Network Fundamentals

ST1010

Assignment Report

Class: DISM/FT/1B/07

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1.0   Benefits

With a network in the company, it helps the company to operate more efficiently with different benefits such as communication and cost benefits.

1.1   Communication

For communication benefits, staff in the company can get in touch with each other more easily and share information and resources with one another. Information can be shared using network-connected peripheral devices such as printers, scanners and copiers which helps to increase productivity. With networked access to a common database, it prevents the same data from being registered multiple times which helps the business to work more efficiently. Company staff will be able to deal with customers' or clients' queries faster and more efficiently as data is shared among staff. Information can be transferred in real-time anywhere and can be accessed from another device if the usual device used to work with has problems.

1.2   Data Management

Another benefit is with data management and storage efficiency and capacity. With a network for the company, storage capacity is increased as data will be stored in a centralised location or database. There can be a centralised backup of critical data which helps to secure and give an option to restore important data that may accidentally be deleted. With centralised network, it makes storing of files easier. For example, if there is a generic graphic file that twenty interior designers might use at different times. With a network, the admin will only need to store the file on one of the twenty computers while without a network, the admin will store a copy of these files on each of the twenty computers. This helps to save of a lot of time and work.

1.3   Security

With a network, it also brings security benefits. It will be easier to secure sensitive data such as customer or client personal information and implement security features to ensure only authorised staff can access the data. Access for staff inside the company and access from remote area can be granted easily. Strong security features and authorisation can be implemented to ensure extra security to the company database so that the information is not vulnerable to attacks. This helps to ensure that confidential company information and data is kept safe and secure from outsiders.

1.4   Convenience

The network will also bring flexibility and convenience to the company. Hardware can be portable, helping to increase mobility. The company staff will be able to access the files and multimedia stored on other machines or storage devices through the network. With more routes to access the files in the network, it becomes more convenient to do work on any device at any time. Transfer of

files can also be done without a using USB drives which speeds up the daily tasks for the company staff.

1.5   Cost

Lastly, there are cost benefits for having a network for the company. The shared database saves cost compared to having multiple databases. With centralised network, less technical IT support will be needed saving cost when maintenance is needed. With a network, cost for buying additional printers can be saved as not every computer need to be connected to a printer for company staffs to print their documents. Cost for hardware components and software can be saved as less hardware parts will be needed and software can be shared among the company staffs.

2.0   Internet Access Plan

The internet access plan that we felt is suitable and choose for the company is the M1 High-Speed Fibre with Managed Cloud Security plan. The plan uses 1 Gbps static IP addresses which will never change and is unique to the company. The cost of the plan is $348 per month which is a reasonable and affordable price as the internet will be used by all 90 staffs in the company. Some features that the plan offers are high bandwidth, strong threat identification software and hardware, managed access control list, and weekly security report.

2.1   Connectivity

The plan comes with high bandwidth which increases data transfer rate and shorter download time. The staffs will have smoother experience when accessing the internet even with multiple online applications running simultaneously, supporting multiple users and online sessions concurrently. However, this will be more expensive due to installation and cable costs. More expensive shielded-twisted pair cable or single-mode fiber cable will be used.

The plan also provides 8 static IPs which ensures that the address does not change and is manually configured. The IP address will stay the same until the device is decommissioned or if the network architecture changes. It will be assigned by the Internet Service Providers (ISPs) which in this case will be M1. There are some advantages of having static IPs. One of it will be that there will be better Domain Name System (DNS) support as the IP addresses will be easier to set up and manage with DNS servers. There will also be convenient remote access as static IP address makes it easier to work remotely using a Virtual Private Network (VPN) or other remote access programs. More reliable communication can be assured as static IP addresses make it easier to use Voice over Internet Protocol (VoIP) for teleconferencing or other voice and video communications. However, there are also disadvantages to using static IP addresses. Static IP addresses are more hackable as hackers will know exactly where the server is on the internet, making it easier for them to attack it. Static IP addresses will also cost more, and security concerns may arise as

anyone with the right tools can find where the staff and his or her computer is located. However, this problem or concern can be solved with FortiGate which also comes with the plan.

The plan also comes with a managed Fortinet FortiGate 61E router. This router offers network security solution in compact fan-less desktop form factor for enterprise branch offices and mid-size businesses. It helps to protect against cyberthreats with industry-leading secure Software-Defined Wide Area Network (SD-WAN). The SD-WAN is a network abstracted from its hardware, creating a virtualised network overlay. Operators can remotely manage and quickly scale the overlay which can span over large geographical distances. It protects against known exploits, malware and malicious websites using continuous threat intelligence provided by FortiGuard lab security services. It can detect unknown attacks using dynamic analysis and provides automated mitigation to stop targeted attacks. Its performance is industries best threat protection performance and ultra-low latency using purpose-built Security Processing Unit (SPU) technology. It also helps to deliver an extensive routing, switching, wireless controller and high-performance IPsec VPN capabilities to con solidate networking and security functionality. The single pane of glass with Network Operations Centre (NOC) view provides 360° visibility to identify issues quickly and intuitively. Predefined compliance checklist analyses deployment and highlights best practices to improve overall security posture. There is also a security fabric which are systems designed to protect the information systems infrastructure of the corporation from malicious attackers.

2.2   Security

With FortiGuard Global Threat Intelligence which comes with the Fortinet FortiGate 61E, the company's network can be kept secure as it provides the network with multiple security features. The Fortinet router is kept armed with best threat identification and protection information. Threat research done will also keep the customer in this case, Rest & Relax Designs Pte Ltd company informed of latest threats, campaigns, actors, and trends to take proactive measures to secure the environment. Zero-Day research is done to analyse 3rd party products and software applications for weaknesses and exploitable vulnerabilities. When vulnerability is found, the team creates protective measures and updates the appropriate elements of the Fortinet Security Fabric. FortiGuard Security Services enables coordinated and consistent real-time defence for the latest attacks. The security services automatically distribute newly created protections, adjusting Fortinet Security Fabric and ecosystem with coordinated market leading defence. The web security, content security and device security are optimized to monitor and protect data and applications against web-based attack tactics, file-based attack tactics and protect against device and vulnerability-based attack tactics respectively while assisting customers with meeting compliance. The FortiGuard Antivirus delivers automated updates that protect against the latest polymorphing attack components.

There will be managed Access Control List (ACLs) which are set of rules configured on a router's interface for specifying which addresses and protocols can pass through an interface and to which destinations. It helps to block packets which are not allowed into the network as known as packet filtering. The ACLs are configured to block traffic based on inbound or outbound traffic, source address and protocols. It helps with traffic flow control and restricts network traffic for better network performance. It can selectively admit or reject inbound traffic, controlling access to own network or specific resources on own network. It also simplifies the way local users, remote users, and remote hosts are identified, using authentication database configured to ensure only approved users are allowed access.

Weekly security reports will be given mainly focused on cybersecurity. The report will include data that meaningfully communicates risk exposure or security performance. Detailed information about potential risks within the company's digital footprint are also included in the report. There needs to practice of communicating the metrics about security, risk and performance of security controls to the stakeholders in the company. The company will then be able to measure, manage, and clearly communicate the risks in their digital ecosystems. This helps to identify gaps in security controls and outline the performance of security programs, also presenting the critical information about cybersecurity threats, risks within a digital ecosystem, gaps in security controls and performance of security programs.

2.3   Reason

Hence, with good connectivity and security features that comes with the plan, I believe the plan will be able to help Rest & Relax Designs Pte Ltd company to have smooth internet access while working. With an affordable and efficient plan, it will be able to help the company and staffs to work at their maximum productivity.

3.0   Network Setup

3.1.1 Network Topology

Physical Topology (Physical Extended Star)

An extended physical star with multiple switches that connect to a central router. This allows access to server data through the central router. An extended star network is easy to upgrade by replacing the central unit if the cables and network cards support it. When the required number of workstations exceeds the number of ports on the core, simply add another core. Given the shortcomings of the physical star topology, we need to have a spare on hand.

Logical Topology (Switched Topology)

Since the central device used is switch, the logical topology should be switched topology. A switched topology creates a dynamic connections or circuits

between two devices whenever data is sent. Sometimes, this topology is considered a switched point-to-point topology because a circuit is established between two points as needed to transfer data. It is very fast as it could directly transfer data to the destination.

Network Technology

The Network technology should be ethernet network. It is easy to install and support with a low-cost factor. It supports a broad range of speeds from 10Mbps to 10Gbps.

3.1.2 Network Protocols

Transmission Control Protocol/Internet Protocol (TCP/IP)

As the network technology used is ethernet, the network protocol that will be used will be TCP/IP. Ethernet II is a frame type used by TCP/IP, it is used for effective communication across a network, computers must be capable of transmitting data reliably and efficiently. TCP/IP specifies how the data is exchanged over the internet by providing end-to-end communications that identify how it should be broken into packets, addressed, transmitted, routed, and received at the destination. It requires little central management and is designed to make networks reliable with the ability to recover automatically from the failure of any device on the network.

3.1.3 Communication Media

Fibre-Optic Cable

Fibre-optic cable are used as backbone cable. Fibre-optic cable trades electrical pulses for pulses of light to represent bits. Because no electrical signals ever pass through the cable, fibre-optic media is as immune to electrical interference as any medium can get. Therefore, light pulses are unaffected by Electromagnetic Interference (EMI) and Radio Frequency Interference (RFI). This characteristic also makes fibre-optic cables highly secure. They emit no external signals that might be detected, unlike electrical or broadcast media, thereby eliminating the possibility of electronic eavesdropping. In particular, fibre-optic cable is a good medium for high-bandwidth, high-speed, long-distance data transmission because of its lower attenuation characteristics and vastly higher bandwidth potential.

I suggest that Category (Cat) 6 Unshielded Twisted-Pair (UTP) should be used. Cat 6 UTP is more efficient as it transmits data faster than Cat 5 or Cat 5e UTP. This means that in a system running in Cat 6, we will have fewer bugs.

3.2 Hardware Recommendations

Router

Router is used to connect to Local Area Network (LAN) to create an internetwork. Router enables multiple LANs to communicate with one another by forwarding packets from one LAN to another. The router creates separate

LANs to contain broadcast traffic and facilitate more effective communication in each unit's LAN. Router maintain routing tables composed of IP network addresses.

Switches (Zyxel MG-108 Multi-Gigabit Ethernet Switch)

The Zyxel 2.5 Gigabit MG-105 Switch is the perfect candidate to boost the speed and performance of your network, giving you the ability to operate up to 2.5 times faster than today's gigabit network. Out-of-the-box network speed boost makes the MG-105 the optimal solution for office users who need more bandwidth for their network with the demands of online gaming, streaming media services or faster wireless network connectivity without complicated installation.

Printer (HP Color LaserJet Pro M255dw)

Impress with color and increase efficiency. Get high-quality color and fast duplex printing. Save time with smart task shortcuts with the HP Smart app and print and scan from your phone. Get seamless connectivity and reliable security solutions. Get the recognition you deserve with an HP Personal Color Laser Printer that delivers great results.

This printer is designed to work only with cartridges with a new or used HP chip and uses dynamic security measures to block cartridges with a chip from another manufacturer. Periodic firmware updates will keep these measures effective and block cartridges that were previously working. The HP Reused Chip allows you to use reused, remanufactured, and refilled cartridges.

Wireless Access Point (Zyxel WAX650S Wi-Fi 6 Access Point)

The Zyxel WAX650S supports maximum data rates of up to 3550 Mbps (2400 Mbps at 5 GHz, 1150 Mbps at 2.4 GHz) using Zyxel Smart Antenna technology, a proven technology that suppresses co-channel interference. New Wi-Fi 6 hotspot provides faster, more stable connections for every user, even in higher density environments, meaning more users and devices can be connected without performance or responsiveness degradation time.

Server (Dell PowerEdge T30)

The PowerEdge T30 combines massive internal storage capacity and high performance in a compact, quiet mini-tower chassis that delivers efficient, uninterrupted performance.

3.3   Software Recommendations

Server Operating System (OS): Windows Server 2022

Windows Server 2022 introduces advanced multi-layer security, hybrid capabilities with Azure, and a flexible application platform. Secured-core server builds on technologies such as Windows Defender System Guard and Virtualization-based Security to minimize risk from firmware vulnerabilities and advanced malware.

Workstation OS: Windows 10 with Microsoft 365 Business Premium

Windows 10 have been dubbed by some as the fastest adopted OS in Microsoft history. It helps to enhance productivity with features such as multiple desktops, better search features and an interactive web browser. New features added to Windows 10 improves it security and help to reduce user downtime.

Mobile OS: Google Android, Apple iOS, Microsoft Windows Mobile

3.4 Additional Information

User Training

To ensure that workers in the workplace are aware of the use of software and are not confused for productivity purposes, workers can be directed to online or offline courses after hours. These training courses can help improve their skills to carry out their tasks and gain the necessary skills that can help them in their roles, such as learning the basics of basic software and server knowledge. In the event of a cyber-attack, employees will be able to stand up and be prepared for what to do to avoid panic.

Future Expansion Plans

It is important to have a well-structured plan that tracks and controls company statistics and growth. This plan may consist of the company's current weaknesses or strengths and potential expansion growth into other areas locally or even globally. In addition, this plan may also include opportunities available to the company, changes happening for customers or the industry, and hopes for future development. The readiness for threats such as cyber-attacks and challenges such as global competitors are also important for the future of the company. As the company expands in future, the network of the company also has to expand. More database servers will be needed to store data and more switches will be added for the network expansion.

Security Measures

Fault Tolerance

Fault tolerance provides methods for a system to continue running after a system failure has occurred. System failures can be power failures, disk failures, and entire computer failures. Fault tolerance isn't a replacement for backups but complements a regular backup routine.

Redundant power supply

A redundant power supply is essentially a second power supply unit in the computer case. Each unit is capable on its own of maintaining adequate power to the computer, so if one power supply fails, the other unit takes on the full

load. When both units are operating, they share the power load, which also reduces heat and stress on each unit, further increasing reliability.

Redundant disk systems

Redundant disk systems can prevent data loss in the event of a disk failure. In fact, a system with a redundant disk configuration can continue operating with no downtime. Redundant disk systems are based on the Redundant Array of Independent Disks (RAID) technology.

Server clustering

A server cluster is made up of two or more servers that are interconnected and appear as a single unit. Two common types of clustering are failover and load-balancing.

A failover cluster is used to provide fault tolerance in the event of a complete system failure. It involves two or more servers sharing a high-speed link used to synchronize data continuously. One server is designated as the primary server, and the others are standby servers. If the primary server fails, a standby server takes its place as the primary server. A failover cluster is usually used to ensure high availability for applications such as database and messaging systems, in which data is read and written frequently.

A load-balancing cluster consists of two or more servers that appear as a single unit to users. All servers in the cluster operate and share the server load. This type of cluster is used when data on the server is comparatively static and with read-intensive applications that exceed a single server's performance capabilities. The advantage of load-balancing clusters is that you still have the benefit of failover: If one server fails, the others just have to shoulder a bigger load

Backing Up Data

Regular backups provide a safety net to restore a system to working order in the event of a disk failure or file corruption. Backing up of data can be done once a week to prevent loss in productivity.

Network Security

Security Policy

A network security policy is a document that describes the rules governing access to an organization's information resources, enforcement of these rules, and steps taken if rules are breached. The document should describe not only who can have access to which resources, but also how these resources are allowed to be used after they're accessed.

Dangers of Malware

Malware encompasses viruses, worms, Trojan horses, rootkits, and spyware. Malware protection should be a required element on every computer and network. Protection from malware can be done by FortiGuard Global Threat Intelligence which comes with the internet access plan stated above.

Lock Account

This account lockout option, used to prevent intruders from guessing a password it can be enabled or disabled.

## Antivirus Software (Comes with Internet Access Plan-FortiGuard)

Protect your company network by blocking access to malicious, hacked, or inappropriate websites with FortiGuard Web Filtering. Web filtering is the first line of defence against web-based attacks. Malicious or hacked websites, a primary vector for initiating attacks, trigger downloads of malware, spyware, or risky content.

4.0   Network Diagram

Physical Diagram
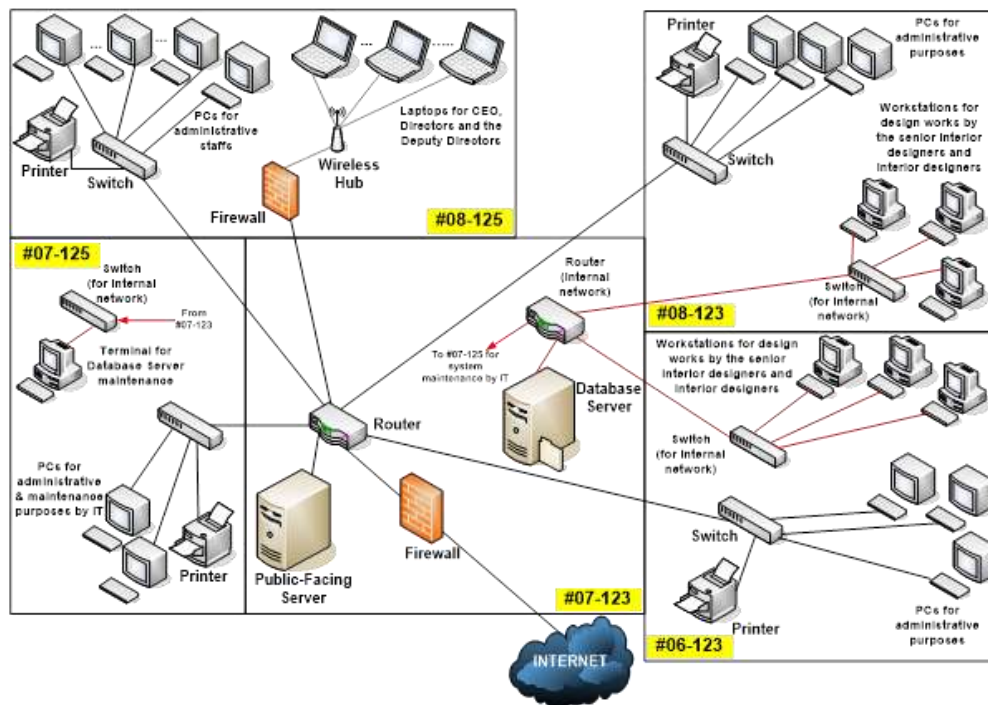
Logical Diagram
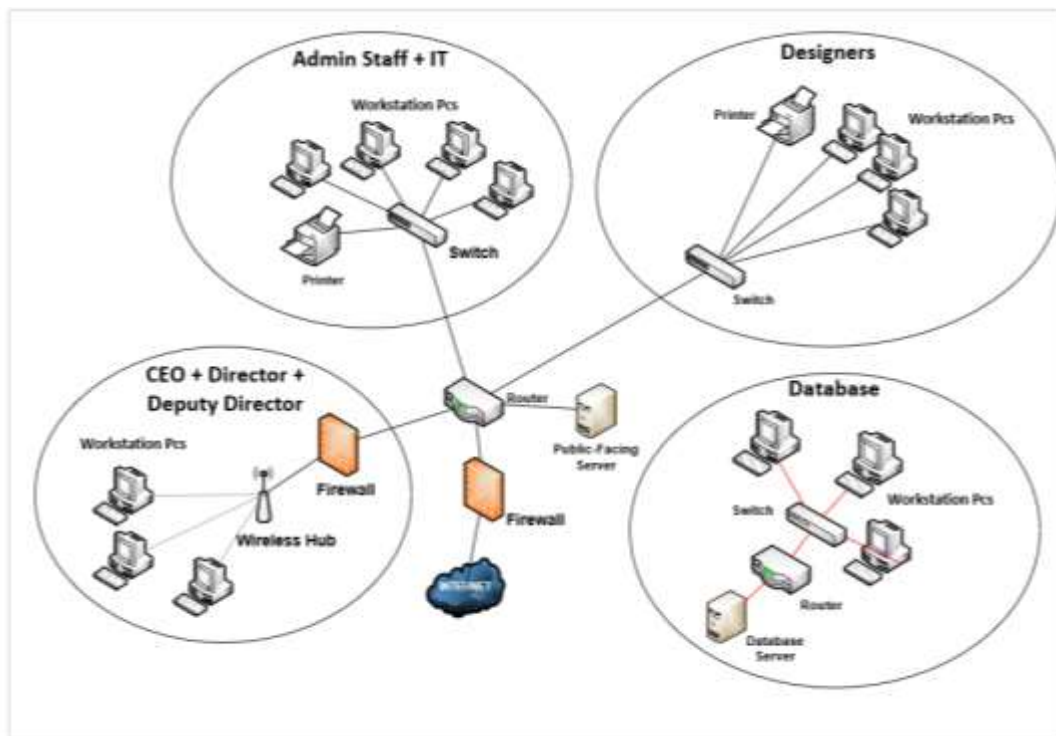
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