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Raspberry Pi Turns into VPN & NAS Server

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Abstract—VPN—This project aims to protect privacy details even though when you are connected to a public Wi-Fi network. You can use the Raspberry Pi VPN server when you are connected to an open Wi-Fi network so that you could bravely use public Wi-Fi after connecting with the Raspberry Pi VPN server.

The most challenging part is connecting our devices to our home network using the Internet of Things.This kind of difficulty is faced by people who travel a lot. These difficulties inspired us to build a VPN and NAS server using Raspberry Pi. We can demonstrate it by using Pi VPN, which is an open VPN installer.

NAS—Owing to the increased use of the internet, there is a greater need for storage improvements in the industry, and NAS can provide us with a separate file server to customise all forms of files. It's a modern system that is oriented towards the network because it has independent storage due to network capacity differences, and any number of clients can access it. The NAS devices that are currently available on the market are extremely costly and lack modifications or enhancements. Another factor to remember is this system requires a certain amount of power to that function.The aim of this new approach is to provide us with low-cost, easy-to-use, and customise Network Attached Storage. We can now work with Clock available storage devices that are legitimate and allow access to the network's data, thanks to new web server and security features. It also saves energy and can be used without being connected to the internet.

Keywords- Network Attached Storage (NAS), Virtual Private Network (VPN), PIVPN, Open VPN Cloud next, destination backup.

1. Introduction

These days Internet has become an essential part oflife. Without the Internet, it will be like working in the dark or without guidance.Since there a considerable percentage of people and companies connected tothe Internet, they might get scam, sabotaged, and attacked by hackers. These practises contribute to cybercrime. Even though some users were aware of the problems, some people connected to public Wi-Fi. The majority of them are members of an established

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Virtual Private Network (VPN) (VPN). The protection and credibility of the new Virtual Private Network (VPN) provider are in doubt because it allows them to cross our privacy line and use data from people who use their app or server.Meaning, without the user's awareness, free VPN providers could sell the user's data as well as their privacy.

Our project will use the Raspberry Pi to create a stronger VPN that tracks the user's data and can only be managed from the user's home network. Because only the administrator has access to it, protection would be improved.

The device storage runs out of space which is due to the high-definition videos and high-resolution photographs. We can free some space and backup data into our external storage, which gets carried by the constraint the data can't be accessed if the external storage devices are not available.A lot of companies could have used these days for storing data. The Cloud offers the client to store data with more excellent capabilities.But the privacy of data has come to be questioned since security is one of the primaryconcerns; due to the increased use of the Cloud, the service provider benefits. These service providers might have access to store data. This right to access data becomes high risk to the data getting exposedpurposely or accidentally.

Our proposed approach will provide "NAS," a web server withfunctionalities many devices can simultaneously access due to the NAS.Theuser can access the data from any device connected with a USB disk drive with better access.

2. Related Works

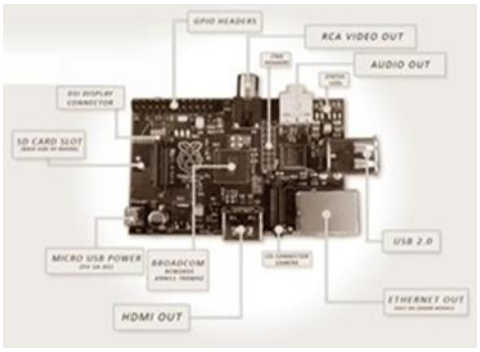

Fig.No:01 Description of our Raspberry Pi

For VPN and NAS implementation

- Raspberry Pi (RPi)
- Router
- SD card of appropriate class
- External Memorable Device (HDD)
- LAN link (wired or wireless)

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The aim of network storage and VPN is to store and share data with other devices on the local network. The data stored is unrestricted in terms of format and files that must be held on the Raspberry Pi.

The RPi can be easily accessed through the local network. On Windows, Mac OS, Linux, smartphones, and tablets, computers can work to their maximum capacity without any limitations. As a SAMBA Server, the Raspberry Pi is needed to complete the project. Samba offers file and print facilities for Microsoft Windows customers.

It's possible to link it to a Windows Server domain. It was either a Primary Domain Controller (PDC) or a part of an Active Directory Domain as a domain member.

Since you can't log in as root for security purposes, the command that can adjust the server configurations must be run by the admin user (the admin user).Another option is to use sudo before each command and then include the admin password, which keeps things tidy and safe during installation. Choose SAMBA and SSH. Also, change the default port to something random.

```
sudo aptitude install nginx php5-fpm php5-sqlite php5-gd
cd /etc./nginx/sites-available
sudo nano owncloud.vhost
```

Since hackers and other hacking software use port 22 to gain access to our server, it will be the default port; however, the IP address will not be static during installation. It will be given a DHCP address by your router if it has never been rebooted or if the router is turned off. Watching images, implementing a large number of requests, and more are all examples of high load.Users can display their home directories as SAMBA shares using the default configuration file.

```
sudo nano /etc./network/interfaces
auto  eth0
iface eth0 inet static
address 192.168.1.101
netmask 255.255.255.0
gateway 192.168.1.1
```

1) Eric Jordan's research paper gives us a simple

understanding of how to set up a VPN on a Raspberry Pi with Open VPN. This research paper was divided into six major sections based on three key criteria: cost, simplicity, and usability.

The Self VPN router is the first. Because a router with VPN capabilities is expensive, this is a costly solution.

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The second method is to build a custom VPN router. This can make determining the root cause of many problems encountered when attempting to create a VPN tunnel, for example, as a file-sharing backup, more difficult. The SSH client/server is the third choice. When a client's setup is complicated and they have issues while travelling, this approach has a problem. This strategy is more likely to be ineffective. With the exception of the most savvy smartphone consumer, this strategy is likely to be unbiased for all apps. Open-Source VPN (Open WAN/Strong WAN) is the fourth solution. This method can be implemented on a Raspberry Pi. This method has a drawback in that it involves server and client configuration changes and tweaks. The client needed to load the configuration file once the server configuration was complete.So, the OpenVPN client takes care of the rest.

2) VasireddyRishitha, SahithiChanduptlain, and

NehaliVaka proposed the onion router (TOR) on Raspberry Pi in their research paper. TOR helps users to surf the web anonymously by masking their identity. This shields our user from network eavesdropping and traffic analysis. Before reaching its destination, any Internet packet passes through three layers of relay.This is a great way to get access to websites that have been blocked. This project makes use of a small router that is also portable. It can be connected from anywhere and provides safe Internet access to any location.

The author also recommends a VPN based on price, ease of use, and compatibility. The concepts that underpin the OpenVPN solution are presented in this paper.

3. Proposed System

The project's suggested solution is to use a Raspberry Pi and router, as well as a robust programme to open VPN and a pie hole. The network diagram for this project is shown in Fig.no:02.

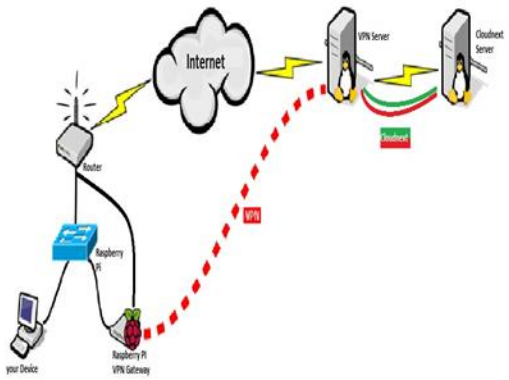

Fig.no:02 Network Diagram

HOW DOES IT WORK?

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Fig.no:03&04Explains to us how NAS and VPN functions. The VPN tunnel connects the VPN and NAS to the VPN client only after its device connects to it. It hides the client's IP address to the external world, followed by encryption and decryption of data, and moves to a cloud server from the Internet.

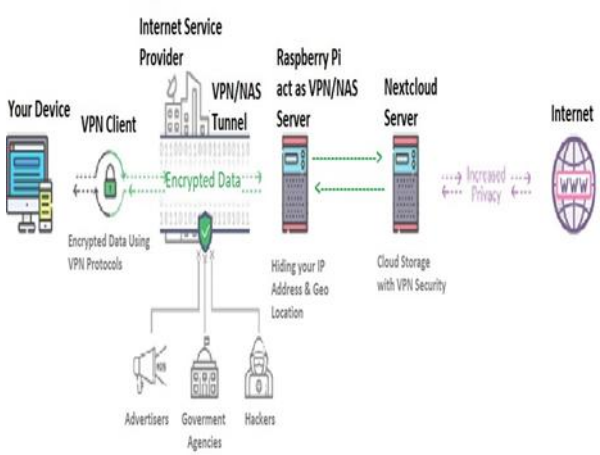

Fig.no:03 How VPN & NAS Works

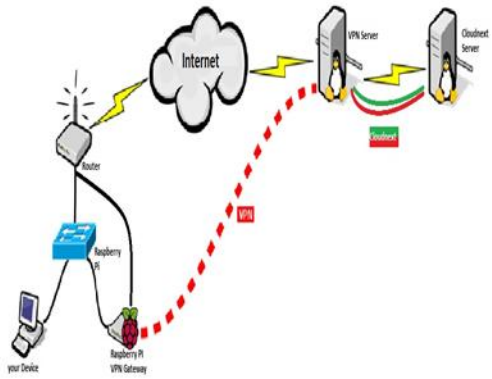

Fig.no:04 Architecture Diagram

The entire process begins with running a VPN client that connects uswith the VPN server and transmitsour device traffic through our Internet Service Provider. Butto have a stronger sense of security,the VPN protocols encrypt all the data that the server is programmed with;thatis,ourISPor anyone won'tbe able to monitor or spy through our VPN.

The process of decryption starts once the encrypted data reaches the other end. These decrypted data will be sent to its destination server.These encrypted data will be sent to our ISP from the webserver. Decryption starts once the requested data has reached our devices.

To better understand its function, take an example of a Tunnelbuilt between the server & client VPN. Data goinginsidethetunnelwill be encrypted, which means it becomes unreadable to people outside the tunnel.

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Thereare certain software & hardware requirementstobuild a NASonRPiwithabetterbackuptosavedataonNAS.

To run it on our network,we must havea Dynamic DNS (DDNS) for havinga domain to enable port forwarding for ports 80 and 443 from our router to Raspberry Pi.

Because of the market's increased reliance on the Internet, there is a growing demand for improved storage. It aids us by allocating a separate file server for customising and storing various file types. Since it has separate storage, it is a computer that is directly connected to the network. Due to the network Availability, different or any number of clients can access it.The NAS is available on the market or highly expensive and does not have upgrades or enhancements, and another thing to be considered is that this device consumes a fair amount of power.

The Raspberry Pi is connected with a router with any turn cable or a Wi-Fi connection for the best results. It will work, too, if you are using Wi-Fi to substitute WLAN for Ethernet.We will discussmore comfortable ways to manage our data withthe next Cloud.

3.1 ALGORITHM

Step-1: In a Raspberry Pi device, install RaspbianOS Along with a static IP address.

Step-2:Install general updates and configure PiVPN router configuration. The software combination assists in facilitating the VPN and NAS Server.A software called successive cloud syncs, the file between server and storage, its interface provides universal access to all stored files.

Step-3:Our VPN & NAS Server should be configured and started running after the previous steps to verify the login and router site. This completes the port forwarding.

Step-4: Configuring Pi VPN for your dependency configuring the router

Step-5: We have to have an account on noip.com, so we signed up for one.It provides a hostname for our own,thatcouldbe accessed with the internet.

Step-6: Port forwarding has to be done to make the device capable of being accessed without being inside the network's coverage

Step-7: In the router configuration page, the hostname created on noip.com as required in dynamic DNS entry, a VPN server can be accessed after completion of the steps mentioned above, along with NAS for the availability of storage space.

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4. Experimental Results

Fig.no:05 Data in Packet OpenVPN

Fig.no:05 Shows the packet OpenVPN. When the data is surrounded by encryption (i.e.,encapsulated),The data in the open packet is clustered and randomised, so it can't be read. As a result, the telnet session will be encrypted and protected from outsiders.

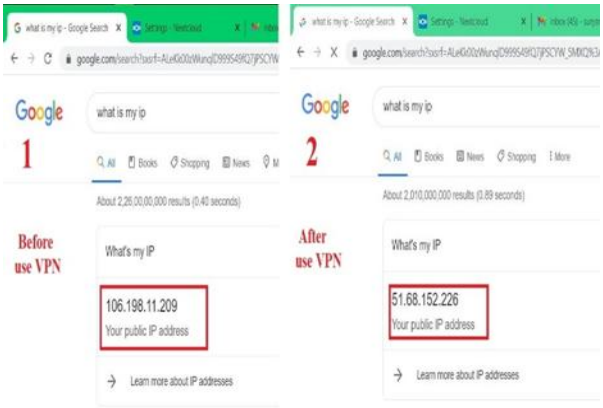

Fig.no:06 VPN Testing

Fig.no:06 Shows the current IP address before turn our VPN.After VPN turns on, it shows a fake IP address.

Fig.no:07 NAS Testing Using Cloudnext

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All are completed successfully. You would be able to Fig.no:07 Shows our cloud storage that connects Raspberry Pi into the hard disk. We access Cloud and VPN from anywhere in the world.

The NAS's access speed was measured using two separate internet connections to distinguish between download and upload speeds. The connection's load speed is very important in deciding the speed at which data is transmitted over the internet. An internet connection with a speed of 3 MBPS and 10 MBPS is considered for testing purposes.

DATA ACCESS SPEED WHILE USING 3 MBPS CONNECTION

File Size	Upload (Average Speed = 72.2 KB/sec)	Download (Average Speed = 233 KB/sec)
122 KB	1 secs	0.51 secs
1.7 MB	25 secs	7.90 secs
10.9 MB	1 mins 27 secs	48.75 secs
110.3 MB	23 mins 20 secs	7 mins 29 secs

DATA ACCESS SPEED WHILE USING 10 MBPS CONNECTION

File Size	Upload (Average Speed = 636 KB/sec)	Download (Average Speed = 1.9 MB/sec)
123 KB	0.19 secs	0.06 secs
1.8 MB	2.89 secs	0.94 secs
11.1 MB	17.87 secs	5.84 secs
113.3 MB	3 mins 4 secs	59.63 secs

Various factors influence the speed of our network, which has an effect on internet speed, such as traffic congestion, packet loss, weather, low signal areas, and so on.

This project takes a more secure approach to the data protection on the hard drive. It allows users to control and configure their data from any location and at any time.RAID with many hard discs is used to ensure data protection. The data that is streamed is consistent.

The files in this project are consistently uploaded and downloaded around the internet. The pace of our internet is determined by the strength and efficiency of our connection.

5.Conclusion and Future Work

Since there are more scams and hackers in the world today, wireless technology systems are extremely vulnerable and they can be easily tampered with by hackers and they are open to communications that can be shielded from cyberattacks.When connecting to an unknown network, users need a private session each time. Our project gives us the knowledge to mount a VPN and NAS on a tiny computer called a Raspberry Pi, giving us full control over our machine.The power of getting our VPN and NAS devices switched on for any number of days

makes it easy to access data from devices and create a safe Internet connection from anywhere in the world, even when we are outside the network coverage. This initiative also aids in the reduction of energy consumption.

Future work will be used to build an ad blocker, antivirus, and parental control system in the future.

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