Networkado

Network Infrastructure, VoIP, and Cloud-Based Service System

by

Emmanuel Ametame
Mohammad Hamdan
Charlotte Badu Osei
Richmond Owusu

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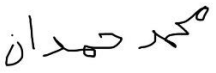
Emmanuel Ametame 04/24/2022

Mohammad Hamdan 04/24/2022



Charlotte Badu Osei 04/24/2022

Richmond Owusu 04/24/2022

Ryan Moore 04/24/2022

University of Cincinnati
College of
Education, Criminal Justice, and Human Services

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Abstract

Over the past years, we encountered an incident lot of firms did not see the great impact (negatively and positively) it had on their day-to-day transactions. Some percentage of rising or small firms had difficulties accessing work-based resources and data. We came up with a solution to help small businesses solve this issue. Networkado can assist small businesses with network infrastructure and the move to a cloud-based solution. Due to the epidemic, most businesses would require more time to allow remote workers to use cloud services. Using easy methods to give users remote access, Networkado will save time and money while relocating. The main goal of this project is to build a wide-area network with a VoIP system that will allow mobile phones, PCs, and other IP-enabled devices to communicate both inside and outside the company. Because of its adaptability, we chose the agile strategy. Networkado is a step toward protecting organizations and enterprises in a world where information is publicly available due to security breaches and hacking. The network uses public network infrastructure to connect geographically dispersed nodes, allowing numerous off-site or remote workers to access the file server. You may also keep track of your staff using dedicated file servers. This necessitates keeping a watch on the actions of the users. This entails safeguarding critical files and keeping track of all data entering and exiting your company.

Introduction

Project Summary: Covid-19 has influenced several businesses to make the switch from working on-site to working remotely. As a result, companies are finding it challenging to migrate to cloud-based resources. Setting up a VPN service for remote workers to access on-premises resources, as well as VoIP/video conference services for more accessible communication, terminal services for access to legacy business applications that can't be installed on employees' personal computers, and virtual and cloud-based desktop infrastructure for remote access to on-premises file sharing.

Problem Statement: According to the US report 4.6 million small businesses faced technological issues during the pandemic as they moved to work remotely for business continuity to combat the new coronavirus (Alexander W. Bartik et al,2021). Most business-facing applications used by the company are difficult to access due to the multiple connection requests/thresholds from employees working or trying to access company resources from home (Jevtic 2020). Document sharing is a high risk due to cyber security concerns considering numerous devices being used to access information from the company's network. According to a recent study and survey, one of the biggest challenges faced by employees was transitioning from working from the office to home (Davis 2021). Connectivity, information security, and business continuity are key concerns (Ashford 2020). It has been difficult, and we come in with our expertise to deploy a solution.

Solution: We designed a business information technology solution to help support Technical departments and users. Our solution is setting up a VPN service that lets remote workers access on-premises resources and VoIP conference services for more accessible communication. Terminal services for access to legacy business applications that can't be installed on employees' personal computers. We set up a virtual and cloud-based desktop infrastructure for remote access to on-premises file sharing. This allows users to access the company's on-premises business and application through a secured VPN network that remotely replicates the organization's network resources. In addition, this solution fixes issues remotely, eliminating the need for physical intervention. In the end, it saves money and time, making the work more efficient and productive.

Project Source: Before the synchronous classes began in August, our group was connected during the summer. We first had a concept for an application, then we changed our minds and came up with a new one. We've all worked for different firms. We discussed how people wait for their packages to arrive from entrepreneurs and decided to create a shipping website that reduces delivery days. We had several other ideas, but with Professor Ryan Moore's help, we could narrow the notion down to network infrastructure and VoIP systems. We'll all contribute suggestions and possible problem areas to this solution.

Discussion

Project Objectives/Goals: This initiative has produced VPN services that allow remote workers to securely access on-premises resources. A terminal service will be set up to allow employees to access apps installed on their PCs. Furthermore, a cloud-based service designed to access on-premises file sharing and host a remote-accessible virtual desktop infrastructure. We also put up a VoIP/video conferencing service on the server for more accessible communication. If an issue emerges, the user will be emailed documentation to help them improve their performance.

Project Scope: We provided a system where employees were able to connect to their company's network with the help of a VPN to work from anywhere they find themselves and employees were also able to communicate with each other using VoIP.

Quick Project Timeline:
A rough estimate of your project timeline in a tabular format with the following fields:

Task #	Task Name	Duration	Start Date	End Date
1	**Analysis and Research**	**30 days**	**8/23/2021**	**9/30/2021**
1.1	Contract	11 days	9/1/2021	9/12/2021
1.11	Create Project Abstract	7 days	9/12/2021	9/18/2021
1.3	User Case and User Profile	7 days	9/19/2021	9/25/2021
1.4	Create Elevator Pitch	7 days	9/24/2021	9/30/2021
2	**Environment Creation**	**7 days**	**9/12/2021**	**9/19/2021**
2.1	VMware/ Sandbox Environment Creation	7 days	10/18/2021	12/30/2021
2.2	Testing and Checking Environment	4 days	10/18/2021	10/24/2021
4	**Development**	**57 days**	**10/18/2021**	**11/16/2021**
4.1	Virtual/Client machines Creation	7 days	10/22/2021	10/27/2021
4.2	VPN creation	14 days	10/22/2021	10/30/2021
4.3	Video creation	21 days	10/22/2021	10/31/2021

4.4	Start Report and submission of Draft	21 days	10/28/2021	10/29/2021
4.5	Present the Product	1 day	11/16/2021	11/16/2021
5	**Finalization**	**125 days**	**12/5/2021**	**4/9/2022**
5.1	VoIP	7 days	12/6/2021	12/13/2021
5.2	Physical server	20 days	1/7/2021	1/27/2021
5.3	Testing	125 days	12/5/2021	4/9/2022
5.4	Final Design Tweaks	59 days	1/5/2022	3/5/2022
5.5	Final Report	49 days	2/5/2022	3/25/2022
5.6	Features Implementation	30 days	2/13/2022	3/13/2022
5.7	Documentation	15 days	3/13/2022	3/28/2022
5.8	Presentation	15 days	3/28/2022	4/11/2022
5.9	Presentation of Final Project	1 day	4/12/2022	4/12/2022

Table figure: 1

Technologies Used:

- VMware: Windows Server 2016
- Windows 10 Pro
- 3CX
- Windows VPN
- Trello - Communication
-
- Network Security Components:
    - Network Access Control,
    - Firewalls,
    - Security Information and
    - Event Management.

Technical Architecture Diagram:

The connections between the networks are depicted in this diagram. Because the firewall prevents you from accessing the internet, a VPN server was developed to allow employees to connect to the system without difficulty.

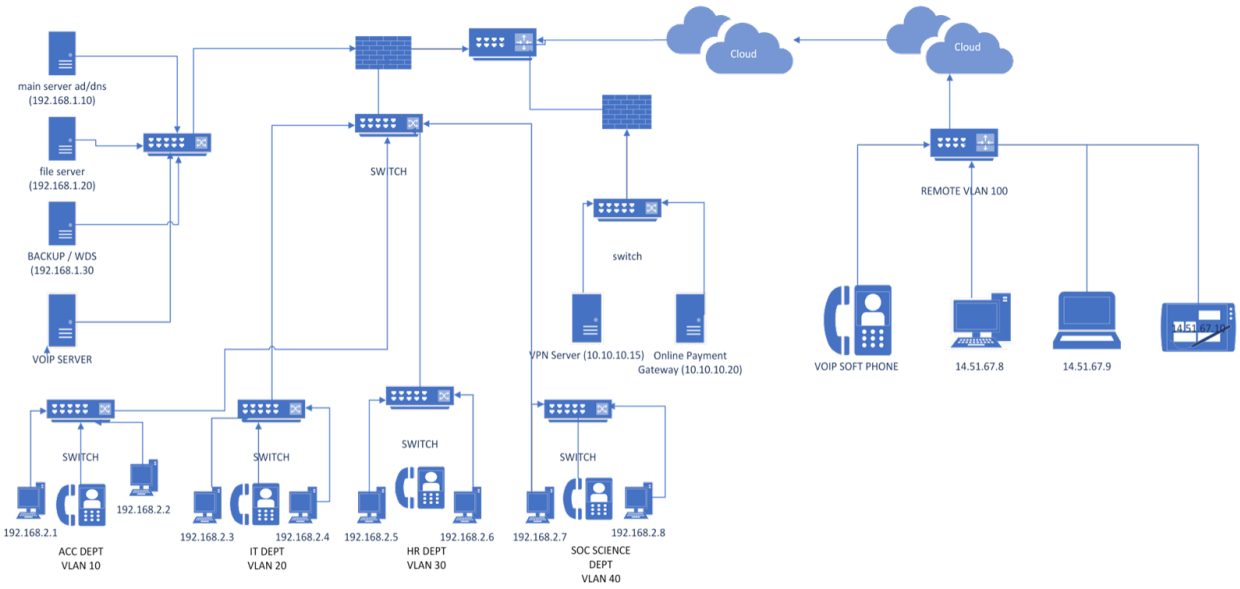

Figure 1: Technical Diagram

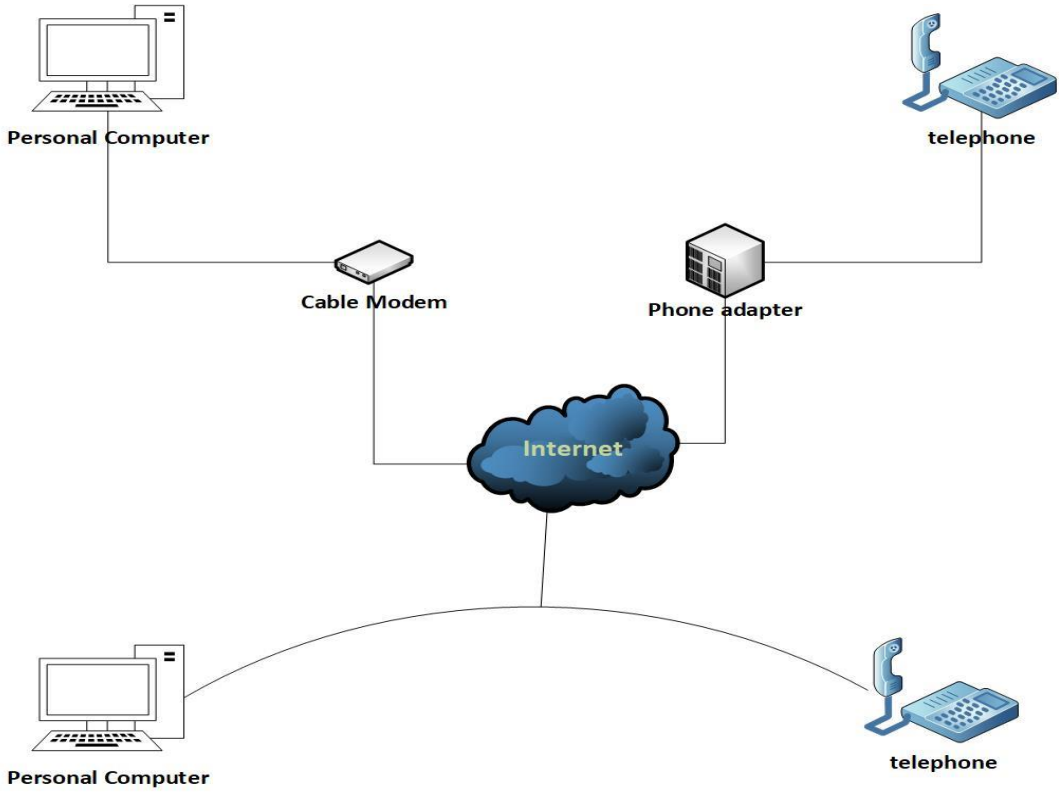

Figure 2: VoIP diagram

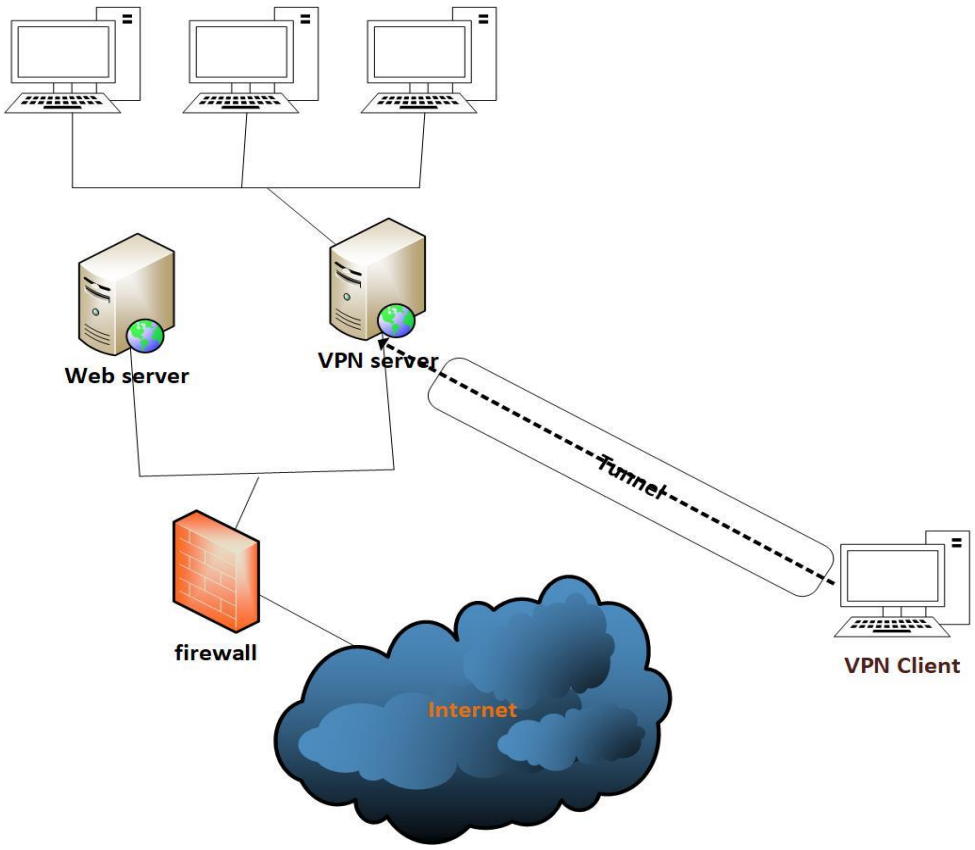

Figure 3: VPN diagram

User Personas:

Table 1 User Persona Table

User Persona: 1	
	Title Sales Manager
	Name Neeko Smith
	Age 27
	Gender: female
Behavior	Neeko works as a Sales Manager for a medium-sized company and reports to the

	board of directors once a week. She must submit these reports to the board of directors online.
Pain	Neeko has had trouble getting her department's report to the board since the pandemic. She has no idea how to handle it and eventually contacts the IT department, but her problem always takes a long time to resolve.
Needs & Goals	Before she meets with the board, Neeko needs a dependable source to deliver all of her reports.

User Persona 2	
	**Title:** IT Technician
	Name: Dan Magic
	Age: 30
	Gender: Male
Behavior	Dan has a few years of experience in IT and is familiar with the company's infrastructure.
Pain	Dan is constantly receiving calls and messages about printers that aren't working, internet connections that aren't working, phone connections that aren't working, app installations that aren't working, etc., wasting his time and energy and costing the company money because he has all of these issues on his plate.
Needs & Goals	Dan wants to devote his time to more important IT projects. So instead of many lengthy phone conversations regarding problems in the organization, Dan requires a short message.

User Persona 3	
	**Title:** CEO **Name:** Patrick Walter **Age:** 45 **Gender:** Male
Behavior	Patrick is the company's CEO, and he has over 50 individuals working for him. Once a month, Patrick meets with the chiefs of each department to evaluate their reports.
Pain	Patrick has no IT skills, and his staff is complaining about problems that he is unable to resolve. Constantly on the phone with the IT department, trying to figure out how to solve employees' problems.
Needs & Goals	Patrick and his workers require a solution that is both simple to grasp and cost-effective to operate productively wherever they are.

User Persona 4	
	**Title:** Supervisor **Name:** Brendan Gates **Age:** 29 **Gender:** Male
Behavior	Brendan works in the Customer Service department as a supervisor. He treats customers the same way he treats his subordinates.

Pain	He needs to communicate with his team, his supervisor, and consumers most of the time, but he has trouble doing so because he is not constantly with his laptop.
Needs & Goals	He wants a simple and quick way to interact and submit reports regardless of whether or not he has his laptop with him.

Use Cases:
Table 2 Use Case Table

Use Case ID	1
Use Case Name	Login
End Objective	The directly observable purpose of this use case is to log in
User/Actor	CEO
Trigger	when the user clicks on the “Sign In” button
Frequency of Use	Daily
Preconditions	Must have Networkado open Must have an account with Networkado Must be on the Networkado sign-in page
Basic Flow	The user will open the Networkado and click on the ‘Sign in’ button. A modal will pop up asking the user to enter their username and password. The user must input the correct username and password and press the enter or sign button
Alternate Flow	That any disabled people are using text to speech and extensions to help them navigate the form. The user understands how usernames, passwords, and email addresses work. User understands English.
Post conditions	The password is authenticated against the server. The user’s session is stored in the database if a match is found, and a cookie is created on the client-side. On the front end,

	the page changes in response to the sign-in, and the modal closes.

Use Case ID	**2**
Use Case Name	Internet error
End Objective	To successfully have an effective internet connection or to inform users and administrators that the system is not working
User/Actor	Neeko
Trigger	Internet connection fails
Frequency of Use	Multiple times per day
Preconditions	The desired connection must be unavailable
Basic Flow	Internet connection fails > Reports the situation to the IT department > IT department starts fixing the issue
Alternate Flow 1 (Internet connections are down)	The user wants to access the office platform to perform her monthly report > User wasn't able to perform any transaction> All systems work perfectly > Error causes internet connection to fail > User receives error notice and notification that internet connection is down > IT departments are then informed that the internet connection is down
	The user receives notifications that the internet connections are down. Administrators are given notice that errors are occurring.

Use Case ID	**3**
Use Case Name	Report Error to Administrator
End Objective	The administrator receives an alert that one of the printers failed a job
User/Actor	IT Administrator

Trigger	Printer Failure, Internet Connection failure, Phone connection failures
Frequency of Use	Often
Preconditions	A printer must be unable to print due to error, no internet connection, connections to phones are down
Basic Flow	The printer has stopped working > The alarm is reported by the system on the "Errors" panel of the system interface > The internet connection is unavailable > There is no efficient workflow.
Alternate Flow 1 (Alert through email)	The internet has stopped working > The workers reported the issue to the IT department > The inaccuracy was brought to the attention of the workers.
Alternate Flow 2 (Alert through phone)	When the phone breaks down, the IT department is notified. When the phone breaks down, the IT department is notified. The inaccuracy was brought to the workers' attention.
Postconditions	Administrators are informed that the printer, internet, and phones are malfunctioning

Use Case ID	**4**
Use Case Name	Report Cost Analysis
End Objective	Accurately track cost analysis
User/Actor	IT Administrator, Interface
Trigger	Successful job
Frequency of Use	Multiple times
Preconditions	The system can be accessed successfully
Basic Flow	The system has been successfully connected > All employees may now access their platform via the internet, phone, or printer without any problems > Through the Interface, the sales manager observes the cost analysis.

Alternate Flow 1 (Through Email)	The system has been successfully connected > All employees may now access their platform via the internet, phone, or printer without any problems > Through the Interface, the sales manager observes the cost analysis through their email
Postconditions	The Managers are informed of the cost analysis

Use Case Diagram:

Employees from several departments would use the system we designed, as seen in the use case diagram below. It also shows how the IT department would handle each task to get the system up and running. The diagram also shows how additional components, such as VPN and VoIP, will function in the system that has been created.

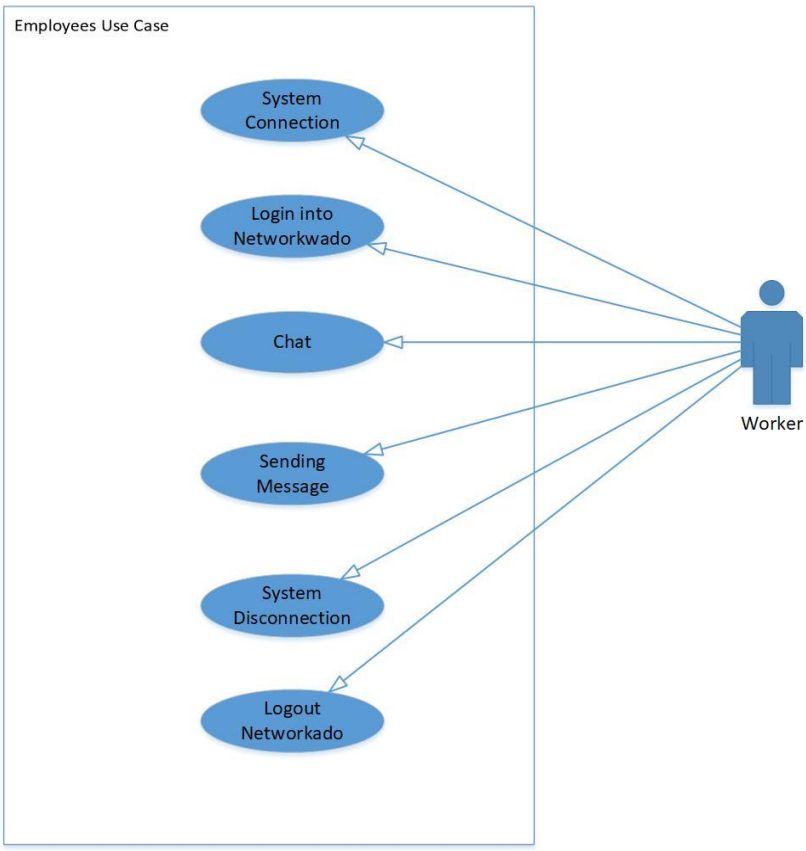

Figure 4: Employee diagram

Figure 4: Administrator diagram

Testing Plan:

Overview

Readers may expect to learn how our team addressed this project and our project management methods in the Testing Plan section. You'll learn how we came up with our methodology and how we carried out our iteration testing.

Methodology

Agile methodology for this project. This path was chosen since our project can easily be broken down into iterations with a solid output after each one. Our iterations will be divided into three phases: planning, construction, and testing. This is a notion for project scope and prioritization. This is where the team meets to talk about and explore possibilities and estimate project time and costs.

- Planning: During the planning stage, the team gathered to discuss the iteration's goals. The team discussed the iteration goal and conduct preliminary research on that goal during the discussion. The iteration budget, iteration timeframe, and personal objectives are part of the initial study and planning.
- Construction: During this stage, the team started working on the iteration targets. During the iteration planning stage, each team member worked toward their particular objectives. Everyone in the group kept track of what we've accomplished in the group log and team progress reports.

- Testing: The team evaluated the construction phase's progress and recorded results and issues during the testing stage. After that, the team gathered after the iteration to discuss what they worked on, what worked, and what challenges they encountered.

After each iteration, we had deliverables in the iteration objective as described by the team during the planning stage, with few or no bugs. Progress was monitored and applied to subsequent iterations.

Scope

A list of all use cases and features that have been evaluated, as well as a description of each component and its significance, is included in the scope of work.

- Logging into the system successfully: The first step is to see if the system can successfully be logged in without any problems; if it can't, we move on to the next step.
- Each user was able to log in successfully and access their folder on the file server. We made certain that none of this was carried out correctly.
- Most users on a separate network were able to connect to the main network without any problems and others weren't, the VPN system was successfully linked. Furthermore, the users were able to connect.

Objectives

What the team expects after of each iteration and what objectives are expected at the end of this Senior Design Project will be the team testing approach and end goals.

After each iteration:

- All key features must be accounted for
- All user cases must be accounted for
- All major problems must be fixed
- Documentation must be finished

IT Expo

- All key features must be accounted for
- All visible problems must be fixed
- All documentation must be accounted for and organized.
- All members of the group must have a thorough understanding of all components of the system.
- All use cases must be accounted for and arranged in an orderly fashion.

Test Logs and Procedures

Iteration Number	Iteration Description
1	Users can access the windows account
2	Users can access their file server
3	Users can connect to the VPN

Table 3: Test Logs

Iteration Number	Test Number	User	Expected Outcome	Actual Outcome	Pass/ Fail	Reason For Failure/Success	Date
1	#1	Emmanuel	User login	unsuccessful login	Fail	User or password incorrect input	11/27/2021 01:21:23
1	#2	Emmanuel	User login	Successful login	Pass	User has access to their windows VM	11/27/2021 01:22:33
2	#3	Emmanuel	File is Connected	Emmanuel's file on the file server is connected	Pass	Emmanuel can access the files from his folder	11/27/2021 01:26:43
3	#4	Emmanuel	VPN Connected	VPN is Connected Successfully	Pass	Emmanuel's IP address has successfully changed	11/27/2021 01:29:53
1	#5	Mohammad	User login	Successful login	Pass	User has access to their windows VM	11/28/2021 05:21:23
2	#6	Mohammad	File is Connected	Mohammad's file on the file server is connected	Pass	Mohammad can access the files from his folder	11/28/2021 05:24:53
3	#7	Mohammad	VPN Connected	VPN is Connected Successfully	Pass	Mohammad's IP address has successfully changed	11/28/2021 05:28:23
1	#8	Richmond	User login	Successful login	Pass	User has access to their windows VM	11/28/2021 06:21:23
2	#9	Charlotte	File is Connected	Charlotte's file on the file server is connected	Pass	Charlotte can access the files from his folder	11/28/2021 09:28:23
3	#10	Richmond	VPN Connected	VPN is Connected Successfully	Pass	Richmond's IP address has successfully changed	11/28/2021 06:31:23
1	#11	Charlotte	User login	unsuccessful login	Fail	User or password incorrect input	11/28/2021 09:21:23

Table 4: Testing

Iteration Number	Test Number	User	Expected Outcome	Actual Outcome	Pass/ Fail	Reason For Failure/Success	Date
1	#1	Raghad Hamdan	User login	Successful login	Pass	User has access to Mohammad Windows VM	4/3/2022 05:22:56
2	#2	Raghad Hamdan	File is Connected	Raghad used Mohammad' s file on the file server is connected	Pass	Raghad can access Mohammad's files from his folder	4/3/2022 05:25:44
3	#3	Raghad Hamdan	VPN Connected	VPN is Connected Successfully	Pass	Raghad's IP address has successfully changed	4/3/2022 05:28:12

Iteration Number	Test Number	User	Expected Outcome	Actual Outcome	Pass/ Fail	Reason For Failure/Success	Date
1	#1	Emery	User login	unsuccessful login	Fail	User or password incorrect input	4/5/2022 07:10:07
2	#1	Emery	User login	Successful login	Pass	User has access to Emmanuel's windows VM	4/5/2022 07:10:58
2	#3	Emery	File is Connected	Emery used Emmanuel's file on the file server is connected	Pass	Emery can access Emmanuel's files from his folder	4/5/2022 07:12:33
3	#4	Emery	VPN Connected	VPN is Connected Successfully	Pass	Emery's IP address has successfully changed	4/5/2022 07:18:19

Testing Review

On the virtual machine, four servers and users were created. We proceeded to set server permissions, with two users having administrator privileges. A shared folder was created and mapped to the network, with rights granted to those who are authorized to view it.

One of the administrators logged onto the client workstation and successfully pinged the client-server. With username and password, the IP address on the file was successfully accessed. This was done to see if the file servers were up and running and if the text written would appear in the text folder. A client machine was built and tested to see if a remote worker could access the system from home. This was successfully done.

Change Management Plan:

In any situation, we would need feedback from our advisor before making any changes to the system we're building. First, team members analyzed the benefits and drawbacks to determine what is required for the project and what would be eliminated. Before making any modifications, the team would express their concerns to the advisor and wait for his approval. If we run into a problem, an email will be sent to all stakeholders detailing what happened and how we plan to fix it.

Budget:

Estimated Cost Rough Order of Magnitude:

	Rate Per/Hr	Work Effort (Hours)	1 X Costs	Ongoing Annual			Comments:
				Rate Per/Hr	Work Effort (Hours)	1 X Support Cost	
Labor - IT	20	60	$ 1,200.00	20	60	$ 1,200.00	
Labor - External			$ -		0	$ -	
Software - External			$ 150.00			$ 125.00	
Hardware - External			$ 1,730.00				
Misc.							
TOTAL			$ 3,080.00			$ 1,325.00	

5-Year ROI Analysis

Description	5- Year Expected	Conservative (1.5)
Total Costs	$ 9,705.00	$ 14,557.50
Total Benefit	$ -	$0
Total Costs/Benefit Differential	$ (9,705.00)	
Conservative Costs/Benefit Differential	$ (14,557.50)	

Figure 6: Budget

Problems Encountered and Analysis of Problems Solved:

Starting off the project was great until we started the technical part of this project.

- Operating System

First and foremost, we needed to create a few client machines, which will be able to access content and details on the server because they will be on the same domain and DNS. We created the client machines on a Windows 10 Home computer. Next, we had to find a Windows 10 Pro or Enterprise ISO or acquire a product key to have a licensed Windows to install our

client on the domain because this Home version of Windows 10 has limited features. We were then able to download a product key for Windows 10 Pro and recreate our client PCs, allowing us to use the domain (networkado.com) that we had acquired.

- Storage

Knowing how much space you have, Virtual machines can emulate a computer as well as its operating system. Unfortunately, we ran out of storage while working out the technical aspects of this project, causing our system to fail whenever we tried to use the virtual machine. Due to a lack of storage on Richmond's laptop, our server crashes and prevents access to several services. Any other server or client machine). We gathered together as a group to figure out how to fix this problem because we couldn't do anything because of the lack of storage. We decided to buy more storage, install it on Emmanuel's laptop, and continue working on the project. Our systems worked great and much better once we did so and transferred all documents and data from Richmond's laptop to Emmanuel.

- Firewall and Network Connections.

We banded together as a team to figure out how to move one of our clients to a separate network, as we had previously had all of our clients on the same network. We decided to set up our VPN connections and firewall using a third-party (PfSense). We were able to obtain the ISO and began configuring the PfSense system. We were able to ping the server on the PfSense after completing all of the configurations, but accessing the PfSense webpage proved difficult. We're still having trouble with this, but we're hopeful that we'll be able to solve it soon

Conclusion

In today's IT infrastructure, voice-over IP is gaining popularity to allow businesses to keep track of their internal communication cost by offering a platform for users to access various communication options that are already built and made into the IT infrastructure. VPN is a data network connection that uses public telecommunication infrastructure, which helps maintain privacy through tunneling protocol and security protocols. It works similarly to a Wide Area Network. The majority of businesses use leased lines, but both solutions are very expensive to purchase in either case.

In addition, to work with a variety of infrastructures, VPNs must support protocols other than IP and current internal network technology for small businesses. This project taught us how to use various open-source tools to set up a network and reduce telecommunication expenses for businesses. Networkado advises small businesses with branches in various remote locations to set up a Network Infrastructure, VoIP, and Cloud-Based Service System to be able to connect and share data with all of their locations. To conclude, we are encouraging businesses to make good use of this work project to communicate with each other and share data and resources to promote a secure working environment.

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