Preparation of Network Requirements

Yiqiao Yin
Ph.D. Student

Abstract

This paper discusses and explores the model architecture of network types. The premise assumes that the role is to create a training document to explore some network types and topology with the interns at a large company. To achieve this task, this paper investigates and provides in-depth overview of the different network types and topologies.

1 Summary of Network Requirements

This paper investigates the requirements of the network system that is to be implemented in the company (throughout the rest of the paper, we refer the "company" to be the target company with simulated assumptions in the assignment). The company has an existing WAN that provides internet services with the entire Northeastern region. The region currently covers 12 branches. After the acquisition, the projection is to expand the network services with 30 additional locations and these are sites that cross multiple different states under the same region.

The goal for this investigation is to provide the basic understanding and the premises required for this expansion. A complex and adaptive system is to be designed for this implementation. A research done in 1979 first recognized the importance of the characteristics of such expansion Hofstadter (1979). It states the phenomenon that though the system can be easily understood at a local level the whole system may work in a surprising way globally due to local interactions amongst different units.

2 Application and Optimal Methods

The network service provider is crucial for the expansion of the company. The best practices come from thorough discussion of detailed road map, contingency plans, protocol amendment and flexible expansion architect. This paper discusses different aspects of the network design and particularly focus on the premise of the expansion of the company in this assignment. Different methods and research literature are discussed as well in regards to network security, data transfer, and network topology. The paper is also based on the understanding of the previous assignment: In-depth Overview of the Different Network Types and Topologies.

The major component of the paper will list out and discuss the key assumptions and constraints identified for the project. The paper will dive into the connectivity issue for the entire Northeastern Region, the management and operating procedures in regards to

the directory domain, and the upgrade and scalability of such expansion. Next, the paper will also examine the online banking service and the potential design as well as issues come along with the expansion.

3 Key Assumptions and Constraints

3.1 Connection to the Northeastern Region

The first premise is regarding to Wide Area Network or WAN. Many scholars have discussed different approaches of management system Scarpitta et al. (2021); Kumbakara (2008); Segeč et al. (2020). The target expansion that the executive team is planning on is a direct application of Wide Area Network (WAN) covering the entire Northeastern region. The network is capable of spanning a large amount of geographical area such as different cities, states, and other locations even nations. WAN is the optimal choice for corporations, multi-location companies, large organizations co-operating amongst different locations to execute data exchange.

Comparing with the other types of networks, WANs serve similar purpose to that of LANS. However, WANs fundamentally has a different structure and the operating procedure is different as well. The branches of a WAN does not take ownership of the connections or the remote computer systems. Instead they are acting as subscribers. A service is provided to the these subscribers (branches). The data transfer speed is mostly about 1.5 megabits per second (Mbps) or less.

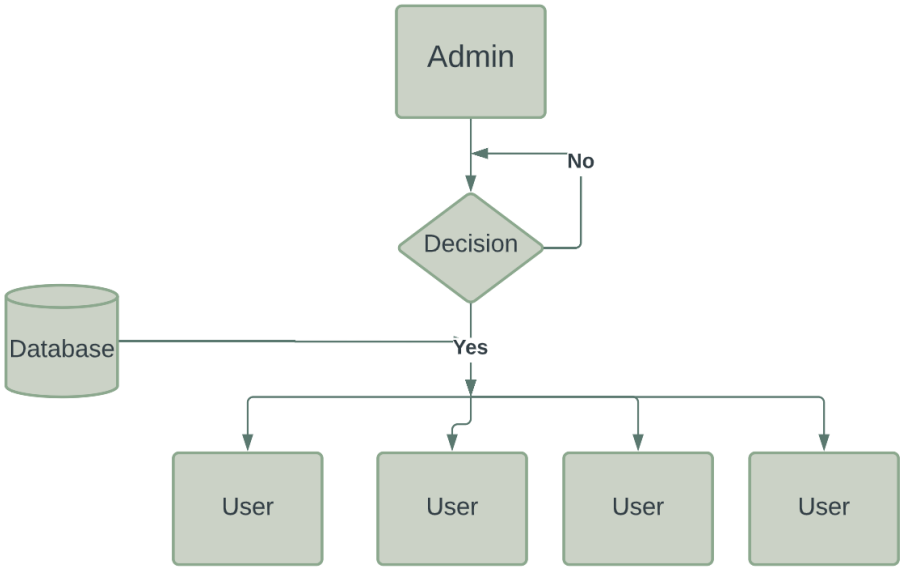
The profiling for WAN is point-to-point. This is based on a procedure that is able to divide digital service. It can split a digital service wire with a rate of 1.544 Mbps into many channels. These channels are technological profile with 64 Kbps each assuming it is split into 24 channels. In addition, cost is another contributing factor. For faster wire connection, the cost is higher. The setup can be quite substantial for a company with this size. A report has projected a 30% growth on the WANs implementation nationwide Held (1998) and due to the amount of branches the executive team is planning to operate WAN is the appropriate choice for the expansion.

3.2 Management of Active Directory Domain

The next assumption is that each branch's operation and management procedure for an active domain and email server. The designed architecture to demonstrate the assumption is shown in Figure 1. The administrator of a branch has their own domain as a main directory. The administrator serves as a lead to govern the behavior of this branch under such directory. The main directory has a portal to access the console and the console allows the administrator to access and manage services for email server, billing, and other product updates. Services for users can include "manage user", "add user", "delete user", "update user name or email", and so on. The administrator also serves as a Human Resources (HR) portal. In some cases, the Human Resources manager will also have control of such portal to access and manage different accounts. In addition, services such as "Billing" and "Product Updates" can also be included. The function "Billing" can be related to email or other basic services. In today's world, especially in data science and machine learning, cloud services can also incur costs for the management team. Similar individual based services such as Microsoft Office and other database management system may incur other costs as well. These are all services and functions that can incur costs and would be required to integrated into email server. Famous platforms such as Gmail/Drive or Outlook/OneDrive bundo the email server and a online server

together. This approach allows users to be able to utilize email more efficiently. Users can transfer files such as PowerPoint, Word Document, Excel Spreadsheet, and so on on a more secured way. Online meetings (Google Meet, Teams, WebEx, Zoom) can also be implemented with emails as well. Since 2019, there is large volume of online meetings due to lockdown from COVID-19 pandemic. The future development and any expansion will have to incorporate such situation into account. Shall it happen again the company and executive teams should provide the platforms to allow users and their employees to work remotely and continue the company's business operations.

Figure 1: **Branch-level Domain and Email Structure**.



3.3 Upgrade and Scalability

From investigation of the executive teams, the networks of the existing setup are outdated. Hence, one of the most important premises is to upgrade both networks and scale up to meet the requirements of the expansion.

The first perspective to discuss if the configuration of the global knowledge. The decisions for the management of such expansion almost always requires the system to be globally optimized first. The management team and the administrator account are required to have sufficient knowledge on a global level to handle the amount of traffic and potential atrocity that may occur.

The next part is decision making and policy amendment with regards to real-time monitoring. The network data transfer on a global level that WAN is operating at this company utilize large volume of data and information on a minute level. The control panel will need to be required to be configured with all effective channels to supervise the network traffic. This procedure may incur potential policy amendment. Hence, this part of decision making may also be involved with policy amendment.

Along with policy amendment, a potential next-step is system control and contingency management Liu and Li (2015). At a global scale, each branch may eventually break the circuit and cause damages to the network system. If the damage is expected and certain

protocol is violated, amendment and contingency plan can be carried out. If the damage is unprecedented, this calls for policy amendment. Either situation would require full range of system control and network monitoring.

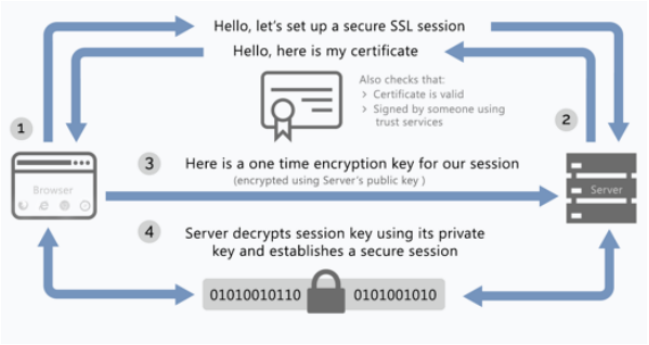
4 Online Banking Service

4.1 Banking with Wifi

Most internet providers have routers connected and the end-users are served using Wifi instead of wired communications devices. Wifi allows efficient ways of managing and transfer information. Most of the clients choose to check their accounts electronically instead of using printed or mailed bills. Almost nearly every online banking service provides "paperless" services and this expansion will have to incorporate similar services. Even if some branches want to avoid Wifi completely, it will be extremely difficult to do. One way to provide secured online banking services is to use encrypted internet services. This refers to the padlock icon that shows "https" on the URL location instead of "http". The diagram is presented in Figure 2.

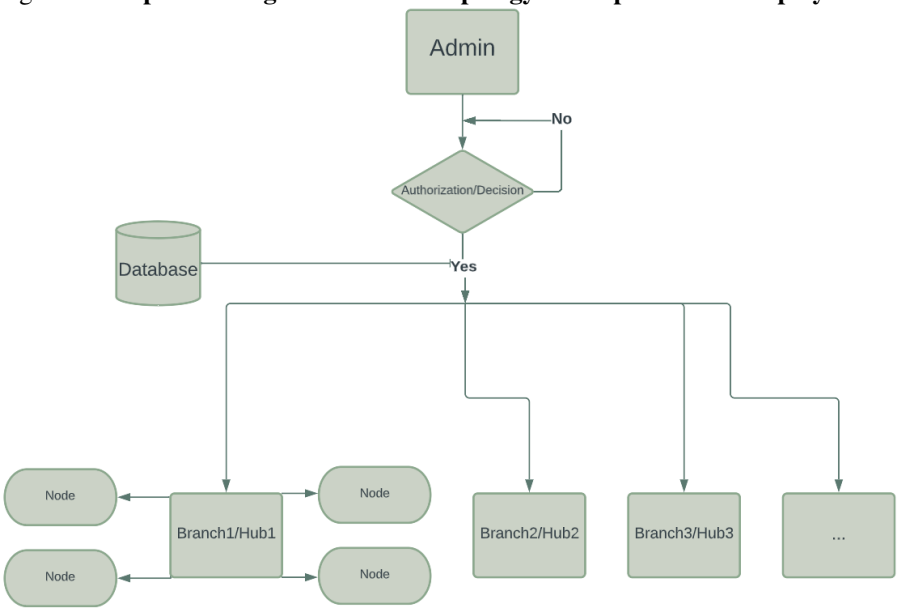
The diagram suggests a process to establish a secured service provider. The four steps (illustrated in circle in Figure 2). The first step is to let the user to requests the information. This can be a session or a request sent by the user at the front-end. In practice, it could be someone click on a link of a website. This action generates a request for data of that website. The second step is an authorization step, which checks the authority of this request and verify its validity. Upon successful verification, the user's request is then "approved".[1] The third step is to provide an encryption method. This is in a form of a key that can be one-time use or it can be multiple times of usage upon the approval of a third party authorization (such as Cisco Connect or Duo Mobile). The services such as Cisco Connect and Duo Mobile provide a second layer of security on a secondary device (usually cell phone). The last step to decode the key provided to the client (this client refers to the user who asked for the data transfer). The decryption happens immediately after the receiving of the key and it usually occurs in a secure session.

Figure 2: **Online URL Encryption**. The diagram on URL encryption. The source can be found here.



[1] In companies, sometimes there are internet networks. This is an area where the second step is crucial. The reason is due to data transfer and data security.

Figure 3: **Proposed Design of Network Topology for Expansion of Employee Size**.



4.2 Expansion of Employee size

One last premise that serves the guiding principle of this document is the expansion of the employee size. The proposed design is a combination of hierarchical and ring topology. This is demonstrated in Figure 3. Due to limited size, the topology is drawn to illustrate the first hub. The remaining hub is proposed to carry out the same topology. From the top of the design, there is a central administrator that supervises the entire network operation. Decisions will have to be approved to access database and data transfer. Upon receiving of the approved decision, the information is passed to each central hub. Each central hub can be regarded as a branch. In the beginning, there are 150 employees. However, it is projected that the expansion will increase the employee number to 500. Using this premise, it is proposed from our investigation that one important setup required is the flexibility of increase/decrease a node or a machine. The previous assignment has already had discussion about different network topologies. This part of the assignment we propose to use a combination of Hierarchical and Star Topology combined together.

5 Conclusion

As a summary, the paper explores the network requirements for the expansion of the company. A variety of different perspectives are laid out and an in-depth discussion of the key assumptions and constraints are also presented. The paper dives into the discussion of connectivity issue, managerial component, and upgrade and scalability side of the expansion. In addition, the paper discusses the online banking system service and provide intricate discussion of the Wifi-related issues due to expansion. A numerous of scholarly resources are listed below in the Reference section.

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