Network Design and Security: An In-Depth Analysis

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Abstract

Network Design and Security are a vital part to all organizations. Without the proper network design and security of that network organizations could face several risks such as a loss of confidential data, loss of network functionality and/or web services or ecommerce functionality, inability to access the network and/or digital resources, reputational and/or legal issues related to compromise of confidential data, and a loss of finances (*How Organizations Can Consistently Reduce Cyberrisk*, n.d.). There can be many differences in a networks design and security that can be influenced by many factors such as the age of an organization, the size of an organization, and lastly, the purpose of an organization. The purpose of this paper is to develop a scenario, discuss the potential fundamental network designs for this scenario, the network implementation, and lastly the network security.

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The scenario that will be being discussed is based on a fictional business titled, Fox's Breast Milk Supply Bank. This company is based in the Bahamas and is a breast milk bank facility. The purpose of Fox's Breast Milk Supply Banks is to provide breast milk for infants who are in emergency situations such as those impacted by disasters, illness, and prematurity. Fox's Breast Milk Supply Banks relies on their partnership with local hospitals to connect their end users (infants) with donated breast milk. They initially get donated breast milk at their facilities from Mothers who have recently given birth at the local hospitals. This process entails the collection and sanitization of breast milk. From there, Fox's Breast Milk Supply Bank transports the breast milk to its recently opened satellite banks on the other islands within the country of the Bahamas. Due to the latest expansion, they are looking to also expand their networks to ensure that business can run smoothly between its central hub and its newly opened satellite banks. The following sections will discuss the options for network expansion, the network components, and the network security implementation.

Fox's Breast Milk Supply Bank initial location is in Nassau, the biggest city in the Bahamas which is located on the island of New Providence. Fox's Breast Milk Supply has opened three more satellite offices on the islands of Andros, Grand Bahama Island, and lastly Abaco. The furthest away island is approximately 128 miles away. The main bank in Nassau will serve as the central hub for all of the other satellite offices. It'll house servers, database systems and management tools. The distance informs Fox's Breast Milk Supply that they will need to implement a WAN or wide area network which "consist of two or more LANs (local area networks) connecting the devices which are geographically far apart." (Vien, 2018). For the scenario there will need to be a LAN created not only in Nassau but for the three additional

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locations as well which include Andros, Grand Bahama Island, and Abaco. For each location, the

Milk Banks will consist of one main computer with additional laptops that can easily be moved

around to collect donor information and/or milk supply status/storage information as well. LANs

can be established at each location by using routers at each location. This is critical because

routers are intermediary network devices used to connect LANs and WANs which is what the

goal is for Fox's Breast Milk Supply Bank. Furthermore, due to the massive distance between the

offices and the mobility of devices needed in the office Fox's Breast Milk Supply Bank can

utilize wireless ethernet with the offices for the LANs and use a Full Mesh topology for the

WAN due to it having a redundant number of links creating better performance and having the

lowest possibility of interruption due to a single broken link not causing much of affect on data

transmission. Expanding on the networks of this business each bank will have high speed

encrypted Wi-Fi connections available as well as additional guest Wi-Fi for its donors.

Furthermore, VoIP (Voice over Internet) and video conferencing software will be implemented as

well to be able to communicate between banks, central management, and medical partners. This

encompasses a general ideal of the network design; however, a networks design can only be as

good as the security of that network. The next section will discuss the security measures

implemented on the aforementioned network.

The following section will discuss the security measures used to secure Fox's Breast Milk

Supply Bank through firewalls, access control, physical security, and data encryption. The first

step in securing Fox's Breast Milk Supply Bank is by implementing a firewall. A firewall is

something that protect networks and network devices from unauthorized access by preventing

network traffic to or from these systems (Acharya, 2020). The implementation of the firewall

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will consist of a network firewall as well as a host firewall. A network firewall is a device/hardware that will be developed and placed within the network to be a first line of defense. Further, a host firewall will be utilized for the network which is the firewall that comes with the operating systems of the computers/laptops as a second layer of defense.

The next line of defense for the network is utilizing access control. This section will discuss the definition of access control and what that looks like for the network and physical locations. Access control is a data security process that enables organizations to manage who is authorized to access corporate data and resources. Access control consist of multiple components such as authentication, authorization, and access. For the network and physical space authentication is a vital part for Fox's Breast Milk Bank. Authentication is the initial process of establishing the identity of a user. For the network, all locations will require a login of a username and password with an additional multifactor application software that the employees could download on their phone. For the physical location, the banks will have physical locks, cameras, and most importantly key cards that only enable authorized employees to enter the bank.

Lastly, data encryption is critical to protect the information of the donors and the data exchange between Fox's Breast Milk Bank and the partnering hospitals. To be able to ensure our network is encrypted we can connect all of the LAN's in each office to VPN (virtual private networks). By doing this all data exchanged to and from the network will be encrypted. This can be done due to the fact that VPN software changes the IP addresses and automatically encrypts all internet traffic. Encryption usually is based on whichever protocol is enforced. For this network Fox's Breast Milk Bank can utilize the protocol, OpenVPN. OpenVPN is a very secure,

highly configurable protocol. Part of the reason for this is because it utilizes Perfect Forward

Secrecy (PFS), which is a security protocol within itself regarding encryption. PFS works by

creating unique session keys, so that potential attackers can only see the data specifically to a

particular exchange if they do discover a key and not have access to the entire server leading to a

lot less data being compromised.

Conclusion

From data encryption to the design and layout of the network can impact the overall

success of a business. Network design, implementation strategies of that network, and securing

that network should all be serious considerations of any and all organizations. The bases for

starting this development is understanding the needs and wants of a business. The above

explored a business who works in multiple locations and deals with sensitive information. Due to

that the above walked through the different designs and security measures to consider when

dealing with the aforementioned qualities. For Fox's Breast Milk Bank a multitude of factors

were considered that lead to the design and security that were chosen. Due to the offices being on

different islands, a WAN in a mesh topology was utilized to ensure limited interruption as well a

strong connection for all offices. This WAN then would utilize a VPN for additional security and

encryption of all data. Speaking on security, firewalls would be implemented via hardware and

software for additional layers of security. Lastly, access of controls would be implemented

through logins, keycards, and physical security measures. By doing such, Fox's Breast Milk

Bank should expect a successfully run business with limited interruptions.

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Resources

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Appendix

This appendix will provide visuals for office locations as well as the design for the WAN mesh topology.