Data Center Service Implementation Using Docker Container and FortiGate Network

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

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APPROVAL

This Project titled "**Data Center Service Implementation Using Docker Container and FortiGate Network**" submitted by Saddman Zahin Himel, 163-15-8371 and Nazmul Ahammad Arman, 163-15-8369 to the Department of Computer Science and Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 06-1-2022.

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DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Refath Ara Hossain, Lecturer, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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ABSTRACT

This project is replication of a concept that how can we utilize our minimum hardware resources at maximum output performance by using Docker container virtualization and also, we can secure our network by using security firewall and monitor our data center monitoring system for vulnerability. We can further develop this system as a VPS server that people can use as their personal computer this is how we can utilize at full performance this system. For this project we are using GNS3 simulation software, VMWARE WORKSTATION. We are replicating an office setup how office network setup work. Head office and branch office network connectivity via VPN and office application configuration and usable for users.

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CHAPTER 1

Introduction

1.1 Introduction

The data center is a facility where data or information store in vast majority in server storage device it could be NAS (network area storage) or SAN (Storage area network) depend on data center designer and data center infrastructure. all data is connected via servers through switches routers, lot, ONU and powered via UPS (uninterrupted power supply) or backup power generator. data center plays most important role in our real life, by the data center we cannot imagine our modern life, it runs our social media platforms, our data privacy, our office work, our financial records etc. [1] [2]

1.2 Specifies a Modern Data Center

Today's server farms are vastly different from what they were only a few years ago. Foundation has transitioned from traditional on-premises physical to virtual organization that assist apps and Jobs across pools of physical framework in a multi-cloud environment. Informational exist and is linked across multiple server farms, the edge, and public and private mists throughout this time. The server farm should be able to share data between these several locations, both services run on the cloud server. Even the public cloud is made up of several farms. When applications services are installed in the cloud server services, the cloud provider's server farm. [3] [4]

1.3 Server Farm Office

To support the middle's equipment and programming, server farm parts necessitate a massive foundation. Power substations, uninterruptible power supply (UPS), ventilation, cooling system, fire protection, independent power generators, and connections to outside networks are among them.

1.4 The Principles for Server Farm Foundation

ANSI/TIA-942 is the most widely accepted standard for server farm plans and frameworks. It integrates ANSI/TIA-942 accreditation criteria, consistency with one of four server farm levels examined for degrees of repetition and internal failure adaption.

- The fundamentals of a website. A Tier 1 server farm provides only little protection against actual events. It features a single, non-redundant dispersion method and Part site foundation with redundancy. This server farm provides enhanced protection against genuine events. It features extra limit pieces and a single, non-redundant delivery path.
- Site framework that is concurrently feasible. This server farm protects against almost all real-world events by providing repeating limit portions and a variety of free conveyance options. Every component can be removed or replaced without disrupting end- user administrations.
- Site framework that is fault tolerant. The higher levels of adaptation to internal failure and excess are provided by this server farm. Simultaneous practicality and one issue anywhere in the establishment without generating vacation is enabled by repetitive limit parts and diverse autonomous dispersion ways.

1.5 Motivation

Server farms are the foundation of the computerized economy and the inescapable reception of cloud administrations, business examination and large information will keep on speeding up their interest. Since server farms burn-through a lot of energy, research endeavors are expected to distinguish what works with activities to carry out practices and innovations to one or the other retrofit to or design green server farms. This paper addresses this issue drawing from institutional, anticipation and inspiration capacity hypotheses and in view of study information gathered from 96 server farms. The discoveries demonstrate that presentation and exertion hope structure the solid request

drivers and along with capacity will prompt the execution of practices and innovations that further develop the energy proficiency of server farms.

- Resource Sharing
- Virtualization
- Host your website
- Data connectivity with wire and wireless
- Communicate system with (e-mail, VoIP, messaging)
- Keep information record (data storage)
- Exploring for new ideas (research and development for new technologies)
- Running simulation for different purpose (space research, flight control, missile testing, virtual system testing).

1.6 Aims and Objectives

- a. Create and carry out an enterprise server farm for getting and delivering basic data resources.
- b. Adoptive hearty and assessable administrations that help the requirements of enterprise partners.
- c. Make a solid and effective assistance for facilitating and delivering basic data resources and different information to its clients.
- d. Carry out security approaches and specialized apparatuses to shield information from disaster, risk, compromise of other improper use.
- e. Decrease costs related with the security and keep of basic data resources.
- f. Offer quality support levels that meet or better client assumptions.
- g. Improvement on efficiencies through essential execution of standard platforms.
- h. Provide improved information security in consistence with administration and other administrative bodies.

1.7 Expected Outcome

Were all technologists, or in any event, clients of innovation. In the server farm space, we are continually utilizing new frameworks, strategies for correspondence, and cutting-edge innovations intended to make life easier. Yearly worldwide IP traffic will reach 3.3 zettabytes by 2021. In 2016, worldwide IP traffic was 1.2 ZB each year or 96 exabytes (one billion gigabytes) each month.

Worldwide IP traffic will increment almost triple over the course of the following five years and will have increment 127-fild from 2005 to 2021.

- a. previous data center system and device was power hungry but new system of data center device is more efficient and less power consumption device. power of data center is reduced via 40% across the globe and recently all data center company shifting their premises is south and north area of earth because of weather condition. North pole and south pole are cold, and it help data center to cool down and work more effectively. it reduces power consumption and burn fossil fuel.
- b. data center can help our country economy growth.it can help our county economy via monitoring all financial system and software algorithm. We can implement more data center infrastructure in our country and provide could base, and data storage services to other countries to earn remittance for our country When we asked respondents about data center growth, we found that ownership, renovations, and building were on the upswing.
- c. How much change innovation and additions are being made in the data center industry in any given year. Such as the public cloud, private cloud and traditional IT.



Figure 1.7 Shows Growth and expansion of data center industry

Figure 1.7: Growth and expansion of data center industry

1.8 Layout of The Report

- a. The introductory chapter gives the background leading of our project about data center and network security.
- b. The chapter Design model of the Project.
- c. This chapter is about Requirement Specification Network project with GNS3 and VMware.
- d. This chapter is about the overview of the project. In this chapter we discuss about FortiGate Brand VLAN, IPsec VPN, Firewall, IDS, IPS, Web Server, FTP Server, NAS Server with Automatic Backup, Mail server with configuration and screenshots.
- e. Demo (Simulation and result) of the project.
- f. We turn into the conclusion and future Scope of the Networking security system of Organizations.

CHAPTER 2

Background

2.1 Firewall

The firewall is a security device which monitor all the traffic activities in the network. the firewall checks each incoming and outgoing packet thought network for malicious packet or information to prevent any cyber-attack like DDOS, MITM (man in the middle) packet sniffing, ransomware attack, BOT etc. Firewall types that United Threat Management Firewall (UTMFW), Next-generation Firewall (NGFW), Threat-focused (TFFW). [5]

2.2 Network Switch

A network switch is a device that works on networking data link layer.it help data or packet to transmit device to device like computer to computer, computer to laptop or mobile or outside through router or firewall. Network switch has its own mac table, and it stores these device macs address each packet contain header destination mac address to reach on destination location. Layer 3 switch is available, and this kind of switch can work route level but can-do NAT (network address translation). [6]

2.3 Network Switch Works

2.3.1 Deployed in The Following Ways

- Edge or access switches: this type of switch is installed in server racks where server is installed. This method can help us to separate the Ares and help us to find network error problem easily. This type of switches directly handles end devices like computer, access control, Ip cameras, access point, printers, scanner, and aggregation switches.
- Aggregation or distribution switches: this switch is installed in middle point where all edge switch uplink cable relates to aggregation switches,

this type must have redundancy and link fault tolerant system to prevent any kind of link breakdown like multiple cores switch a downlink line, two power supply and two or more power incoming system for nonstop performance.

Core switches: these switches also have redundancy link, but these switches are directly connected under firewall or routers. This switched distribute data or packet and sometime provide Ip address, depend on data center configuration. This switches downlink is aggregation switches and uplink are firewall and routers sometimes both can be connected to prevent link down error.

2.4 VLAN

VLAN (virtual LAN) is a technology that works inside Lan port. multiple data can be sent in one port in different network.it reduce the Lan port to use individual port by port. Each VLAN has its own network and subnets, and gateway Lan can work in multiple switches though VLAN ID and its smooth the internal network architecture and data flow inside network. [7]

2.5 IPsec VPN

VPN is virtual private network connections forwarded (tunneled) through public-to-public Ip networks. IPsec VPN Is s protocol, secure the network connection in standards way to create a VPN (virtual private connection). IPsec is a group of protocols that work together to set up encrypted connection between two or more router and firewall devices. IPsec VPN system used to set up VPNs and it works by encrypting IP packets. Within the team "IPsec" "IP" stands for "Internet Protocol" and "sec" for secure. [8] [9]

2.6 IDS

An intrusion detection system (IDS) is a system and work as a software application that monitors all the packets in the network for malicious activity or policy breaches via monitoring time any kind of malicious activity or violation can scan via IDS it is reported and stored centrally using a security data and event management system. Some IDS's can detected intrusion via network scanning. [10]

These are classified as intrusion prevention systems (IPS), IDS detection types:

- NIDS Network Intrusion Detection System
- HIDS Host-based Intrusion Detection System
- HIDS Host Intrusion Detection System

2.7 IPS

IPS (intrusion prevention system) is a system that can detect and prevent any kind of cyber security like DDOS (distributed denial of service) Bot attack, brute force entry, email bombing, network vulnerabilities, exploits, and hackers, MITM (man in the middle) IPS (intrusion prevent system) can quickly block ports and prevent the attack. [11] [12]

2.8 Web Server

A web server is use in store information and spread the information everyone. like online newspaper. but now a day webserver is very necessary to everyone. web servers contain information, this information cloud be person information, social media platform information, online job circular based information by the webserver we can collect information though public example online vote, online public opinion, online store for place order any product, curriculum vita collection, and many more. web servers need a hosting pc to host the site and domain server for its identity to identify in public itself. websites need HTTP (hypertext transfer protocol) SMTP (simple mail transfer protocol.

2.9 DMZ

In cyber security, a demilitarized zone (DMZ) is a subnetwork which separates the internal local area network (LAN) external networks. The external-facing server, resources and services sit in the DMZ, meaning that they have accessible from and have access to the internet in addition to the other parts of the internal LAN. This means there is no direct access between the internet and the internal LAN cannot be reached. Examples of services that might be in the DMZ. [13]

2.10 VMware Workstation

VMware Workstation is a virtual machine software that is used for x86-64 based computer operating system to run multiple operating systems over a single physical computer. Each virtual machine can run a single any operating system (Microsoft, Linux etc.). VMware Workstation Strongly supports hardware compatibility and works as a bridge or as a NAT and host mood network between physical machine for all kinds of hardware sources with hard disk, USB tool. All drives are installed via the host physical machine. [14] [15]

2.11 GNS-3 (Graphical Network Simulation)

GNS3 is used by hundreds of thousands of network engineers worldwide to emulated, configure, test and troubleshoot virtual and real network. GNS3 allows you to run a small topology consisting of only a few devices on your laptop, to those that have many devices hosted on multiple servers or even hosted in the cloud. [16] [17]

At first, we will install VMware software on our main host laptop after that we will install VM pc (windows 10 user pc) follow the step following figures.

- Click on create new virtual machine
- Select typical then click on next
- Elect I will install the operating system latter
- Select Microsoft windows and windows vision which windows you want to install
- Give a virtual machine and virtual machine install location

- Give the virtual machine install size and select virtual store type
- Now select virtual machine setting and select cd/DVD and use iso file and give the iso file location.

Let's install VM ware in windows 10. After finishing install VM ware, then the open VM ware we will see on display like the picture below.

Figure 2.11 – 1 Shows windows 10 in VM



Figure 2.11 – 1: windows 10 in VM

VM ware it will be seen on the display in the next step. Figure 2.11 - 2 shows windows 10 in VM

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	Or, even better, use an online account					
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To direct input to this VM, click inside or press Ctrl+G.					0300	a 🖴 🔊 📘

Figure 2.11 - 2: windows 10 in VM

VM ware it will be seen on the display in the next step. Figure 2.11 - 3 shows windows 10 in VM

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Figure 2.11 – 3: windows 10 in VM

Our window 10 user end pc is ready to use we will add 5 more pc as user pc now we will install ubuntu server on our VM machine.

- Create a new virtual machine
- Select language (English) then install ubuntu
- From update and install select normal install and download Ubuntu while installing.
- Installation type select erase and install Ubuntu
- Select time zone and create username password on VM Ubuntu server

Now, we will set up ubuntu in VM ware, this is one part of Linux. After finishing install Ubuntu, then the open Ubuntu we will see on display like the picture below. Figure 2.11 - 4 shows Ubuntu Server setup



Figure 2.11 - 4: Ubuntu Server setup

VM ware it will be seen on the display in the next step. Figure 2.11 - 5 shows Ubuntu Server Setup



Figure 2.11 - 5: Ubuntu Server setup

2.11.1 Install GNS-3 and insert GNS-VM and Fortinet 64vm Version 7.0.1

Let's install GNS3 in VM ware. After finishing install GNS3, then the open GNS3 we will see on display like the picture below. Figure 2.11.1 - 1 shows Installed Gns3vm and Fortinet 64vm

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one-stop networking shop GNS3 Network Pros	empty30G.qcow2	3411a599e822f2ac6be560a26405821a	0 MB	Download
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saturaid	FGT_VM64_KVM-v6- build1010- FORTINET.out.kvm.qcow2	da411e21e4c0bc25553d0e72201af7a4	59 MB	Download
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	File	MD5	Size	
	FGT_VM64_KVM-v6- build0866- FORTINET.out.kvm.qcow2	588df9ba0db485976f6681810001ae73	58 MB	Download
	empty30G.gcow2	3411a599e822f2ac6be560a26405821a	0 MB	Download

Figure 2.11.1 – 1: Installed Gns3vm and Forninet 64vm

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Gns3vm and Fortinet 64vm it will be seen on display in the next step.

Figure 2.11.1 – 2 shows Installed Gns3vm and Fortinet 64vm

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Figure 2.11.1 – 2: installed Gns3vm and Forninet 64vm

Gns3vm and Fortinet 64vm it will be seen on display in the next step.

Figure 2.11.1 – 3 shows Installed Gns3vm and Fortinet 64vm



Figure 2.11.1 – 3: Installed Gns3 VM and Fortinet 64vm

Gns3vm and Fortinet 64vm it will be seen on display in the next step.

Figure 2.11.1 – 4 show	s Installed Gns3vm	and Fortinet 64vm
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Figure 2.11.1 – 4: Installed Gns3vm and Fortinet 64vm

2.11.2 Configure our Fortinet head office firewall wan port, LAN port, IP address, DNS configure security policies, Firewall policies, Static route and VPN IPsec.

We need to enable our wan port on cli (command line interface) mode

WAN Port

FortiGate-VM64-KVM # config system interface FortiGate-VM64-KVM (interface) # edit port1 FortiGate-VM64-KVM (port1) # set mode static FortiGate-VM64-KVM (port1) # set ip 192.168.122.89 255.255.255.0 FortiGate-VM64-KVM (port1) # set allowaccess https http ping telnet ssh FortiGate-VM64-KVM (port1) # set role wan FortiGate-VM64-KVM (port1) # set alias WAN-port FortiGate-VM64-KVM (port1) # end

LAN Port

This is our firewall Lan port dashboard in this panel we can configure our Lan port as our requirement. Figure 2.11.2 - 1 Shows LAN Port

FortiGate - HAED-OFFICE-FIR	EW/ × +								0	-	٥	×
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🕞 HAED-OFFICE-FIREWALL 🔻	≡ Q			FortiGate time is out of s	ync.				? -	¢ 2 ∙	👤 ad	lmin •
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+ Network *	Interface	🗎 port3				FortiGate						_
Interfaces 🏠	VLAN ID	10 🖋 Edit				HAED-OFFICE-FIREWALL						
DNS	VRFID 8	0										
Packet Capture	Role 0	LAN	•			Status						
SD-WAN	Address					e op						
Static Routes	Address					MAC address						
Policy Routes	Addressing	mode	Manual DHCP Auto-m	hanaged by FortilPAM		0c:53:48:b3:00:02						
RIP	Create add	ress object matching subr	net 🕥			Additional Information						
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Routing Objects	Secondary I	IP address	0			TO References						
Policy & Objecte						>_ Edit in CLI						
A Security Profiles >	Administrat	tive Access				 Documentation 						
므 VPN >	IPv4	Speed Test	HTTPS	PING		Online Help II						
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	Miscellaneo	ous										
	Comments		A0/255									
				OK	Cancel							

Figure 2.11.2 - 1: LAN Port

Security Policies

This figure shows us firewall web filter (websites) security polices where we can customize out polices as our requirement. Figure 2.11.2 - 2 Shows Security Policies



Figure 2.11.2 – 2: Security Policies

IPS Policies

This is firewall IPS (intrusion prevention system) where we can configure our

IPS and prevent cyber-attack. Figure 2.11.2 - 3 Shows IPS Policies

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Image: HAED-OFFICE-FIREWALL + ■ Q Image: The transmission of t	≻_ 😯 • 🗘 2 • 🔹 admin •
Delationard Falley & Oktyok Policy & Objects Policy &	PortiGate ■ MacD-OFFICE-FIREWALL PS Signatures ■ View IPS Signatures Additional Information ● API Preview ● References > Edit in Cut ● Online Help © ● Online Help © ● Video Tutorials (2)

Figure 2.11.2 – 3: IPS Policies

Static Route

This is static route configuration. Figure 2.11.2 – 4 Shows Static Policies

Figure 2.11.2 – 4: Static Route

VPN Setup for Two Branches

This is site to site VPN setup and configuration. Figure 2.11.2 – 5 Shows VPN



setup for two branches



This is site to site VPN setup and configuration. Figure 2.11.2 - 6 Shows VPN setup for two branches

FortiGate - HAED-OFFICE-F	IREWA × +		• - • ×
d D C I	Not secure	192.168.122.89/ng/vpn/ipsec/edit?name=HEAD-BRANCH2	ন ও 💟 🕰 🖬 🗉 🗉
🕞 HAED-OFFICE-FIREWALL 👻	≡ Q		>_ 🔞 • 🖓 3 • 🔎 admin •
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	Local Address	Subnet	
	Remote Address	Subnet • 192.168.30.1/24	
			OK Cancel

Figure 2.11.2 - 6: VPN Setup For Two Branches

Firewall Policies

This is firewall access policies for VPN, wan and Lan connectivity in firewall policies. Figure 2.11.2 - 7 Shows Firewall Policies

R HAED-OFFICE-FIREWALL	L - Ξ Q								>_ 0	• Д 🛛 • 😕 admin •		
		FortiGate time is out of sync.										
🔁 Dashboard	> + Create New / Edit	Delete Q Policy Lo	okup Search		Q				Interf	ace Pair View By Sequence		
+ Network	Name	From	То	Source	Destination	Schedule	Service	Action	NAT	Security Profiles		
Policy & Objects	local lan to internet	I OCAL-LAN (port3)	wan-nort (nort1)		(E all	always		✓ ACCEPT	C Enabled	sertificate-inspection		
Firewall Policy	vnn bead to branch1 local 0	I OCAL-LAN (port3)	bead to branch1	bead to branch1 local	The bead to branch1 remote	ahvavs		✓ ACCEPT	O Disabled	St. novinspection		
IPv4 DoS Policy	vpn head to branch1_secure	 bead to branch1 	IOCAL-LAN (port3)	The bead to branch1 remote	The bead to branch1 local	a hunys		ACCEPT	O Disabled	Sil povintraction		
Addresses	upplinead to branch _ render		book bergologi	The based because a level	The based because 2 access		TEL ALL	ACCEPT	O Disabled			
Internet Service Database	vprijhead-breanch2jiocarjo	C Local-Daiv (ports)	E Local Latt (cont)	The head-breaking local	head-breakch2_remote		W ALL	▼ ACCEPT	Disabled	sac no-inspection		
Services	vpn_head-breanch2_remote_0	(1) head-breanch2	EUCAL-LAN (port3)	head-breanch2_remote	head-breanch2_local	Lo always	W ALL	✓ ACCEPT	O Disabled	ss. no-inspection		
Schedules	Implicit Deny	∐ any	U any	🔄 all	📱 all	to always	L ALL	Ø DENY				
Virtual IPs												
IP Pools												
Protocol Options												
Traffic Shaping												
Security Profiles	>											
Q VPN	>											
💄 User & Authentication	>											
🌣 System 🧉	D >											
🔆 Security Fabric	>											
네 Log & Report	>											
FERTIDET	Security Rating Issues									() Updated: 10:59:15		



2.11.3 Branch Office 1

Now we will configure our Fortinet branch office 1 firewall wan port, LAN port, IP address, DNS configure, security policies, firewall policies, static route and VPN IP-sec. We need to enable our wan port on cli (command line interface) mode.

WAN Port

FortiGate-VM64-KVM # config system interface FortiGate-VM64-KVM (interface) # edit port1 FortiGate-VM64-KVM (port1) # set mode static FortiGate-VM64-KVM (port1) # set ip 192.168.122.226 255.255.255.0 FortiGate-VM64-KVM (port1) # set allowaccess https http ping telnet ssh FortiGate-VM64-KVM (port1) # set role wan FortiGate-VM64-KVM (port1) # set alias WAN-port FortiGate-VM64-KVM (port1) # end

Configuration for wan port of firewall via FortiGate VM64 KVM. Figure 2.11.3 – 1 Shows WAN Port

FortiGate-VM64-KVM	(port1) # set mode static
FortiGate-VM64-KVM	(port1) # set ip 192.168.122.226 255.255.255.0
FortiGate-VM64-KVM	(port1) # set allowaccess https http ping ssh
FortiGate-VM64-KVM	(port1) # set role wan
FortiGate-VM64-KVM	(port1) # set alias wan-port
FortiGate-VM64-KVM	(port1) # end
FortiGate-VM64-KVM	# config system global
FortiGate-VM64-KVM	(global) # set hostname BRANCH-OFFICE-1
FortiGate-VM64-KVM Unknown action 0	(global) # END
FortiGate-VM64-KVM	(global) # end
BRANCH-OFFICE-1 #	

Figure 2.11.3 – 1: WAN Port

LAN Port

Branch office 1 LAN dashboard, where we can configure Lan interfaces and service as our requirement. Figure 2.11.3 - 2 Shows LAN Port

O C O	FortiGate - BRANCH-OFFICE-1	× +	• - • ×
BIANACH OFFICEL	a Þ.c. a	A Not secure 192.168.122.226/ng/interface/edit/port2	🕶 ର 💯 🚣 🖬 🖬 🖻
I baltward Jean Hairland I baltward Name I bOCALLAN (pet2) I baltward Name I bOCALLAN Packet Capture I BANOCH-OFFICE 1 Static Boarder Name I bOCALLAN Packet Capture I Providel Interface I BANOCH-OFFICE 1 Static Boarder Name I bOCALLAN Robert Capture I Providel Interface I BANOCH-OFFICE 1 Static Boarder Address Address Static Boarder Address I Providel Interface Boding Objects Address I Provide Interface Boarder Operation Address I Provide Interface I Verk Operation I Provide Interface	BRANCH-OFFICE-1	■ Q ● FortiGate time is out of sync.	>_ 🕢 • 🗘 3 • 🤹 admin •
	Image: Security Fabric > Image: Security Fabric >	Local-LAN Alias LocAL-LAN Type ClocAL-LAN Type Phyloid Interface Phyloid Interface Phyloid Netrals Address Address Address Address Create address object matching subnet Secondary IP address Create address object matching subnet Secondary IP address Device detection DHCP Server Traffic Shaping Outbound shaping profile Network	FortiCate BRANCHOFFICE1 Status V Up MAC address Ceca437ac0001 Additional information Additional information Additional information Additional information C ADIP Review C Documentation C Documentation

Figure 2.11.3 – 2: LAN Port

This is DNS (domain name server) we are using google DNS. DNS Configure

DNS dashboard, where we can configure DNS are using google DNS as our requirement. Figure 2.11.3 - 3 Shows DNS (Domain name server)

FortiGate - BRANCH-OFFICE-1	× +	o – o ×
⊲ ⊳ c □	A Not secure 192.168.122.226/ng/network/dns/settings	ञ 🔍 🖓 🖓 🖬 🖻 🗉
BRANCH-OFFICE-1 •	 Q Praticate time is out of sync. 	>_
Dashboard	DNS Settings	
Horizonta H	Dris servers Use Pertiduard Servers Specify Primary DNS server: 9:9:9:9 Local domain name • Dris Protocols • Dris (UDP/33) • TLS (TCP/443) •	DNS Servers 208,91,112,32 Additional Information APProvise Editin CL Setup guides ONS Local Domain List (? Using Provides as JDNS Server (?) FortiGuard DDNS [? * Online Help (?) * Online Help (?) * Video Tutorials (?)

Figure 2.11.3 – 3: DNS Configure

VPN IP-sec configure with head office

VPN IP-sec dashboard, where we can configure VPN IP-sec configure with head office as our requirement. Figure 2.11.3 - 4 Shows VPN IP-sec configure with head office

FortiGate - HAED-OFFICE-FIRE	NA 🗙 🖽 FortiGate - BRANC	H-OFFICE-1 × +				0	-	٥	×	
⊲ ⊳ c □	🛦 Not secure 192.168.122.226/ng/vpn/ipsec/edit/BRANCH1-HEAD?name=BRANCH1-HEAD								G	Ξ
BRANCH-OFFICE-1 -	■ Q Edit VPN Tunnel		• FortiGate ti	ne is out of sync.		>_	0.	4 <mark>8</mark> -	🙎 adm	in •
+ Network Policy & Objects Policy & Objects Policy & Objects Policy & Objects Policy & Other VPN VPN VPnec Tunnels VPN Ventals SSL-VPN Portals SSL-VPN P	Name Comments Network Remote Gateway : Stati Authentication Authentication Method IKE Version : 1, Mode : Phase 1 Proposal Algorithms : DES-MD5, Diffie-Hellman Groups XAUTH Type : Disabled Phase 2 Selectors Name Loca BRANCH1 : 192.166 ;	BRANCH1-HEAD Comments 0/25 Com	S T Edit Edit Edit Edit Edit Add Add	OK Cancel	c: VPNs sec: VPN Cookbook Recipes (2) agen/httClint unentation nile Hele (2) deo Tutorials (2)					

Figure 2.11.3 – 4: VPN IP- sec configure with head office

Firewall Policies

This is firewall access policies for VPN, wan and Lan connectivity in firewall policies.

Figure 2.11.3 – 5 Shows Firewall Policies

BRANCH-OFFICE-2										>_ @•	40 • 😢 admin •
		FortiGate time is out of sync.									
Dashboard		+Create New 🖋 Edit 🔒	Delete Q Policy Look	Jp Search		Q				Interface	Pair View By Sequence
Network	>	Name	From	То	Source	Destination	Schedule	Service	Action	NAT	Security Profiles
Policy & Objects	×	LOCAL-LAN TO INTERNET	E LOCAL-LAN (port2)	WAN-PORT (port1)	🗉 all	🖾 all	G always	D ALL	✓ ACCEPT	Enabled	default
IPv4 DoS Policy Addresses											APP block-high-risk
Internet Service		vpn_branch2-head_local_0	E LOCAL-LAN (port2)	branch2-head	The branch2-head_local	branch2-head_remote	G always	ALL.	✓ ACCEPT	O Disabled	ss no-inspection
Database		vpn_branch2-head_remote_0	D branch2-head	E LOCAL-LAN (port2)	branch2-head_remote	branch2-head_local	6 always	D ALL	✓ ACCEPT	O Disabled	ss. no-inspection
Schadular		vpn_branch2-branch1_local_0	E LOCAL-LAN (port2)	branch2-branch1	B branch2-branch1_local	branch2-branch1_remote	to always	D ALL	✓ ACCEPT	O Disabled	ss no-inspection
Virtual IPs		vpn_branch2-branch1_remote_0	Ibranch2-branch1	EUCAL-LAN (port2)	branch2-branch1_remote	branch2-branch1_local	Co always	D ALL	✓ ACCEPT	O Disabled	ss. no-inspection
IP Pools		Implicit Deny	🗆 any	🗆 any	🖾 all	🖬 all	to always	D ALL	Ø DENY		
Protocol Options											
Traffic Shaping ▲ Security Profiles ↓ VPN ▲ User & Authentication ♦ System ★ Security Fabric 止 Log & Report	> > > >									_	
FURTIDET	704	Security Rating Issues								0	Updated: 11:45:41 📿
	V7.0.1										



The same configure we will follow in fortinet branch office 2 only the wan port lan port and firewall polices will be change.

2.11.4 Configure our main ubuntu server

- First, we will install docker on ubuntu server
- \$ sudo apt-get update
- \$ sudo apt install apt-transport-https ca-certificates curl softwareproperties-common
- \$ curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo aptkey add
- \$ sudo add-apt-repository "deb [arch=amd64]
 https://download.docker.com/linux/ubuntu focal stable"
- \$ sudo apt install docker-ce

2.11.4.a Next Cloud

- docker pull nextcloud
- docker run -d -p 8080:80 -name = clouds service nextcloud

Docker and Ubuntu server dashboard, where we can configure docker and ubuntu server as our requirement. Figure 2.11.4.a - 1 Shows Docker and Ubuntu server

ubunto@ubunto CONTAINER ID ubunto@ubunto	<pre>-virtual-machine:~/Desktop\$ sudo docke IMAGE COMMAND CREATED STATUS -virtual-machine:~/Desktop\$ sudo docke</pre>	rps PORTS NAI rps-a	MES		
CONTAINER ID	IMAGE COMMAND CREATED STATUS	PORTS NAM	MES		
ubunto@ubunto-	<pre>-virtual-machine:~/Desktop\$ sudo docke</pre>	r image			
Usage: docker	r image COMMAND				
Manage images					
Commands:					
build	Build an image from a Dockerfile				
history	Show the history of an image				
import	Import the contents from a tarball to	create a filesys	stem image		
inspect	Display detailed information on one o	r more images			
load	Load an image from a tar archive or S	TDIN			
ls	List images				
prune	Remove unused images				
pull	Pull an image or a repository from a	reaistrv			
push	Push an image or a repository to a re	aistrv			
rm.	Remove one or more images				
save	Save one or more images to a tar arch	ive (streamed to	STDOUT by defaul	t)	
tag	Create a tag TARGET IMAGE that refers	to SOURCE IMAGE			
Run 'docker in	mage COMMANDhelp' for more informat	ion on a command.	•		
ubunto@ubunto.	-virtual-machine:~/Desktop\$ sudo docke	r images			
REPOSITORY	TAG TMAGE TO CREATED	STZE			
nextcloud	latest 1d418eb70dce 7 days ano	937MR			
ubunto@ubunto	victual-machine:~/Deskton\$ sudo docke	r run -d -n 8080	.80name cloud-	service nextcloud	
bassdcf3eaf43	2184327d5d92a79e1929f3895539662b5eeeed	7564017416774		Service nexceloud	
ubunto@ubunto	victual machine: /DesktopS sudo docke				
CONTATNED TO	TMACE COMMAND		CTATUC	DODIE	NAMES
basEdcf2o0f4	nextsloud "/ontsuppint sh apas "	15 soconds ago	Up 14 coconde	A A A A 99000 >00/tcp	cloud convico
ubunto@ubunto	victual machine to /Decktop	15 Seconds ago	op 14 seconds	0.0.0.0.0000->00/tcp,8080->80/tcp	ctoud-service
apan collanan co-	ver coace machine rey besk cops				

Figure 2.11.4.a - 1: docker and ubuntu server

Then Docker and Ubuntu server will show dashboard for log in. Figure

2.11.4.a - 2 Shows docker and ubuntu server log in



Figure 2.11.4.a - 2: docker and ubuntu server login

2.11.4.b Web Server

 sudo docker run -d --name web-server -p 801:80 -v /home/ubunto/webserver:/usr/share/nginx/html nginx

Figure 2.11.4.b - 3 Shows web server

ubunto@ubunto-virtual-machine:~\$ ls	and the second	and the second		
Desktop Documents Downloads Music Pictures Pub				
ubunto@ubunto-virtual-machine:~\$ sudo docker ps				
CONTAINER ID IMAGE COMMAND	CREATED	STATUS	PORTS	NAMES
b055dcf3e9f4 nextcloud "/entrypoint.sh apac"	7 minutes ago	Up 7 minutes	0.0.0.0:8080->80/tcp, :::8080->80/tcp	cloud-service
ubunto@ubunto-virtual-machine:~\$ sudo docker run -c	name web-serve	г -р 801:80 -v	/home/ubunto/web-server:/usr/share/nginx	/html nginx
Unable to find image 'nginx:latest' locally				
latest: Pulling from library/nginx				
eff15d958d66: Already exists				
1e5351450a59: Pull complete				
2df63e6ce2be: Pull complete				
9171c7ae368c: Pull complete				
020f975acd28: Pull complete				
266f639b35ad: Pull complete				
Digest: sha256:097c3a0913d7e3a5b01b6c685a60c03632fc	7a2b50bc8e35bcaa3	691d788226e		
Status: Downloaded newer image for nginx:latest				
bddbfbed58ef6ce9fe0947bae6b15e795a26cd1ef99909b5f21	109ea4ee9a6fb			
ubunto@ubunto-virtual-machine:~\$ sudo docker ps				
CONTAINER ID IMAGE COMMAND	CREATED	STATUS	PORTS	NAMES
bddbfbed58ef nginx "/docker-entrypoint"	8 seconds ago	Up 8 seconds	0.0.0.0:801->80/tcp, :::801->80/tcp	web-server
b055dcf3e9f4 nextcloud "/entrypoint.sh apac"	13 minutes ago	Up 13 minutes	0.0.0.0:8080->80/tcp, :::8080->80/tcp	cloud-service
ubunto@ubunto-virtual-machine:~\$				

Figure 2.11.4.b - 3: web server

2.11.4.c FTP Server

- \$ sudo docker run -d -v /home/ftpserver:/home/vsftpd -p 20:20 -p 21:21 -p 47400-47470:47400-47470 -e FTP_USER=Zenith -e FTP_PASS=Zenith -e PASV_ADDRESS=127.0.0.1 --name ftp -restart=always bogem/ftp
- \$ sudo apt-get update
- \$ sudo apt-get install filezilla

Figure 2.11.4.c – 4 Show Ftp Directory



Figure 2.11.4.c - 4: Ftp Directory

2.11.4.d Mail Server

To configure our mail server, we need specific requirements to our mail server which we will take it as our VM machine.

processor: 4vCPU, Ram: 8GB, disk space: 50GB

- \$ sudo vim /etc/dnsexample.com.conf
- \$ sudo hostnamectl set-hostname client.exmaple.com
- \$ sudo vim/etc/hosts
- \$ sudo systemctl restart
- \$ wget https://files.zimbra.com/donwloads/8.8.15_GA/zcs 8.8.15 GA 3869.UBUNTO18 64.20190918004220.tgz
- \$ tar -xvf zcs-8.8.15_GA_3869.UBUNTU18_64.20190918004220.tgz
- \$ cd zcs-8.8.15_GA_3869.UBUNTU18_64.20190918004220.tgz
- \$ sudo ./install.sh
- \$ sudo apt-get install update
- \$ nslookup server.example.com
- \$ sudo vim/etc/resolv.conf
- \$ sudo nano /etc/resolv.conf

CHAPTER 3

Requirement Specifications

3.1 Element

- a. VMware Software
- b. Gns3 (Graphical Network Simulator)
- c. Operating system Image file (windows 10 and Ubuntu server OS)
- d. Computer
- e. Switch
- f. Firewall
- g. Host Computer
- h. IP Address
- i. Subnet Mask
- j. Default Gateway
- k. Domain Name
- l. Domain Server
- m. NTP Server
- n. FTP Server
- o. Web Server
- p. Mail server
- q. DMZ

3.2 Internal and External Requirements

3.2.1 Firewall Overview

As we know it very well that Fortinet (cyber security) company is one of the leading network security devices manufactures, Next-Generation Firewall (NGFW). [18] [19]

- Ultra-fast security, end to end
- Consistent real-time defense with FortiGate Services

- Excellent user experience with security processing units
- Operational efficiency and automated workflows

3.2.2 Windows 10 Overview

Windows 10 is a major release of the Windows NT operating system developed by Microsoft. It is the successor to Windows 8.1, which was released nearly two years earlier and it self was released to manufacturing on July 15, 2015 and broadly released for the general public on July 29, 2015.

3.2.3 Ubuntu Overview

Ubuntu is a complete Linux operating system, freely available with both communication and professional support. The Ubuntu community is built on the ideas protected in the Ubuntu Platform: that software should be obtainable free of charge, that software program tools should be serviceable by people in their local language and despite any incapacities and that people should have the freedom to modify and change their software program in whatever way they see suitable.

3.2.4 Docker Overview

Docker is an open platform for developed, supply and running application. Docker enables you to separate your application from your infrastructure so you can deliver software quickly. With docker you can manage your infrastructure in the same ways you handle your applications. By taking benefit of docker's systems for delivery, analysis and deploying code quickly, you can significantly reduce the interruption between composing code and running it in production. [20] [21]

CHAPTER 4

Data Center Design and Diagram

4.1 Design and Diagram

For this project we are using GNS3 simulation software, VMware Workstation. We are replicating an office setup how office network setup work. Head office and branch office network connectivity via VPN and office application configuration and usable for users.

Figure 4.1 Shows Data Center Design



Figure 4.1: Data Center Design

CHAPTER 5

Impact on Society, Environment and Sustainability

5.1 Impact on Society

As we mention before in data center facility there are lot of server and NAS (network attached storage) remain on this kind of facility and gathers data from everywhere and people buy space package or use some free space offer package as they like, but in backend system strong AI system run on server system and monitor everything and social media platform is rub by this server.so we all relay on this backend data center system to run our own social platform.

5.2 Impact on Environment

In the world all big data center data mining company and bitcoin miners, data storage companies are trying to reduce their electricity cost by transferring their farms in north pole and south pole location for cold area and it also reduce energy cost by burning fossil fuel and trying to reduce environment temperature naturally.

5.3 Ethical Aspects

It is most important thing in data center to keep everyone data privately. data center company should not look for any type of information and sale data to other companies. Every company of this system should use firewall for prevent cyber-attack from black hat hackers or stolen information from any intruders.

5.4 Sustainability Plan

For future upgrade and expansion data center should chose those type of place when data center can be expended if needed and from prevent environment type disaster like cyclone flood, earthquake, and most important load shedding. And rooftop we can use solar panel to create electricity from the sun and use this power energy in night this is how we can sustain our system properly.

CHAPTER 6

Conclusion and Further Development

6.1 Conclusion

The main reason behind the developing this project because we want to show that we can improve our server services with minimum hardware requirement by Docker container virtualization. This project is just a concept for future virtualization system. This virtualization can help to improve our environment by low energy consumption.

6.2 Scope for Further Developments

- a. We can add more server services as we need for future development.
- b. We can Improve firewall security policies for more secure network.
- c. All the server services should run on real server machines.
- d. We will improve our web server and next cloud server services as future requirement.

References

- K. M. P. Kant, "Guest Editors' Introduction: Internet Data Centers," Computer, vol. 37, no. 11, pp. 35-37, 2004.
- [2] S. Arnon, "Next-generation optical wireless communications for data centers," in Broadband Access Communication Technologies IX, 2015.
- [3] D. ONLINE, "DATAQUEST(TECH4GROWTH)," CyberMedia, https://www.dqindia.com/ 27 5 2016. [Accessed 11 12 2021].
- [4] M. R. S. R. B. H. N. V. A. Al-Fares, "Hedera: dynamic flow scheduling for data center networks," in Nsdi, 2010.
- [5] kaspersky, "kaspersky Web site," Available at :

<< https://www.kaspersky.com/resource-center/definitions/firewall >> [Accessed 11 12 2021] at 3.00 pm

- [6] P. M. J. G. N. L. W. Papaphilippou, "Hipernetch: High-Performance FPGA Network Switch," ACM Transactions on Reconfigurable Technology and Systems (TRETS), vol. 15, no. 1, pp. 1-31, Nov 2021.
- [7] N. Zhan-Ping, "Application of VLAN technology in the intelligent substation network [J]," Power System Protection and Control, vol. 37, pp. 75-78, 2009.
- [8] P. K. S. P. P. Singh, "A Novel approach for the Analysis & Issues of IPsec VPN," International Journal of Sciences and Research, vol. 2, pp. 187-89, 2013.
- [9] V. K. M. W. S. Bollapragada, IPSec VPN Design, Cisco Press, 2005.
- [10] GeeksforGeeks, "GeeksforGeeks," 2020., Available at :

<< https://www.geeksforgeeks.org/intrusion-detection-system-ids/ >> [Accessed 11 13 2021] at 10.17 am.

- [11] R. Kartika, "Upaya Meningkatkan Prestasi Belajar Pada Pembelajaran IPS dengan Media Pocket Book Flouna," Paidea: Jurnal Pendidikan dan Pembelajaran Indonesia, vol. 1, pp. 51-19, 2021.
- [12] A. S. H. A. Newell, Human problem solving, vol. 104, Prentice-hall Englewood Cliffs, NJ, 1972.
- [13] Fortinet, Available at : << https://www.fortinet.com/resources/cyberglossary/what-is-dmz >>.[Accessed 11 14 2021] at 11.00 am.
- [14] B. Choi, "Introduction to VMware Workstation," in Introduction to Python Network Automation, Springer, 2021, pp. 139-168.
- [15] K. Hess, Available at : << https://www.zdnet.com/article/vmware-workstation-12-is-yourgateway-to-windows-10-adoption/ >>. [Accessed 11 14 2021] at 12.25 pm.

- [16] Y. W. J. WANG, "Use gns3 to simulate network laboratory," Computer Programming Skills & Maintenance, vol. 12, p. 046, 2010.
- [17] B. Choi, "GNS3 Basics," in Introduction to Python Network Automation, Springer, 2021, pp. 415-489.
- [18] H. Abie, "An overview of firewall technologies," Telektronikk, vol. 96, no. 3, pp. 47-52, Jan. 2000.
- [19] K. H. R. C. L. Neupane, "Next generation firewall for network security: A survey," in SoutheastCon 2018, 2018.
- [20] GeeksforGeeks, "GeeksforGeeks," Available at :

<< https://www.geeksforgeeks.org/introduction-to-docker/ >>. [Accessed 11 15 2021] at 2.00 pm.

[21] C. Boettiger, "An introduction to Docker for reproducible research," ACM SIGOPS Operating Systems Review, vol. 49, no. 1, pp. 71-79, 20 Jan 2015.

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