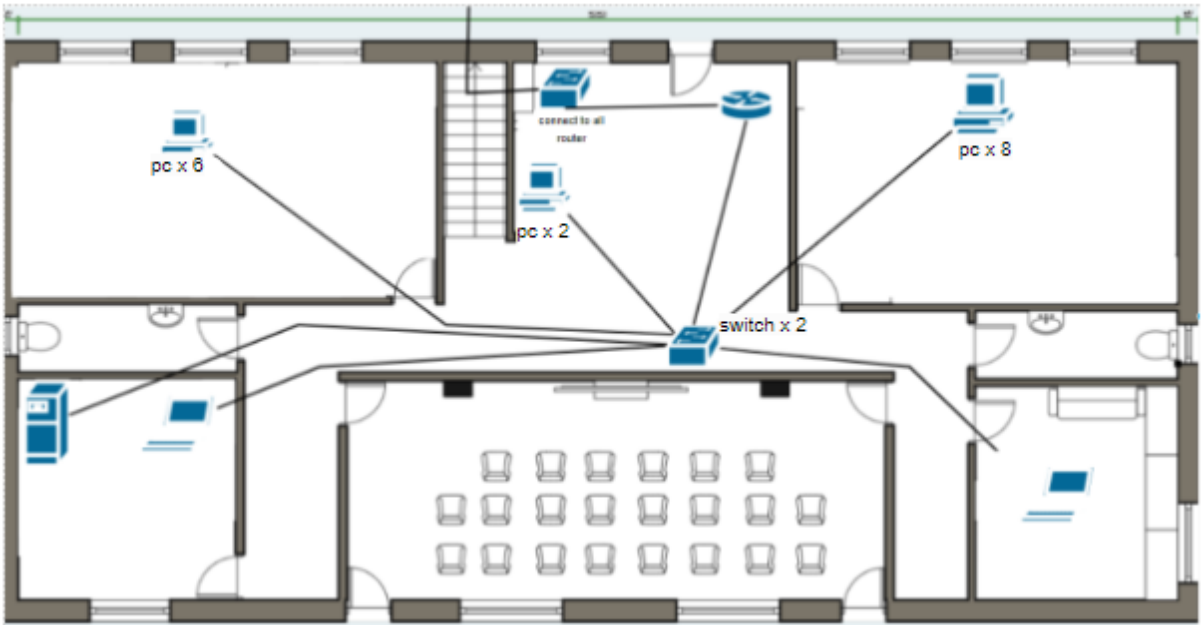
Office 1st floor (Block A)



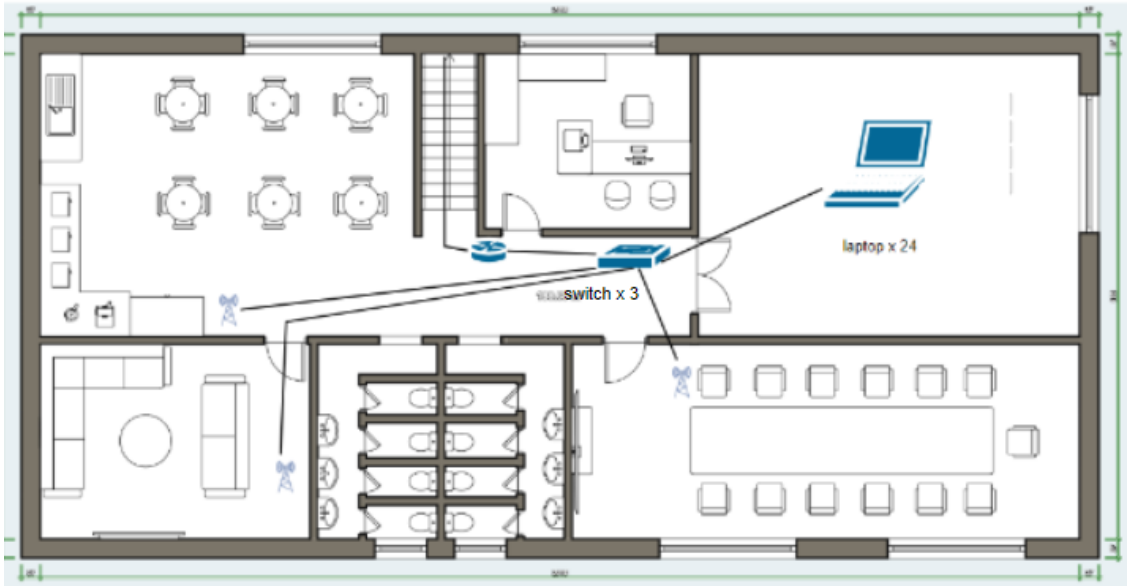
Office 2st floor (Block A)



Office 1st floor (Block B)



Office 2nd floor (Block B)

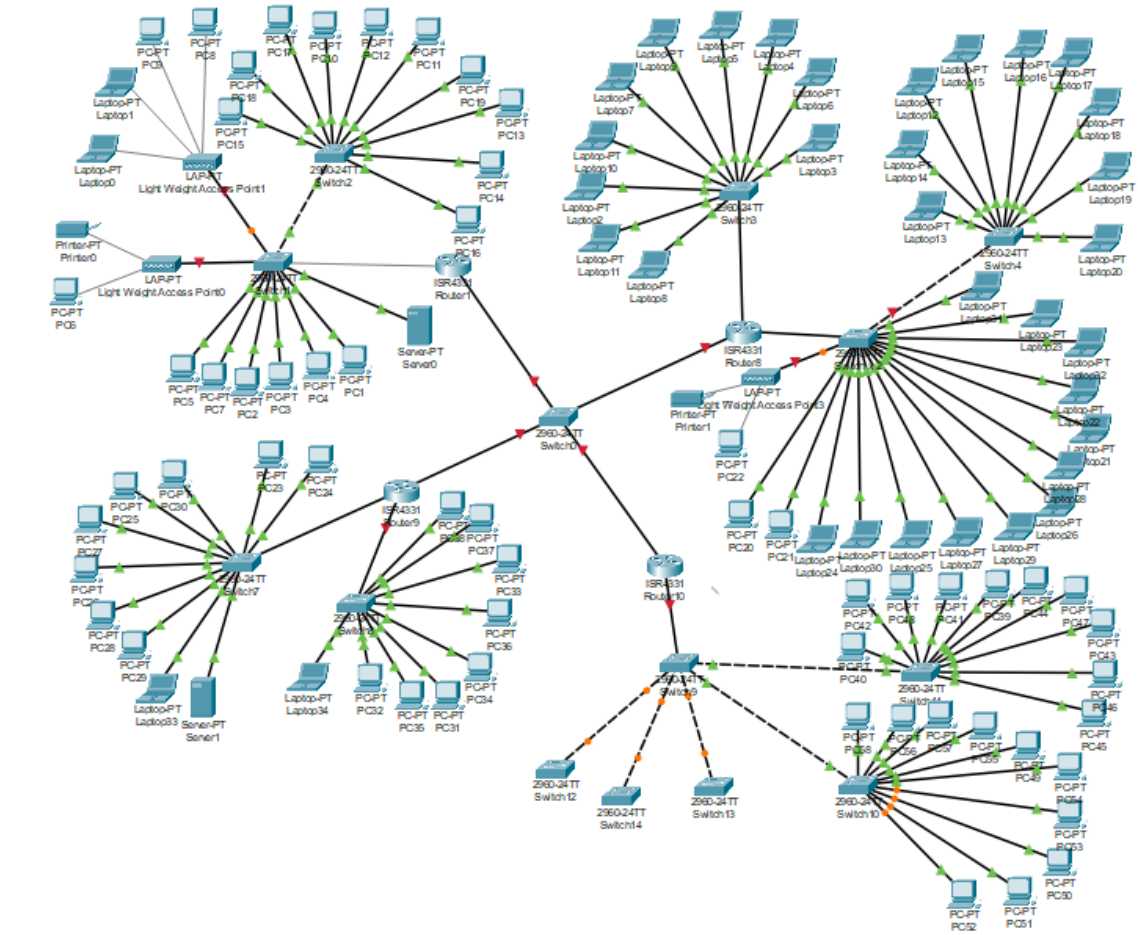


 pc  wireless access point  server  laptop 

router

 Printer  switch

4.3 Network Design （Packet Tracer）



5.0 INDIVIDUAL COMPONENTS

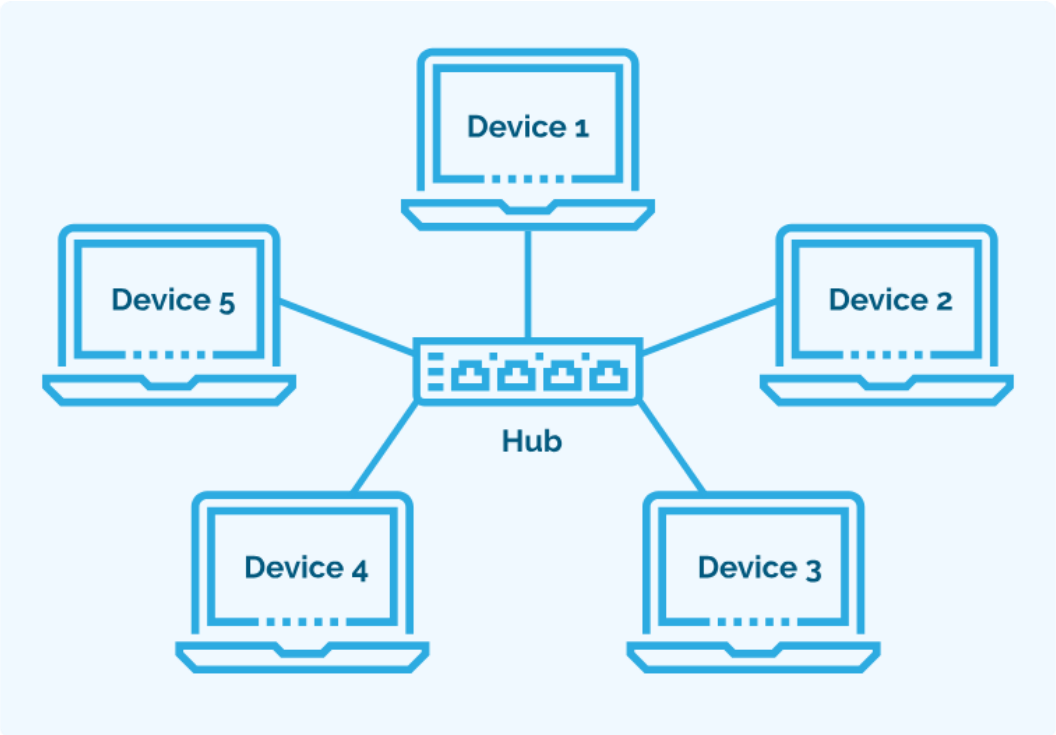
5.1 Edmund Ong Tze Fung 2370107-DEC

Design the Floor Plan Layout of Block A **Office 1st** and 2nd floor, Explanation of Block A topology part and the difference between Star topology and Ring topology . And do PPT.

Block A topology

The Network topology design use in the Office 1st floor (Block A) and Office 2st floor (Block A) is Star topology. This setup combines features of ring and bus topologies, forming a star-shaped structure. In this structure is all devices are connected to a central device, such as a switch or hub, through separate cables. Each device is directly connected to the center device, which handles all network traffic. This topology makes managing and troubleshooting the network much simpler, and also facilitates expansion because new devices can be easily connected to the center device without changing existing connections.

Star Topology



We chose this design because the star structure is suitable for organizations with multiple departments or teams on different floors. In our case, Block A has two floors and has different areas, such as employee offices, manager offices, and meeting rooms. Each area can be connected to the network through a central hub, which simplifies management. Compared with the ring structure, the star topology is easier to scale and troubleshoot, and it also avoids problems caused by network congestion and traffic overload.

Comparison between Star Topology and Ring Topology

	Star Topology	Ring Topology
Routing	- Nodes connect to a central hub or router, making routing simple and efficient.	- Data is transmitted in the ring, passing through each node, which may slow down the network speed if there are many connected devices.
Cost	- More expensive due to the need for more cables and a central hub. However, the ease of management and expansion can justify these costs.	- The cost is moderate, but special connectors and possible required repeaters will add to the expense.
Advantage	- Very reliable; a single cable failure will not affect other nodes. - High performance with minimal data conflicts. - Easier installation and expansion. - Adding or removing nodes will not affect the entire network. - Easier troubleshooting due to centralized control.	- Data transfer speed is consistent because data is passed in one direction. - Fewer cables are required compared to star topology.
Disadvantage	- If the central hub fails, the entire network is affected. - Requires more cables than other topologies.	- If any node fails, the loop may be interrupted, causing the entire network to fail. - Troubleshooting may be difficult. - Limited scalability.

5.2 WONG CHEE HANG 2370088 – DCS

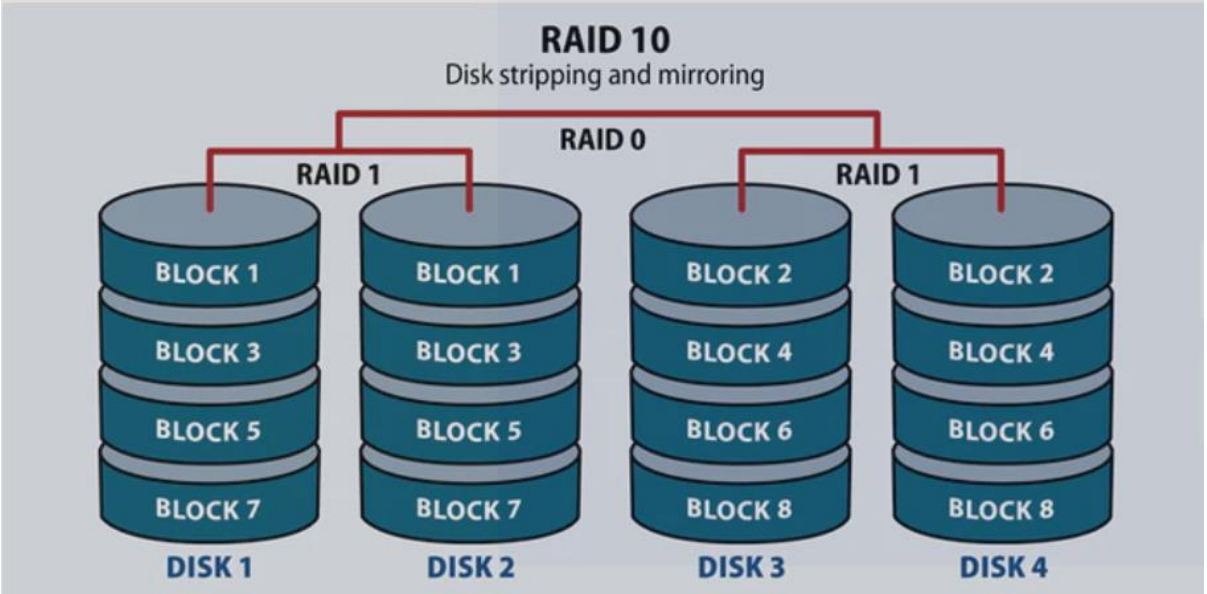
Drawing network design diagram. Explanation of network reliability. Explanation of introduction part.

Network Reliability

Network reliability is crucial for any organization as it ensures continuous and uninterrupted operation of business-critical systems, safeguarding against costly downtime and data loss. A reliable network supports seamless communication, real-time data transmission, and the smooth functioning of mission-critical applications, which are essential for maintaining productivity and customer satisfaction. Additionally, it plays a vital role in enhancing security, ensuring compliance with regulatory standards, and providing the scalability needed for business growth. In an increasingly connected world, network reliability is a cornerstone of operational efficiency and long-term success.

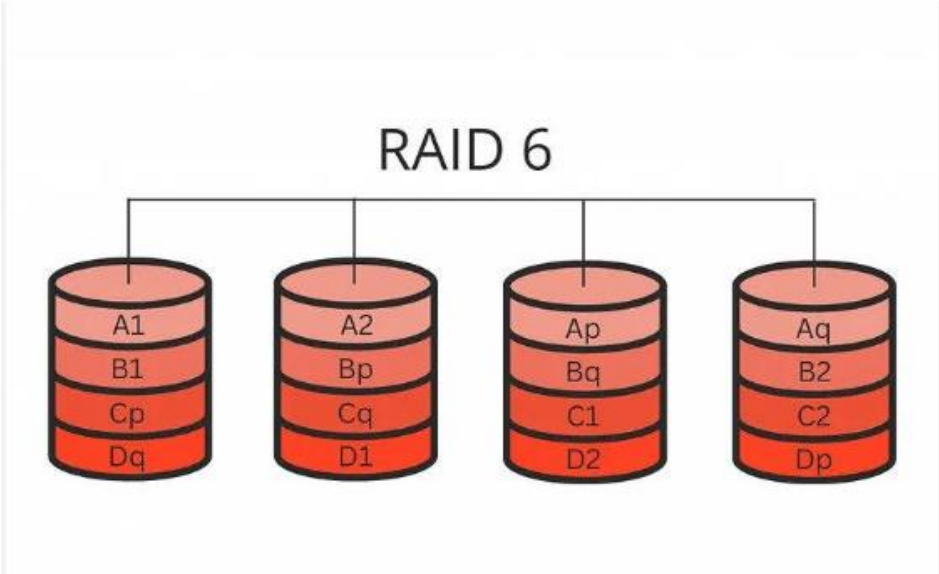
RAID 10 (1+0)

Structure: RAID 10 combines RAID 1 (mirroring) and RAID 0 (striping). It requires at least four drives. Data is mirrored across pairs of drives (RAID 1), and then these mirrored pairs are striped (RAID 0) for performance.



RAID 6

Structure: RAID 6 uses block-level striping with double distributed parity. It requires at least four drives. Data and parity information are spread across all the drives, and RAID 6 includes two parity blocks, allowing for additional fault tolerance.



	RAID 10 （1+0）	RAID 6
Performance	• excellent read and write performance • data is both mirrored and striped	• slower write performance compared to RAID 10 due to the overhead of calculating and writing two sets of parity data.
Recovery	• recovery is quick because the system only needs to copy data from the mirrored drive to a new one.	• more complex • involves rebuilding data using parity information.
Cost	• Cost will be higher • need twice as many drives to achieve the desired capacity	• Lower cost • more usable storage compared to RAID 10.

In conclusion, we will choose RAID 10. It is because:

Data Redundancy: RAID 10 combines the benefits of RAID 1 (mirroring) and RAID 0 (striping). This means your data is mirrored across pairs of drives, ensuring that if one drive fails, an exact copy of the data is available on another drive. This redundancy significantly reduces the risk of data loss, which is critical for maintaining business continuity.

Quick Recovery: In the event of a drive failure, RAID 10 allows for fast and straightforward recovery, minimizing downtime. The system continues to operate normally while the failed drive is replaced and rebuilt from its mirror, ensuring that your office remains productive even during hardware failures.

High Performance: RAID 10 provides superior read and write speeds, making it ideal for an office environment where fast access to data is crucial. This is particularly beneficial for handling large files, databases, or any application that requires high-speed data processing.

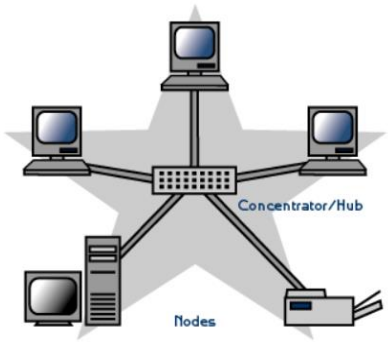
Reliability: RAID 10's ability to tolerate multiple drive failures (as long as they are not in the same mirrored pair) makes it highly reliable, providing peace of mind that your office's data is well-protected against unexpected hardware issues.

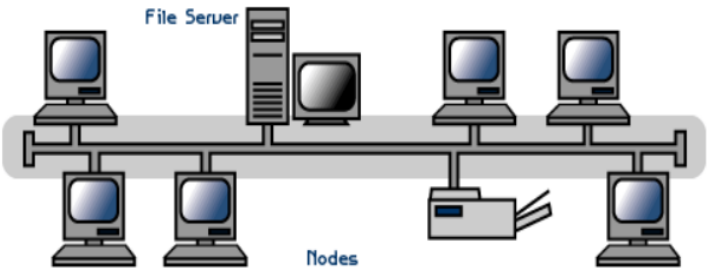
5.3 NG KAH DUNG 2370282 – DCS

Design the Floor Plan Layout of Block B **Office 1st** and 2nd floor, Justification of Floor Plan Design, Explanation of Block B topology part and the difference between Star topology and Bus topology.

Block B topology

Characteristic	Star Topology	Bus Topology
Type of connection	Centralized: All devices are connected to a central hub or switch.	Linear: All devices are connected to a single central cable (the bus).
Direction of Data	Data is sent from the device to the central hub, which then forwards it to the destination.	Data is transmitted along the bus in both directions until it reaches the destination.
Cost	Higher: Requires more cables and a central device （hub/switch）.	Lower: Requires less cabling and no central device.
Security High / Low	High: Data is isolated on individual connections, making it harder for unauthorized access.	Low: Data is broadcasted to all devices on the bus, making it easier to intercept.





Star Topology Bus Topology

The star topology, which is distinguished by a single hub that links every device, is the best network architecture for companies that place a high priority on security, performance, scalability, and dependability. By effectively isolating errors, reducing traffic via dedicated connections, and enabling centralized security monitoring, it guarantees continuous operations even in the event that individual nodes fail. Scalability is a major benefit. A star topology is

easy to expand, as new devices can be added to the network by simply connecting them to the central hub without interfering with the operation of the rest of the network. This makes star topologies a great option for networks that may need to expand over time. The star topology is the obvious choice for business environments with significant networking demands because of its flexibility, powerful security against unwanted access, and ability to sustain high-speed data transfer.

5.4 CHONG HONG YAO 2370277 – DCS
networking assignment I Responsible 4.0 NETWORK DEVICES for investigating, selecting and comparing equipment and do a 6.0 CONCLUSION part. In additional provide the network security part.

Network Security
Network security is a must for every network system. It helps us protect hardware, software and data from being destroyed, changed or leaked due to accidental or malicious reasons. Network security ensures the sustainability and reliability of the system, and guarantees the normal operation of the system and uninterrupted network services.

Email security
Email security is the measure to protect the email accounts,content , and communication from the unauthorized access,phishing, malware, and other cyber threats.the email security meth is monitoring and filtering of email traffic for suspicious activities and strong authentication mechanisms,such as two-factor authentication (2FA), are often employed to prevent unauthorized access to email accounts.protecting email communications, organizations can prevent data breaches, identity theft, and other cyber attacks that could compromise sensitive information.

Firewall
A firewall is a system that manages network traffic to prevent malicious traffic attacks (e.g., ransomware, spyware) from invading network systems. It monitors incoming and outgoing network traffic and allows or blocks packets based on existing security policies. Advanced firewalls often include additional features such as intrusion detection and prevention systems （IDPS） to identify and block malicious activity in real time. By implementing network security policies, firewalls help maintain the integrity and confidentiality of data and ensure the safe operation of network systems.

Wireless security

To enhance wireless security, start by setting a strong and unique password for your network. Make sure your router's management interface also has a different, complex password to prevent unauthorized access. Update these credentials regularly to mitigate potential security risks. Additionally, use WPA3 or WPA2 encryption to protect data transmitted over the network.

6.0 CONCLUSION

In summary, we collaborated to create a strong and scalable LAN that prioritizes reliability and works the network requirements of both buildings, not just for regular office usage but also for large quantities of network traffic. We employed a star topology to guarantee that the network was efficient and reliable. We chose cutting-edge and inexpensive technology and wiring to assure dependable Internet access, efficient internal communications, and secure, high-performance connections between buildings. The design accommodates development and technological advancements while meeting present demands.

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