

LOW POWER NETWORK STORAGE DEVICE USING RASPBERRY PI 3 MODEL B

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Abstract— Network-attached storage is a dedicated file-based data server connected to a home network providing data access to a heterogeneous group of clients. The Raspberry Pi is powerful credit card-sized computer with System on Chip (SOC) processor ie. Broadcom BCM 2837. The best advantage of having an always-online network storage device is that it is extremely convenient to have your data always accessible to the members of a organization both inside and outside your network. Combining the raspberry pi with low powered hard drives yields a user friendly accessible network attached storage device. A Raspberry Pi-based network storage device consumes about 1.99W of power per second as compared to the traditional network storage devices with a power rating of 50W.

Index Terms— NAS, Raspberry PI, HDD, NTFS, Ethernet.

I. INTRODUCTION

Innovative ideas when combined with Raspberry pi, can help in realizing various complex devices at significantly lower cost such as a fully deployable server or a BTS (Base Transmission Station) and many more to count. Its flexible architecture, good CPU performance, low powered processing and ease of interfacing additional components makes it easy and reliable to use. The latest version of raspberry Pi is of 64 bit and is easy to deal with on board high speed processing. Enabled with an Ethernet and on board WI-FI adapter makes it more attractive for IOT applications. To create a network storage, Raspberry PI along with a bunch of flash drive or a low powered hard drive can be used. By using the on board 4xUSB hub, we can add an unlimited number of storage devices. The description of all the important modules is presented in Figure 1. which is provided by Elements 14, the authorized resellers of Raspberry Pi .[1] Network-attached storage was developed with the early file sharing Novell's NetWare server operating system and NCP protocol in 1983. 3Com's

3Server and 3+Share software was the first purpose-built servers (including proprietary hardware, software, and multiple disks) for open systems servers, and the company led the segment from 1985 through the early 1990s. 3Com and Microsoft would develop the LAN Manager software and protocol to expand this new market. Inspired by the success of file servers from Novell, IBM, and Sun, several firms developed dedicated file servers. While 3server was among the first firms to build a dedicated NAS for desktop operating systems, Auspex Systems was one of the first to develop a dedicated NFS server for use in the UNIX market. The method used in this paper works on the samba server application which provides file and printing based server on the network. It is an open source application that allows for interoperability between Linux/Unix servers and Windows-based clients. Nowadays, many companies have come up with a variety of deployable NAS. Some are Neatgear Ready NAS 202, Buffalo TeraStation 5200DN and many more to count. An average NAS costs up to Rs. 20000 and has a power rating up to 70W. The routers have also been developed with a USB port such as Synology DiskStation DS1511+ in which whenever a low powered drive hard drive is connected, a file based server is set up which caters to the users as a network attached storage for group sharing. In routers, the server software are already embedded with their firmware and the network administrator has to initiate a network forwarding protocol.

II. EXPERIMENTAL MODEL

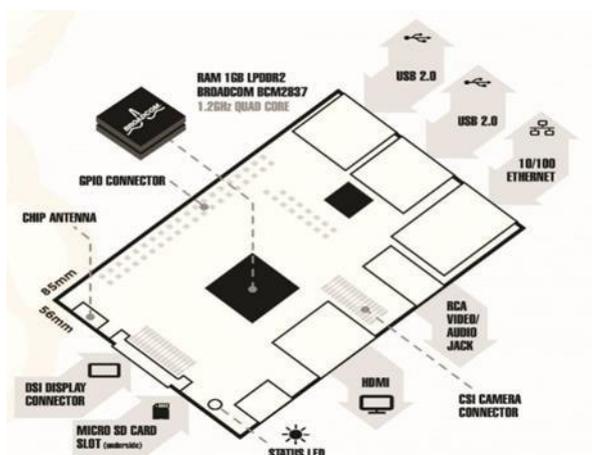


Fig 1. Description of Raspberry Pi

Built specifically for the new Raspberry Pi 3, the Broadcom BCM2837 system-on-chip (SOC) includes four high-performance ARM Cortex-A53 processing cores running at 1.2GHz with 32kB Level 1 and 512kB Level 2 cache memory, a VideoCore IV graphics processor, and is linked to a 1GB LPDDR2 memory module on the rear of the board. The Raspberry Pi 3 features the same 40-pin general-purpose input-output (GPIO) header as all the Pis going back to the Model B+ and Model A+. Any existing GPIO hardware will work without modification; the only change is a switch to which UART is exposed on the GPIO's pins, but that's handled internally by the operating system. The Raspberry Pi 3 shares the same SMSC LAN9514 chip as its predecessor, the Raspberry Pi 2, adding 10/100 Ethernet connectivity and four USB channels to the board. As before, the SMSC chip connects to the SOC via a single USB channel, acting as a USB-to-Ethernet adaptor and USB hub. The board is also Bluetooth and WIFI enabled which makes its existence more reliable and optimizable.

Components required for the realization of NAS :

1. Raspberry Pi (RPi)
2. SD card class 10
3. Router
4. External memorable device – (HDD) or any flash drive

Wireless or wired connection to the LAN

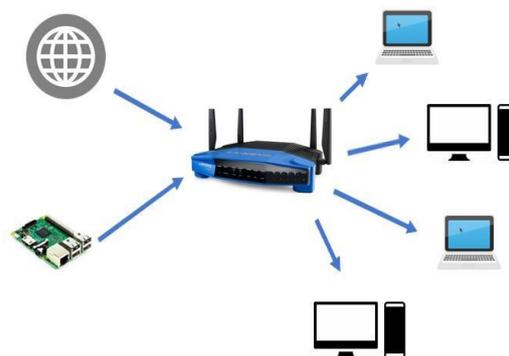


Fig. 2. Experimental setup

III. METHODOLOGY

The basic idea behind the method is storing and sharing information with other computers and laptops on the local network and the information that can be stored is no restriction on the format. Files stored on the raspberry pi, can be easily accessed by local network. Devices that can work with them with no restriction on operating system - Windows, Mac Os, Linux and smart phone and tablets. For the execution of this project, Raspberry Pi needs to be configured as a Samba server, and thus provide the files via Samba client to users on the network. Samba provides file and print services for various Microsoft Windows clients and can integrate with a Windows Server domain, either as a Primary Domain Controller (PDC) or as a domain member. It can also be part of an Active Directory domain. Samba protocol was used only in windows as it was called Server message Block, but is now known under other operating systems. The installation of Samba on the raspberry pi is very see requiring a set of commands. First step starts with the downloading of the operating system of raspberry pi i.e. raspbian jessie from the official site of Rpi. SD formatter is used to format the sd card which ensures that the full capacity of the storage card will be available. To write the disk image, Win32DiskImager is used, available from Sourceforge. SD card is placed in the slot of raspberry pi and is ready for you. The raspberry pi boots up with the raspbian jessie operating system. Other operating systems are also available such as risc OS, kali LINUX, Gentoo LINUX, Arc Linux, Linutop, Pidora, Ubuntu mate

etc. The default login credentials are: User name- pi and password- raspberry.

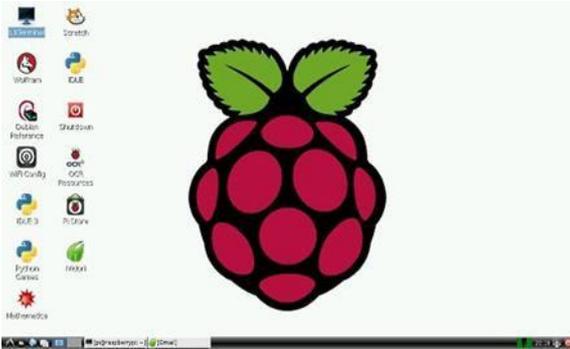


Fig 3. GUI of Raspbian jessie.

Now, the raspberry pi needs to be updated and configured with a samba server. Several commands to have to given on the terminal window of raspberry pi. The commands are to be given with the sudo to provide administrative root privileges.

```
Sudo apt-get install update
```

Since NAS is to be used with the windows based machines, so a compatible support file system needs to be installed on the LINUX operating system. New Technology File System (NTFS) is suitable for the imperceptible file system since all the hard drives and flash drive supports the NTFS file system. The partitions are needed to be mounted in the LINUX system as the raspberry pi boots up every time. The following commands are to be mentioned to do so. Before mounting the drives, a directory also needs to be created mount the drives in the operating system. A separate folder also needs to be created on the hard drive so as to segregate the shared information from the unshared information.

```
Sudo apt-get install ntfs-3
Sudo mkdir /media/USBHDD1
Sudo mount -t auto /dev/sda1 /media/USBHDD1
Sudo mkdir /media/USBHDD1/shares
```

After configuring the basic protocols of the LINUX system, the client server needs to be installed. The following command downloads and installs samba package on the raspberry pi.

```
Sudo apt-get install samba samba-common-bin
```

All the configurations are managed by the samba.conf file. Any changes in the contents of this file will make changes to the configuration of the server. So the original file needs to be backed up before making any changes to the original samba.conf file. Once the backup has been created, it's time to do some basic editing in the Samba configuration file. The following command line opens the samba.conf file in the nano editor in the Linux terminal itself.

```
Sudo nano /etc/samba/smb.conf
```

Nano is completely keyboard controlled , use the arrow keys to move the cursor to the location you want to edit. The first is the workgroup identifier, by default workgroup = WORKGROUP. If using a different name for your home workgroup, it will be changed accordingly. The next step is to turn on user authentication for our samba storage, otherwise anyone with general access to our network (like guest Wi-Fi users) will be able to walk right in and hinder the privacy. Scroll down in the Samba .config file until you get to the section that reads:



Fig 4. The authentication area on samba.conf file.

Remove the # symbol from the security = user line (by highlighting it with the cursor and pressing delete). Anything command beginning with a '#' is termed as a comment in LINUX. Removing the '#' enables the "username/password" authentication for the content shared on the samba drive. The next step is adding necessary information of the user. The drive mounted in earlier steps

also needs to be mentioned in the samba configuration file. Disk read/write permissions also needs to be mentioned.

```
[Backup]
Comment = BACKUPNAS
Path = /media/USBHDD1/shares
Valid users = @users
Force group = users
Create mask = 0660
Directory mask = 0771
Read only = no
```

Press CTRL+X to exit, press Y when asked if you want to overwrite the existing configuration file. At this point we need to add in a user that can access the Pi's samba shares. Make an account with the username "user1" and the password "backupsinfinite". The terminal will prompt twice to type in the password to confirm. Restart the samba daemon drives.

```
Sudo useradd user1 -m -G users
Sudo passwd user1
Sudo /etc/init.d/samba restart
```

In the above step the user has been added to the Pi's local accounts. Now we need to add the legitimate users to the samba servers.

```
sudo smbpasswd -a user1
sudo shutdown -r now
```

Samba will again to ask the password twice. Hence the installation and configuring of the samba server has been done.

IV. RESULTS

Now for testing the server, log into any of the samba capable windows pc connected to our network via Ethernet or Wi-Fi and switch to the network drive hosted by the samba server pinging on the same workgroup. The drive can be accessed by scrolling into the network folder or can be mapped individually on My Computer While opening the drive, it will prompt for a username and password that we assigned to the samba terminal I the earlier steps. For the real time analysis of the processing of raspberry pi, an

online platform Cayenne myDevices have been used that measures the performance of raspberry and gives an interactive graphical display of results. Figure 7 shows the performance analysis of raspberry pi when the drive is not being used and Figure 8 shows the performance when the drive is being used.



Fig 5: Accessing implemented NAS through a windows machine.

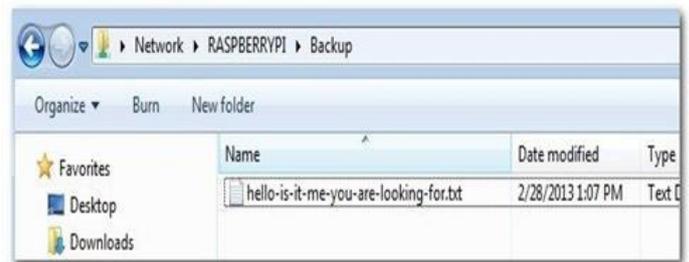


Fig 6. Accessing a file on the NAS.

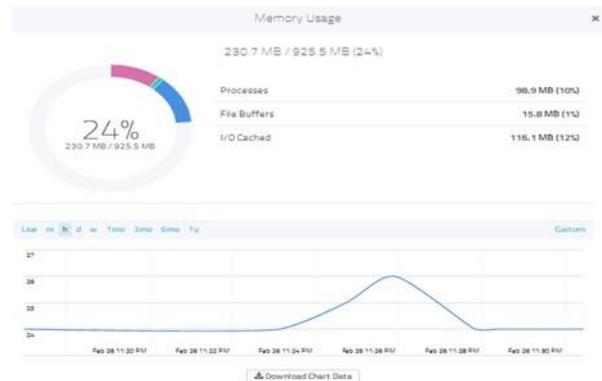


Fig 7: Graph of performance when the drive is idle.



Fig 8. Graph of performance when the drive is being used by the users.

CONCLUSION

Raspberry pi is a very powerful board for realization of various systems. It also gives way to a number of handmade digital appliances that researchers can develop and analyze for multiple purposes. It can also be deployed to other applications while working as a NAS. Traditional NAS systems available these days are although efficient but they turn up to be very costly and power consuming whereas Raspberry based NAS is cost effective and consumes one third of power.

References

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