FreeNAS - the home Network Attached System that you can build yourself !

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The challenge with NAS devices for the Home market is really that the purchase price for the NAS device that you want, that has a realistic amount of storage, 5 to 10 Terabyte, will be in the region of a 1000 Euro. These boxes are all proprietary hardware, making repair and component replacement difficult. These boxes are built with underpowered processors and always too little ram for a realistic disk cache, making them slow. With FreeBSD Unix as the base building block, an exceptional NAS system can be built with just a little more money. I invested approximately 600 Euro in a MicroATX tower PC and about 900 Euro in 10 diskdrives, gaining a Home NAS system with much higher performance and functionality.

Advantage FreeNAS

Recently (spring of 2013) the FreeNAS product team has completed the migration of FreeNAS to FreeBSD 8.3 kernel, and even more important to the Zettabyte file system, (ZFS) version 28, originally designed by Sun Microsystems and released with open-source license. The ZFS product now supports: Data compression , Data Encryption and Data Deduplication.

FreeNAS is built on the FreeBSD (Berkeley System Distribution) OpenSource operating system that is today's version of the classic BSD operating system from the university of California originally designed by Bill Joy in around 1980 . The addition of the new Zettabyte File-system with its Hybrid storage-pools, makes this platform ideal to use for a DIY SOHO NAS system.

My previous NAS device a Netgear ReadyNAS NV+ with 4 disk drives never manged to transfer data faster than 200 Mbit/s. The new FreeNAS system with ZFS hybrid SSD system transfers data at wire speed: 1080 Mbits per second.

Design considerations.

No RAID card.

Most of todays SOHO NAS boxes uses some form of RAID card to ensure redundancy. ZFS file-system is designed to work without RAID cards. ZFS is both a file-system and a volume manager. ZFS uses the main processor to mange RAID levels such as mirroring, striping and single, dual or triple RAID with parity.

ZFS Hybrid Storage Pool

ZFS also has the option of constructing a Hybrid storage Pool. SSD devices can be used as write and read cache accelerators, making the NAS devices capable of   20.000 read IOPS   and 8000 write IOPS instead of the below 1000 IOPS we achive with a couple of standard 7.200 RPM SATA drives. (IOPS is Input Output oPerations per Second)

MicroATX Tower

When building a media server that most likely will sit in your livingroom bookshelf, the primary design criteria is that its silent. A chassis built with sound silencing in mind is a boon. The smallest size fan that should be used is a 120 m.m. Those are the standard size fan in a micro-tower. The next criteria is that the chassis can harbor several disk-drives. Preferably at least six disks.

Motherboard.

When selecting a Motherboard for a FreeNAS server you need to consult with the FreeBSD Hardware Notes for the FreeBSD release you are going to use. FreeBSD 8.3 is the base for FreeNAS 8.3.1.   You need to investigate and understand that a certain motherboard contains devices that are supportable by the operating system. This is particularly important for LAN and Disk Chipsets. MOBO manufacturers are famous for making MOBOS with new and cheap chipsets, and only deliver MS windows drivers for their products.
See: http://www.freebsd.org/releases/8.3R/hardware.html

Memory.

ZFS needs RAM, which is very low cost these days. I configured my system with 16 GB DDR3-1333 memory. To use ZFS your system should have atleast 8 GB RAM.

CPU selection.

A modern CPU with powerstate transitions working (i.e. not Celeron) is needed for the FreeBSD Power-daemon to shift the CPU down to low-power state.   A Modern CPU is also needed for Disc Encryption to work with some speed The cryptographic AES-NI instructions needs to exist in the CPU-silicon to run disc encryption with efficiency.
See: http://en.wikipedia.org/wiki/AES-NI#Supporting_CPUs

Disk drives.

When I started this build exercise some time ago, the 2 TB disk had the lowest price per gigabyte. Today 3TB drives are slightly cheaper per gigabyte. So things change. I would use 3 TB drives today.
ZFS Hybrid storage pools are built with SSD drives that don't need to be particularly big. Intel 120 GB SSD drives are fine for this purpose.

SD-Memory-CARD

I decided to install the FreeNAS software on to a SD-CARD and use a Card reader as Boot device in the server. This way I did not need a CDROM using space In the chassis, and did not need to use an internal disk drive for installing the software. All the Space in the chassis could be used for NAS diskdrives. It's also very simple to install FreeNAS on to a SD-CARD. One just dumps the FreeNAS image to the SD-CARD with different utilities depending which Operating system used at the time. Then when the boot-volume is transferred SD-CARD its ready to boot from.

This then became the NAS servers configuration:

Chassis: ACE of Sweden's   ECCO250 Micro ATX Tower.
                http://www.aceofsweden.com/ace/case/microtower/ecco250.html

Motherboard : ASUS M5A88-M   Micro-ATX with six SATA connectors
                http://www.asus.se/Motherboards/AMD_AM3Plus/M5A88M/

RAM: 4 x 4 GB DDR3-1333 corsair.
            http://www.corsair.com/us/memory-by-product-family/dominator.html

CPU: AMD Phenom(tm) II X4 965   3.4 Ghz
                http://www.amd.com/us/products/desktop/processors/phenom-ii/Pages/phenom-ii.aspx

PSU: Corsair 650 W (80-PLUS gold)
                http://www.corsair.com/us/power-supply-units/hx-series-power-supply-units.html

Disks: 6 x Seagate 2 TB SATA 7.200 Rpm
            http://www.seagate.com/gb/en/internal-hard-drives/desktop-hard-drives/desktop-hdd/?sku=ST2000DM001

Disks (SSD) :   4 x Intel series 330 120 GB drives.
                http://www.intel.com/content/www/us/en/solid-state-drives/solid-state-drives-320-series.html

Disk I/O ctrl: 1 Marvel SATA 4 port 3 Gbp/s controller
                http://www.sybausa.com/productInfo.php?iid=1160

SD-CARD reader: AKASA multi memory card reader.
        http://www.akasa.com.tw/update.php?tpl=product/product.list.tpl&type=Card%20Reader/Hub&type_sub=Card%20Reader

Disk mounting: 1 Scythe Slot-Rafter   for mounting SSD drives
                http://www.scythe-usa.com/product/acc/064/slotrafter_detail.html

FAN   2 additional   120 m.m fans .

Power management .

The new NAS box is naturally at bit more power hungry than the old NetGear Readynas appliance I had, which drew around 60 watts. The FreeNAS box now consumes 95 Watts at rest and about 150 watts when active. This is the effect of the AMD processors Cool & Quit low powerstate when idle, and the FreeBSD power-daemon working to minimize the power consumption. As there is no graphics card in the machine (just the rudimentary VGA chip on the MOBO) its a lot less power hungry than a normal deskside PC. So why Does the system have a 650 Watt PSU ? Its the smallest 80-PLUS GOLD certified PSU sold by Corsair and it has an efficiency rating of at least 87 % . This is the most environment friendly purchase decision I can make in a new server. To procure the most efficient power supply and not waste electricity.

Booting UP

To use an SD-CARD as a boot device, ofcourse requires that the motherboard BIOS allows booting from a USB device. This usually takes a bit of fiddling with the BIOS.
Next it is really an advantage to have a DHCP server on you local network when starting the FreeNAS box for the first time, as it automatically does DHCP-Discover to gain an IP address. The IP address is shown on the presumably attached VGA screen. Or in your DHCP log one would assume. Then you can point your browser to this IP address and start configuring.
Alternatively you would have to go in through the text based Network configuration utility using the VGA screen.

Documentation.

FreeNAS documentation is here:

http://www.freenas.org/images/resources/freenas8.3.1/freenas8.3.1_guide.pdf

DOWNLOAD:

FreeNAS images for download is here, they are hosted on sourcefourge.net

http://www.freenas.org/download-releases.html

Final words

FreeNAS has become one of the most versatile NAS products on the market. It has lots of functionality out of the box:

- It does CIFS, NFS, AFP, FTP and SCP   file transfer protocols.
- It uses the most modern open-source file system. The Zettabyte filesystem.
- It does Data Encryption , Data Compression, Data Deduplication and Snapshots.
- It does several type of streaming media , both video and audio.
- Its a Bit-torrent peer-to-peer client/server.
- It has an advanced virtualization technology (FreeBSD JAILS) that isolates applications and data from intruders. And allows internet facing services.

Its extendable with almost anything. There is more than 24.000 applications in the program repository for FreeBSD.   http://www.freebsd.org/ports/

http://www.freenas.org
http://wiki.freenas.org/index.php/Main_Page