

## **M.Sc. Thesis Synopsis**

# **Integration of High Availability Load Balancing in Free NAS Storage**

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## **Abstract**

FreeNAS is one of the most popular and famous operating systems used in a variety of storage solutions worldwide. As it contains a lot of features and provides extensive support which makes it suitable to fit in almost every storage solution. FreeNAS is designed and built in the FreeBSD Unix branch which provides tremendous storage capabilities and features by using legacy hardware. It provides powerful administrative tools & its deployment is completely up to the administrator to design from start to finish. Thus, FreeNAS provides incredible freedom in designing the solution that's right for you or your organization's needs.

The new features are added day by day which makes it more robust and suitable to be integrated in customized storage solutions. One of the most important features which FreeNAS still awaits to deploy is a cluster of FreeNAS servers in High Availability Load balancing and failover support, where multiple FreeNAS systems work in a cluster mode to provide up to the mark storage solution with reliability and high performance.

## **Introduction**

FreeNAS™ is an embedded open source network-attached storage (NAS) system based on FreeBSD and released under a BSD license. A NAS provides an operating system that has been optimized for file storage and sharing.

FreeNAS supports multiple file-sharing protocols, including CIFS, NFS, and iSCSI, making it suitable as a file-sharing device for Windows, Mac, and Unix/Linux clients. And iSCSI support makes FreeNAS a good choice for shared storage of virtual machines. FreeNAS also can act as an FTP and TFTP server, and it supports rsync for backup to and from the appliance. And it can be configured as a backup server for Windows Shadow Copy and Apple Time Machine.

FreeNAS contains many of the most popular services for NAS. To increase more features based on custom requirements and to increase the ability & functionality of FreeNAS that end, FreeNAS includes a plugin system with support for a wide variety of add-on software.

FreeNAS supports the core features of a NAS appliance out of the box. However, many users like to enhance their NAS appliance with third party software for media streaming, alternative

Protocols, or web applications. To make sure NAS can do everything, FreeNAS offers a third-party plugin system based on the FreeBSD jails system and the PBI system from PC-BSD. The plugin system isolates third-party software from the core operating system but allows plugins access to user-specified directories and configuration from the main Web User Interface.

In FreeNAS, jails are installed on individually segregated ZFS datasets. The admin creates transparent mount points to storage outside of the jail's dataset, all of which can be done from the web UI. The plugin API also allows a plugin to communicate through an IPC interface to the web UI, allowing it to be configured and enabled/disabled as a service without resorting to the command line.

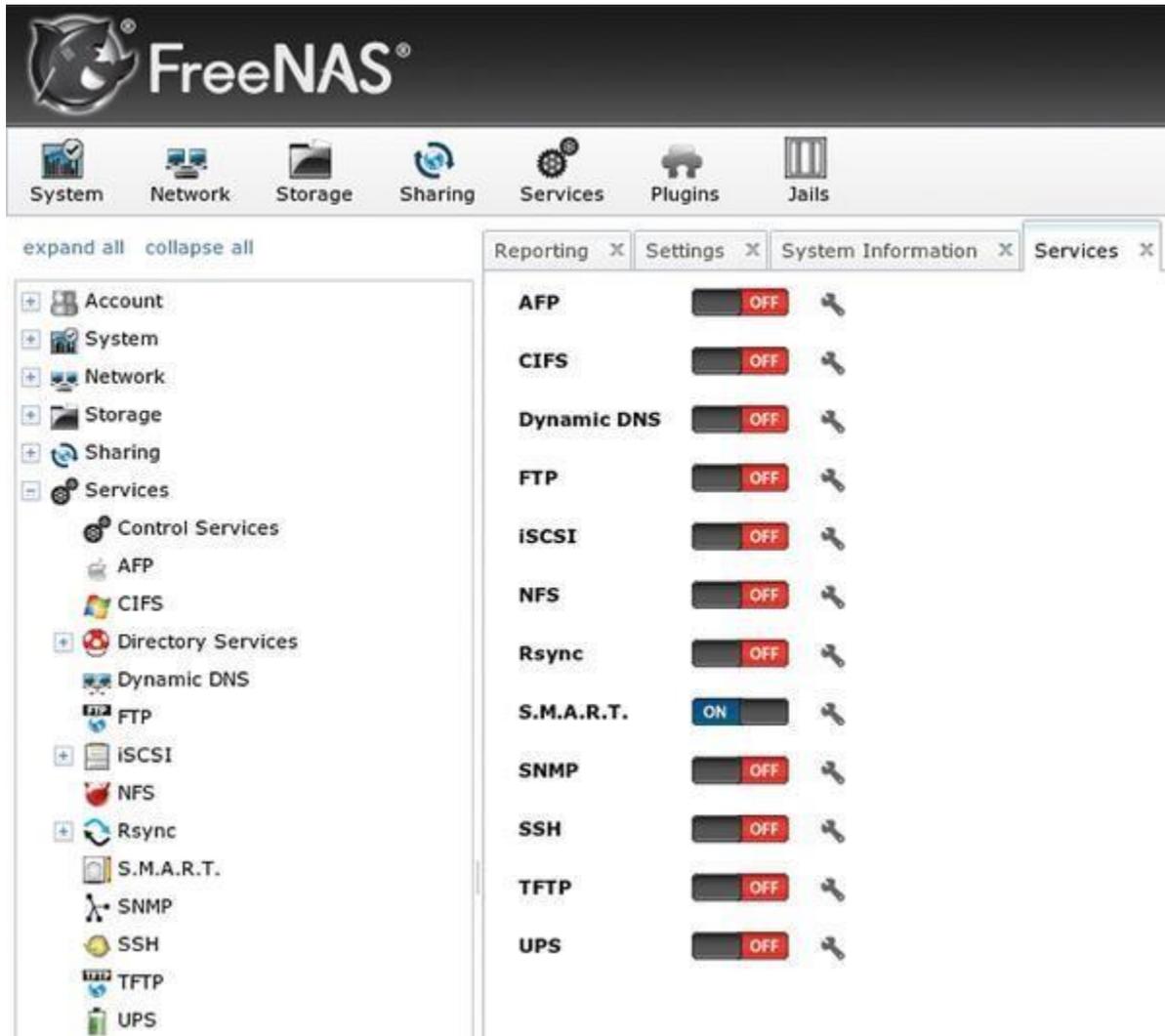
A key feature of FreeNAS is ZFS (or "Zettabyte" File System). Originally developed by Sun Microsystems, [ZFS](#) was designed for large storage capacity and to address many storage issues, such as silent data corruption, volume management, and the RAID 5 "write hole." ZFS supports a variety of software RAID levels, including stripes, mirrors, and up to triple-parity RAID-Z.

## Supported Features

Notable features in FreeNAS™ 8.0.3 include:

- Supports AFP, CIFS, FTP, NFS, SSH (including SFTP), and TFTP as file sharing mechanisms
- supports exporting file or device extents via iSCSI
- Supports Active Directory or LDAP for user authentication
- Supports UFS2 based volumes, including gmirror, gstripe, and graid3
- Supports ZFS as the primary filesystem, enabling many features not available in UFS2 such as
- Quotas, snapshots, compression, replication, and datasets for sharing subsets of volumes
- Upgrade procedure takes advantage of NanoBSD by writing the operating system to an inactive
- Partition, allowing for an easy reversal of an undesirable upgrade
- Different FreeNAS™ servers as the same device
- Multiple IPs can now be specified per iSCSI portal
- Ssh daemon now logs to /var/log/auth.log
- CIFS now defaults to AIO enabled

- ZFS hot spare cutover helper application within GUI
- SMART monitoring in GUI
- UPS management in GUI
- USB 3.0 support



## Methodology

Storage is the main part in cloud computing and in enterprise networks almost all organization spend millions in use commercial appliances for storage like NAS and SANS, these are very high performance and highly reliable appliances, we will use open source distributions to achieve the similar functions along with best performance (lower than commercial appliances) based on Free NAS, its widely used in commercial projects and the features are growing day by day, Free NAS will provide the storage based on ISCSI targets in cloud computing architecture, high

performance computer will be required for installation of Free NAS with up to 4 gigabit interfaces in order to provide greater uplink Free NAS uses NIC TEAMING (Interface aggregation/Ether Channel) so that we may achieve 4Gbps backbone storage speed. It is recommended to use high speed SCSI / SAS hard drive installed in RAID controller into server which will provide high reliability and disk redundancy to keep the data safe and sound, recommended configuration will be RAID 5 and maximum number of devices would be almost 5 to 6 which depend on available space in computer. In order to achieve the storage level redundancy a cluster of Free NAS storage need to be deployed for better reliability, failover mode with real time data replication

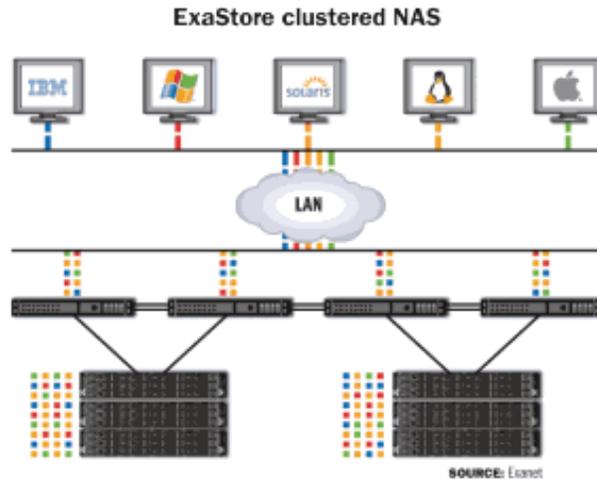
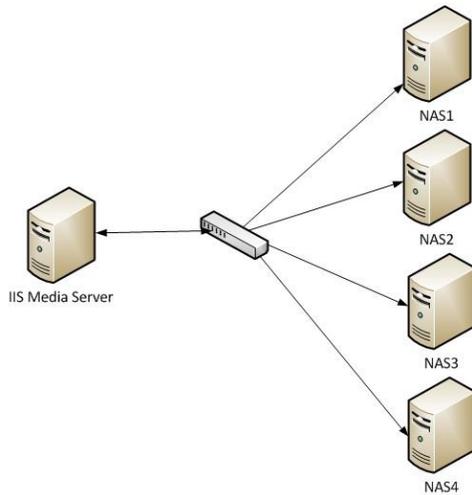
Currently the Free NAS project does not support any kind of cluster capabilities, although there is a failover features which may be used to back up the data but not automatic redundancy and load balancing feature is introduced yet. Our research based on introducing the plugin which makes the Free NAS to be workable in cluster environment with High availability Active/Active and Active/Passive load balancing, although the number of Free NAS servers in a single cluster is not decided yet but it will be designed to meet the requirement of performance and reliability.

By integration of High availability load balancing a new horizon of research will open and make Free NAS to be more robust and to meet the enterprise storage requirements. In Cluster of Free NAS multiple Free NAS serves will communicate each other to provide redundancy along with failover support and increase the performance and storage capacity by avoiding the single point of failure.

High availability plugin will enable user to configure the deployment of Free NAS in cluster environment by a single Web Graphical User Interface, this plugin also allow community developers to add more features related to high availability load balancing.

After successful development of High Availability and clustering feature, a deep performance test will be perform to measure its throughput, capacity, latency, packet forwarding, Disk I/O utilization, Load balancing performance, failover time period and uptime, scalability factor and data routing & sharing mechanism among servers in cluster.

Logical Overview of NAS Cluster will be



## Intended Results and Applications

Below mentioned are some intended results on

- High availability of Free NAS storage
- enables Free NAS to be deployed in Cluster
- High speed connectivity and data retrieval
- Data accuracy with efficiency
- Fail over support for both storage and hosts
- Easy management for user by GUI Plugins
- Scalability with high performance
- Performance testing
- Throughput and disk I/O utilization
- Capacity measurement

## Key Contribution

Main contribution regarding the proposed solution is to study the protocols & methods to integrate High availability features in FreeNAS project, FreeNAS High HA Clustering plugin will allow user to configure Free NAS in High availability, Failover mode with multiple network interfaces bonding and teaming to increase the reliability and throughput.

Deep performance analysis includes bandwidth, throughput, latency, disk utilization, cluster performance, load balancing among servers, backup and restoration, failover support efficiency, with comparison of other storage solutions provide by other vendors in market, meet the key point indicators designed for enterprise use.

## Time Schedule

After the approval of synopsis needed following time schedule to build infrastructure and conducting the performance testing.

Task	Time
Logical network design	1 week
Writing Plugin for Free NAS	2 weeks
Integration of FreeNAS HA Plugin	4 weeks
Miscellaneous configuration	2weeks
Performance & Load testing	3 weeks

## References

<http://www.admin-magazine.com/Articles/Build-a-Network-Attached-Storage-System-with-FreeNAS>

<http://cloudstack.apache.org/>

<http://www.tricerat.com/resources/topics-library/hypervisor-virtualization-software>

<http://home.ubalt.edu/abento/315/hypervisor/index.html>

[http://doc.freenas.org/index.php/Quick\\_Start\\_Guide](http://doc.freenas.org/index.php/Quick_Start_Guide)

**Comments of the Supervisor**

I certify that this is my own work. The work has not, in whole or in part, been presented elsewhere for assessment. Where material has been used from other sources it has been properly acknowledged. If this statement is untrue I acknowledge that I will have committed an assessment offence and should be penalized accordingly.

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Signature of supervisor

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Signature of Student

Endst. No. Unive/ \_\_\_\_\_ Date \_\_\_\_\_

This proposal duly recommended by the Postgraduate Committee of The Department of Electrical Engineering meeting held on \_\_\_\_\_ is hereby forwarded to the Director Research for obtaining the approval of the Vice Chancellor.

Chairman,  
Department of Electrical Engineering.

Dean  
Faculty of Electrical Engineering

