FreeNAS - ZFS for Home and Office

Aaron Poffenberger

2015-08-22 Saturday

FreeNAS®

Outline

1. Introduction
2. What is FreeNAS?
3. UI Walkthrough
4. Why FreeNAS Rather than $NAS
5. Conclusion
6. Resources
7. License and Credits

Introduction - Background

- Software developer
  - 17+ years professionally
  - 30+ otherwise
  - Security software
  - Design and implement secure APIs
- IT Background
  - Boeing Aerospace Operations
  - ISP (dial-up land)
  - Consulting
- Software Development
  - PentaSafe Technologies
  - NetIQ
  - TheAnimenetwork.com
  - BRS Labs
- CISSP 2005+
- BSD user
- Amateur radio enthusiast

What is FreeNAS

- An appliance distribution of FreeBSD focused on Network Attached Storage
- Open source — Free as in beer and free as in speech.

Features

- Replication
  - Time Machine
  - Windows Backup
  - rsync
  - PC-BSD Life Preserver
- Encryption
  - Volume encryption (FreeBSD geli)
  - Uses AES-NI when available
- Snapshots
  - ZFS snapshots (more later)
- File Sharing
- Web UI
  - Console and ssh access as well
- Plugins
  - Open specification

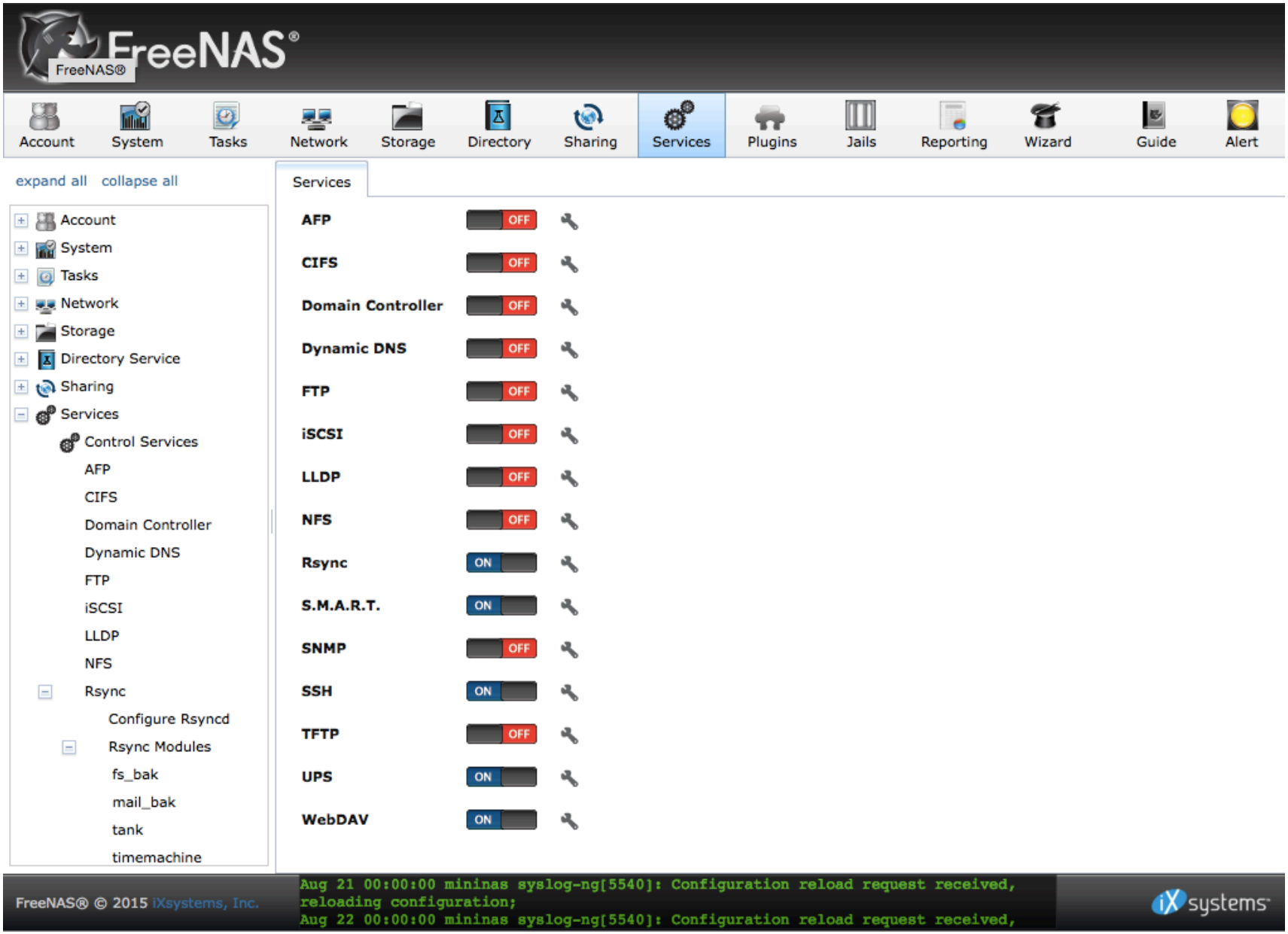
Features - System Services

- File services in base:
  - Appletalk (netatalk)
  - CIFS (samba 4.x)
  - Domain controller (samba 4.x)
  - Dynamic DNS
  - FTP
  - NFS
  - rsync
  - WebDAV
- Appliance and server services:
  - S.M.A.R.T.
  - ssh
  - tftp
  - UPS (nut)
- Somewhat unexpected:
  - iSCSI
  - LLDP

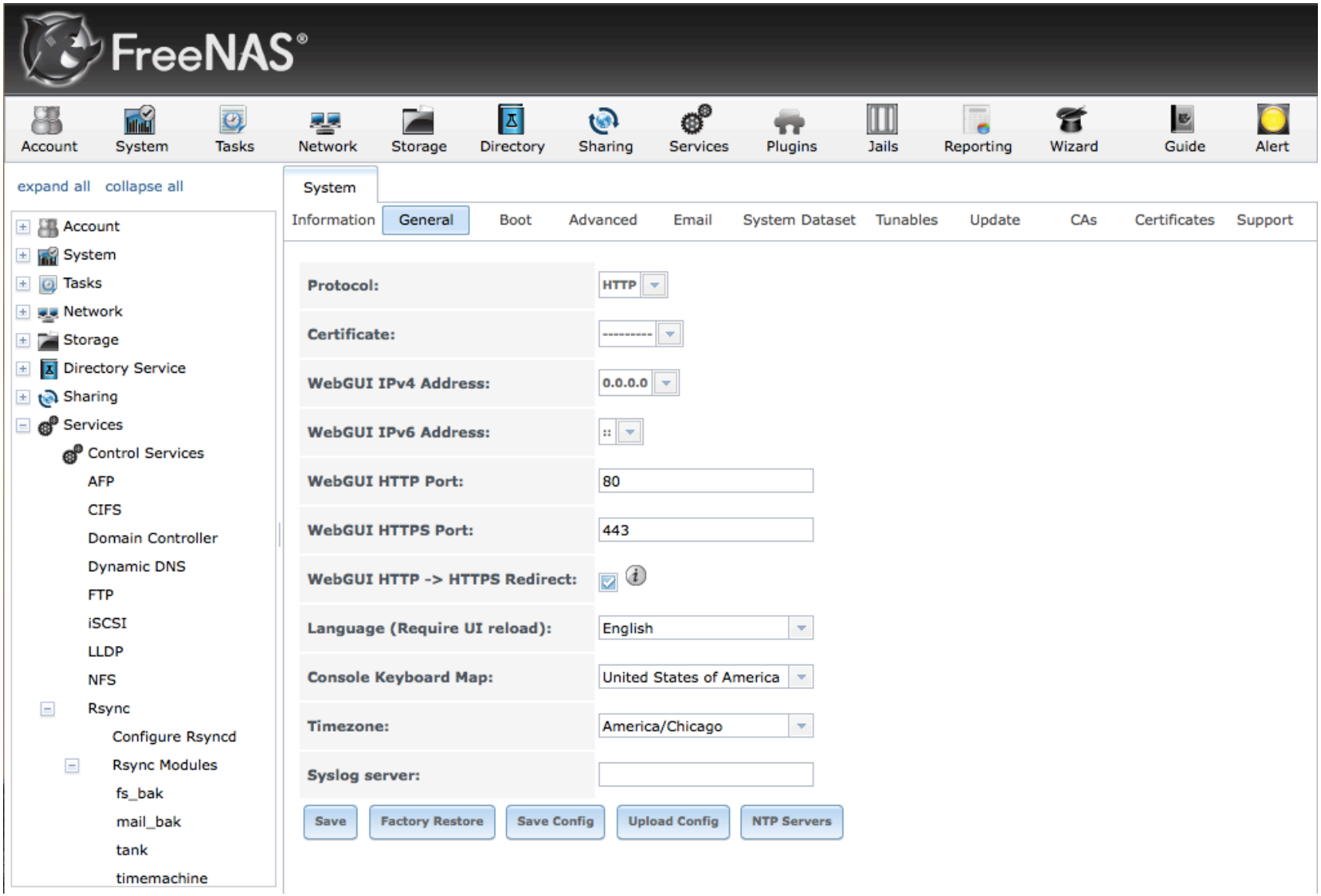
Plugins

- bacula (server)
- couchpotato
- gamez
- maraschino
  - XBMC overview page
- mylar
  - comic book downloader
- sabnzbd
- Transmimssion
  - BitTorrent client
- BitTorrent Sync
- CrashPlan
- htpc-manager
- minidlna
  - DLNA server
- ownCloud
- plexmediaserver
- sickbeard
  - PVR for newsgroups
- 3rd Party

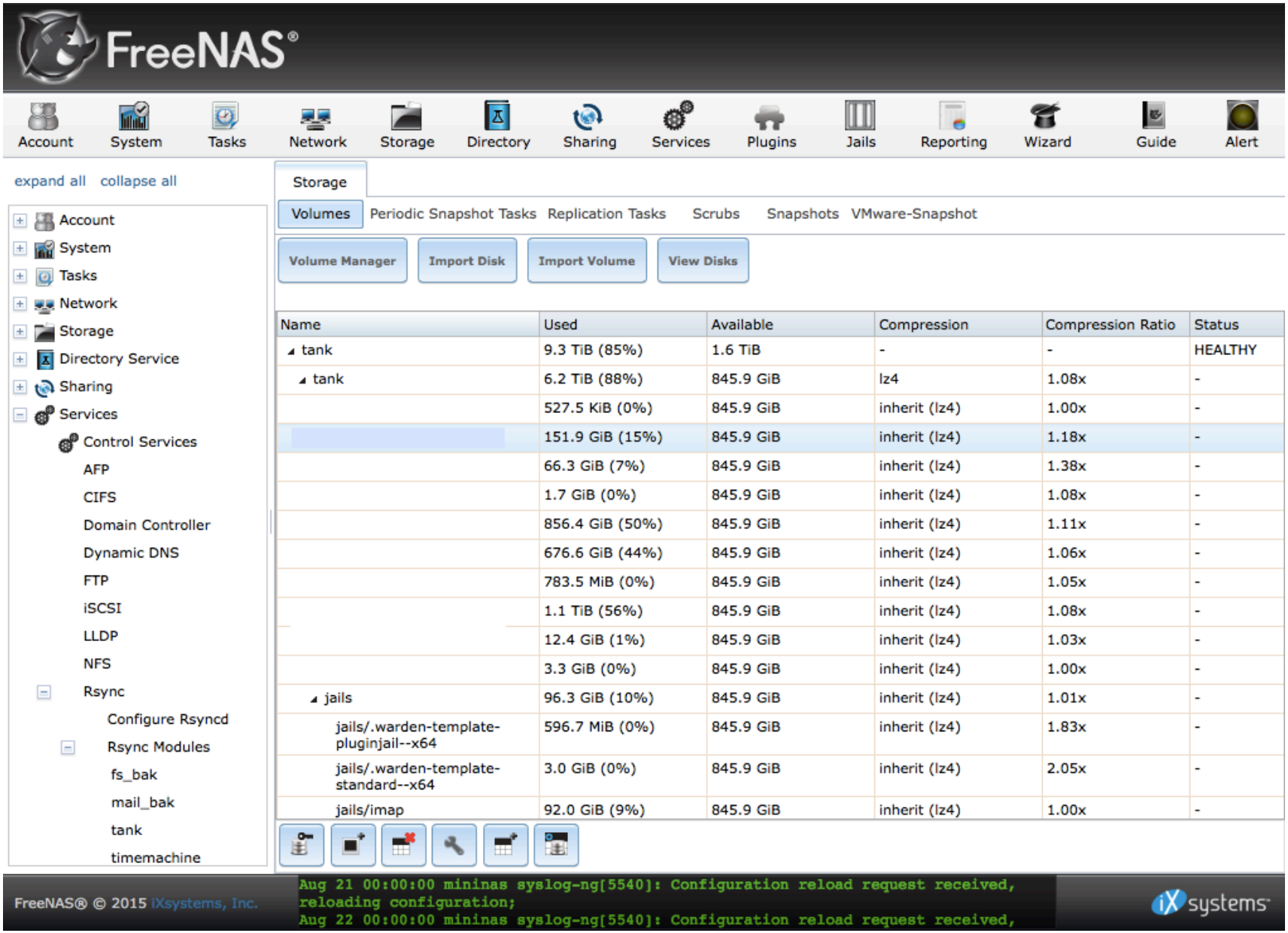
Services


FreeNAS®
Account
System
Tasks
Network
Storage
Directory
Sharing
Services
Plugins
Jails
Reporting
Wizard
Guide
Alert
expand all
collapse all
Account
System
Tasks
Network
Storage
Directory Service
Sharing
Services
Control Services
AFP
CIFS
Domain Controller
Dynamic DNS
FTP
iSCSI
LLDP
NFS
Rsync
Configure Rsyncd
Rsync Modules
fs_bak
mail_bak
tank
timemachine
Services
AFP OFF
CIFS OFF
Domain Controller OFF
Dynamic DNS OFF
FTP OFF
iSCSI OFF
LLDP OFF
NFS OFF
Rsync ON
S.M.A.R.T. ON
SNMP OFF
SSH ON
TFTP OFF
UPS ON
WebDAV ON
FreeNAS® © 2015 iXsystems, Inc.
Aug 21 00:00:00 mininas syslog-ng[5540]: Configuration reload request received, reloading configuration;
Aug 22 00:00:00 mininas syslog-ng[5540]: Configuration reload request received,
iX systems

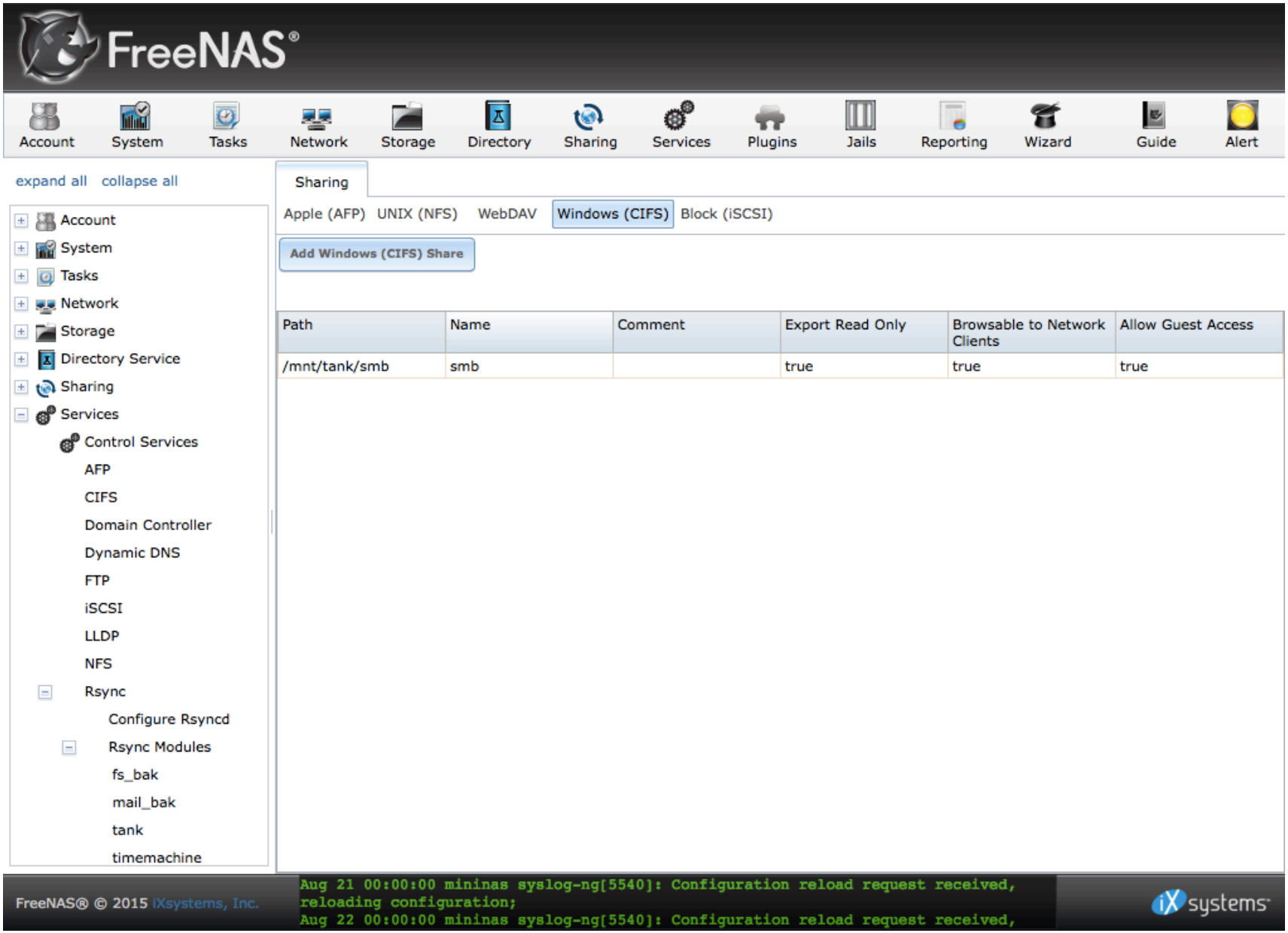
System


FreeNAS®
Account
System
Tasks
Network
Storage
Directory
Sharing
Services
Plugins
Jails
Reporting
Wizard
Guide
Alert
expand all
collapse all
Account
System
Tasks
Network
Storage
Directory Service
Sharing
Services
Control Services
AFP
CIFS
Domain Controller
Dynamic DNS
FTP
iSCSI
LLDP
NFS
Rsync
Configure Rsyncd
Rsync Modules
fs_bak
mail_bak
tank
timemachine
System
Information
General
Boot
Advanced
Email
System Dataset
Tunables
Update
CAs
Certificates
Support
Protocol:
HTTP
Certificate:
WebGUI IPv4 Address:
0.0.0.0
WebGUI IPv6 Address:
WebGUI HTTP Port:
80
WebGUI HTTPS Port:
443
WebGUI HTTP -> HTTPS Redirect:
Language (Require UI reload):
English
Console Keyboard Map:
United States of America
Timezone:
America/Chicago
Syslog server:
Save
Factory Restore
Save Config
Upload Config
NTP Servers

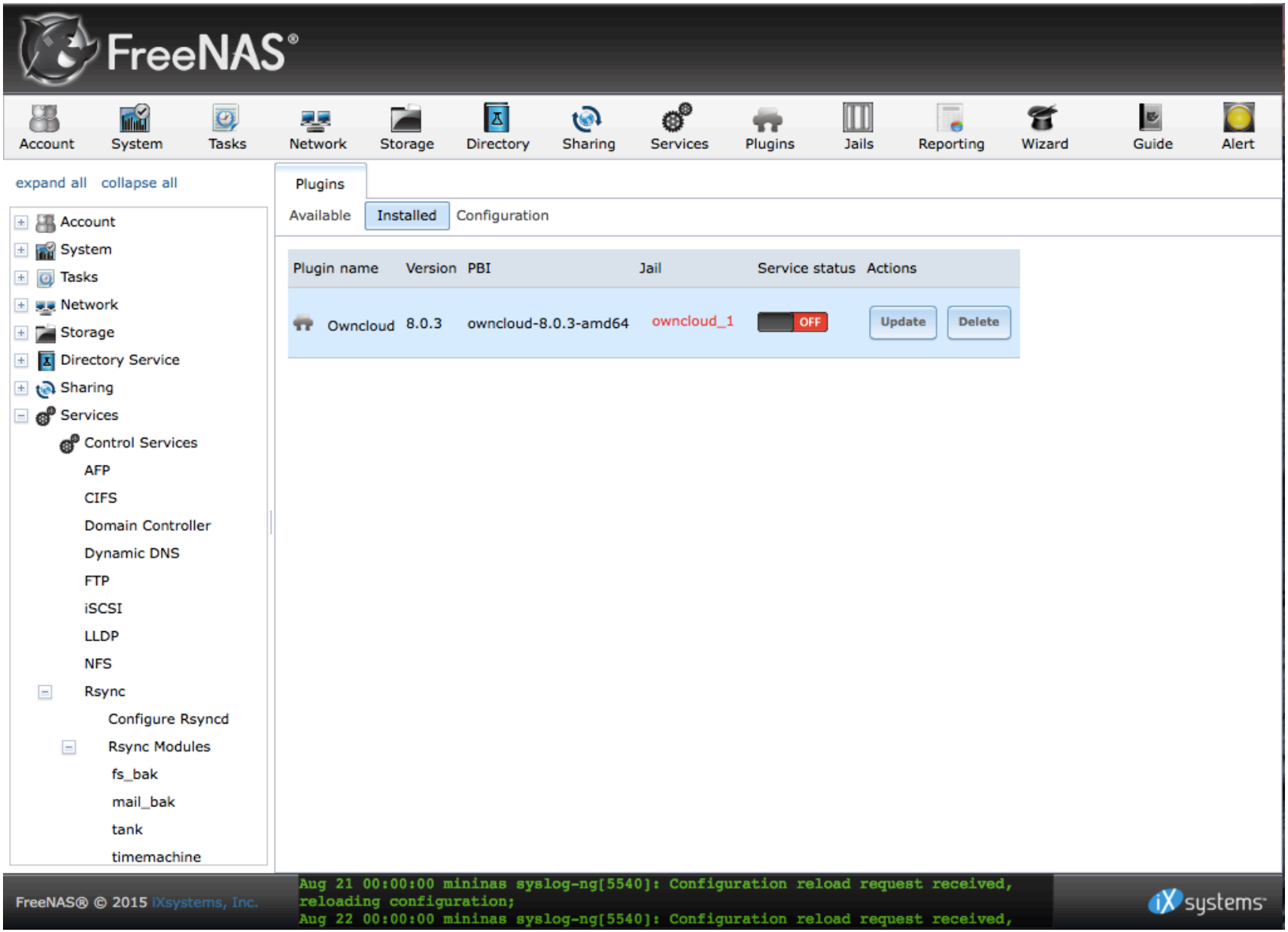
Volumes


FreeNAS®
Account
System
Tasks
Network
Storage
Directory
Sharing
Services
Plugins
Jails
Reporting
Wizard
Guide
Alert
expand all
collapse all
Account
System
Tasks
Network
Storage
Directory Service
Sharing
Services
Control Services
AFP
CIFS
Domain Controller
Dynamic DNS
FTP
iSCSI
LLDP
NFS
Rsync
Configure Rsyncd
Rsync Modules
fs_bak
mail_bak
tank
timemachine
Storage
Volumes
Periodic Snapshot Tasks
Replication Tasks
Scrubs
Snapshots
VMware-Snapshot
Volume Manager
Import Disk
Import Volume
View Disks
Name
Used
Available
Compression
Compression Ratio
Status
tank 9.3 TiB (85%) 1.6 TiB - - HEALTHY
tank 6.2 TiB (88%) 845.9 GiB lz4 1.08x -
527.5 KiB (0%) 845.9 GiB inherit (lz4) 1.00x -
151.9 GiB (15%) 845.9 GiB inherit (lz4) 1.18x -
66.3 GiB (7%) 845.9 GiB inherit (lz4) 1.38x -
1.7 GiB (0%) 845.9 GiB inherit (lz4) 1.08x -
856.4 GiB (50%) 845.9 GiB inherit (lz4) 1.11x -
676.6 GiB (44%) 845.9 GiB inherit (lz4) 1.06x -
783.5 MiB (0%) 845.9 GiB inherit (lz4) 1.05x -
1.1 TiB (56%) 845.9 GiB inherit (lz4) 1.08x -
12.4 GiB (1%) 845.9 GiB inherit (lz4) 1.03x -
3.3 GiB (0%) 845.9 GiB inherit (lz4) 1.00x -
jails 96.3 GiB (10%) 845.9 GiB inherit (lz4) 1.01x -
jails/.warden-template-pluginjail--x64 596.7 MiB (0%) 845.9 GiB inherit (lz4) 1.83x -
jails/.warden-template-standard--x64 3.0 GiB (0%) 845.9 GiB inherit (lz4) 2.05x -
jails/imap 92.0 GiB (9%) 845.9 GiB inherit (lz4) 1.00x -
FreeNAS® © 2015 iXsystems, Inc.
Aug 21 00:00:00 mininas syslog-ng[5540]: Configuration reload request received, reloading configuration;
Aug 22 00:00:00 mininas syslog-ng[5540]: Configuration reload request received,
iXsystems

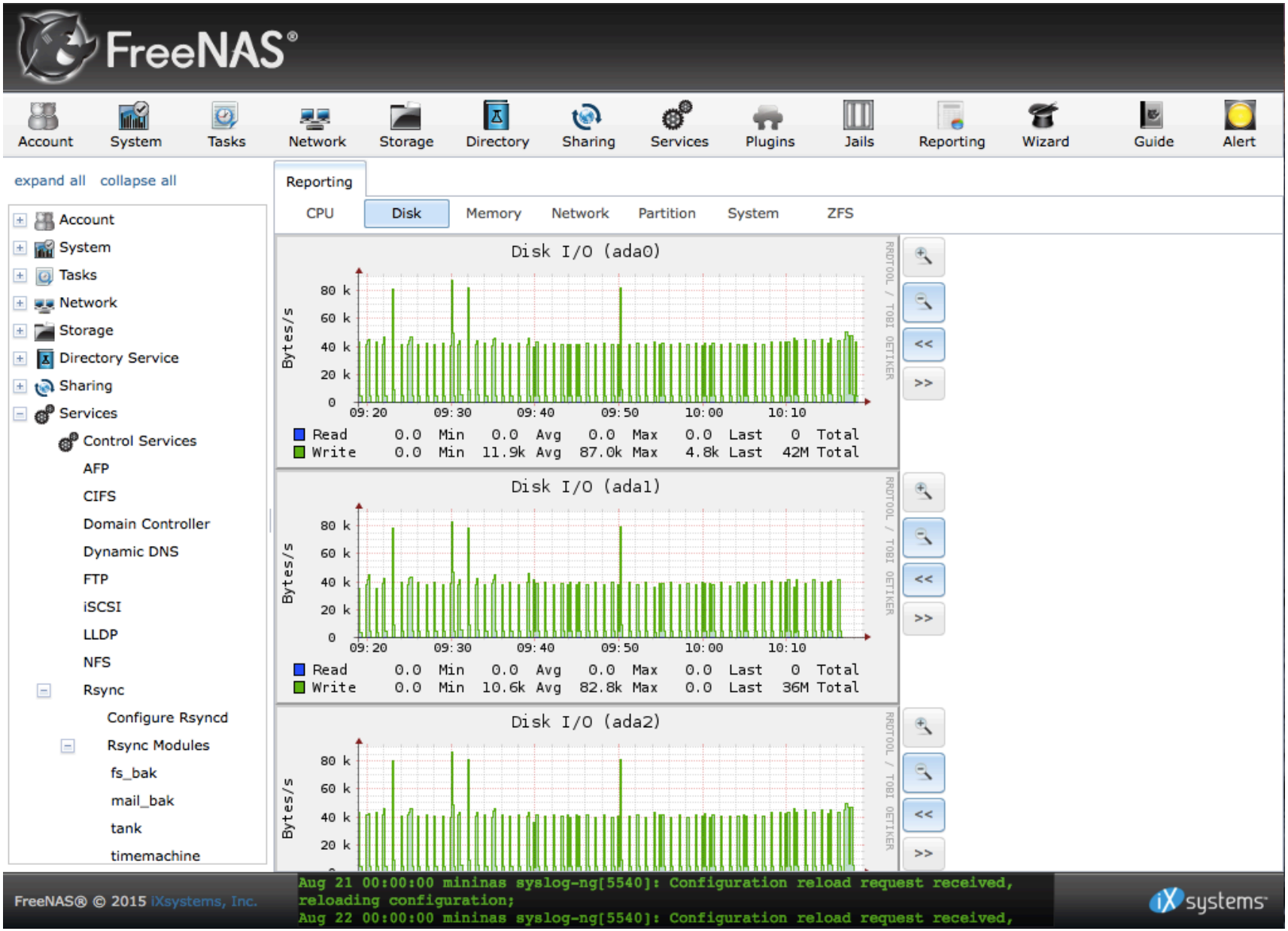
Sharing


FreeNAS®
Account
System
Tasks
Network
Storage
Directory
Sharing
Services
Plugins
Jails
Reporting
Wizard
Guide
Alert
expand all
collapse all
Account
System
Tasks
Network
Storage
Directory Service
Sharing
Services
Control Services
AFP
CIFS
Domain Controller
Dynamic DNS
FTP
iSCSI
LLDP
NFS
Rsync
Configure Rsyncd
Rsync Modules
fs_bak
mail_bak
tank
timemachine
Sharing
Apple (AFP)
UNIX (NFS)
WebDAV
Windows (CIFS)
Block (iSCSI)
Add Windows (CIFS) Share
Path
Name
Comment
Export Read Only
Browsable to Network Clients
Allow Guest Access
/mnt/tank/smb
smb
true
true
true
FreeNAS® © 2015 iXsystems, Inc.
Aug 21 00:00:00 mininas syslog-ng[5540]: Configuration reload request received, reloading configuration;
Aug 22 00:00:00 mininas syslog-ng[5540]: Configuration reload request received,
iX systems

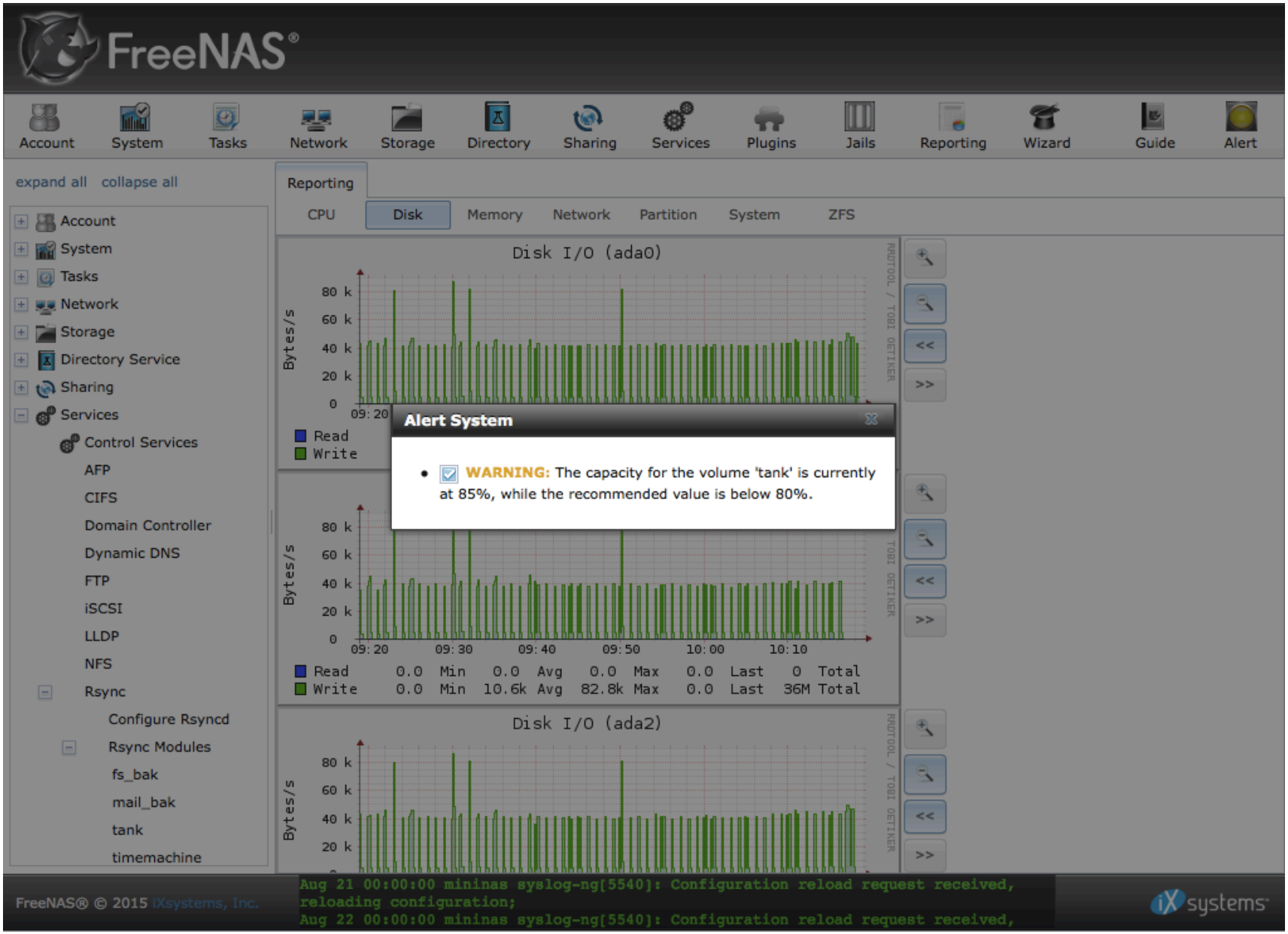
Plugins


FreeNAS®
Account
System
Tasks
Network
Storage
Directory
Sharing
Services
Plugins
Jails
Reporting
Wizard
Guide
Alert
expand all
collapse all
Account
System
Tasks
Network
Storage
Directory Service
Sharing
Services
Control Services
AFP
CIFS
Domain Controller
Dynamic DNS
FTP
iSCSI
LLDP
NFS
Rsync
Configure Rsyncd
Rsync Modules
fs_bak
mail_bak
tank
timemachine
Plugins
Available
Installed
Configuration
Plugin name
Version
PBI
Jail
Service status
Actions
Owncloud
8.0.3
owncloud-8.0.3-amd64
owncloud_1
OFF
Update
Delete
FreeNAS® © 2015 iXsystems, Inc.
Aug 21 00:00:00 mininas syslog-ng[5540]: Configuration reload request received, reloading configuration;
Aug 22 00:00:00 mininas syslog-ng[5540]: Configuration reload request received,
iX systems

Reporting


FreeNAS®
Account
System
Tasks
Network
Storage
Directory
Sharing
Services
Plugins
Jails
Reporting
Wizard
Guide
Alert
expand all
collapse all
Account
System
Tasks
Network
Storage
Directory Service
Sharing
Services
Control Services
AFP
CIFS
Domain Controller
Dynamic DNS
FTP
iSCSI
LLDP
NFS
Rsync
Configure Rsyncd
Rsync Modules
fs_bak
mail_bak
tank
timemachine
Reporting
CPU
Disk
Memory
Network
Partition
System
ZFS
Disk I/O (ada0)
Bytes/s
80 k
60 k
40 k
20 k
0
09:20
09:30
09:40
09:50
10:00
10:10
Read 0.0 Min 0.0 Avg 0.0 Max 0.0 Last 0 Total
Write 0.0 Min 11.9k Avg 87.0k Max 4.8k Last 42M Total
Disk I/O (ada1)
Read 0.0 Min 0.0 Avg 0.0 Max 0.0 Last 0 Total
Write 0.0 Min 10.6k Avg 82.8k Max 0.0 Last 36M Total
Disk I/O (ada2)
RRDTOOL / TOBI OETIKER
FreeNAS® © 2015 iXsystems, Inc.
Aug 21 00:00:00 mininas syslog-ng[5540]: Configuration reload request received, reloading configuration;
Aug 22 00:00:00 mininas syslog-ng[5540]: Configuration reload request received,
iX systems

Alerts


FreeNAS
Account
System
Tasks
Network
Storage
Directory
Sharing
Services
Plugins
Jails
Reporting
Wizard
Guide
Alert
expand all
collapse all
Account
System
Tasks
Network
Storage
Directory Service
Sharing
Services
Control Services
AFP
CIFS
Domain Controller
Dynamic DNS
FTP
iSCSI
LLDP
NFS
Rsync
Configure Rsyncd
Rsync Modules
fs_bak
mail_bak
tank
timemachine
Reporting
CPU
Disk
Memory
Network
Partition
System
ZFS
Disk I/O (ada0)
Bytes/s
80 k
60 k
40 k
20 k
0
09:20
Read
Write
Alert System
WARNING: The capacity for the volume 'tank' is currently at 85%, while the recommended value is below 80%.
09:30
09:40
09:50
10:00
10:10
Read 0.0 Min 0.0 Avg 0.0 Max 0.0 Last 0 Total
Write 0.0 Min 10.6k Avg 82.8k Max 0.0 Last 36M Total
Disk I/O (ada2)
FreeNAS® © 2015 iXsystems, Inc.
Aug 21 00:00:00 mininas syslog-ng[5540]: Configuration reload request received, reloading configuration;
Aug 22 00:00:00 mininas syslog-ng[5540]: Configuration reload request received,
iX systems

Why FreeNAS?

- Jails and ZFS

Jails

- Not mentioned as a feature of FreeNAS but integral
- Core to plugin-functionality
- Not limited to plugin architecture
- What are jails?

What are Jails?

- Process isolation:
  - Full OS
  - Separate network stack
  - Own users and groups (including root)
  - Own processes
  - Unable to access other jails outside of normal network access
- More than just chroot
- Lighter than full OS virtualization
- One kernel to rule them all…
- Very mature, appearing in FreeBSD 4.0
- Similar to Solaris Containers
- More than a Docker container

Jails in FreeNAS

- Used for plugin-architecture
- Each plugin runs in a jail
- One ipv4 address per jail
- Neat, clean separation between each plugin
- Yes, you can run docker-images in a FreeNAS jail
  - `http://www.freenas.org/whats-new/2015/07/docker-done-right.html`
- `http://www.freenas.org/whats-new/2013/04/freenas-plugins-everything-you-ever-wanted-to-know.html`

What is ZFS?

- Not mentioned as a feature of FreeNAS but integral
- Combined file system and logical volume manager
- Focused on:
  - Data protection
  - High (insane) storage capacity
  - Efficient data compression
  - Continuous integrity checking and repair
  - RAID-Z layouts
  - Native CIFS, NFS and ACLs
- Originally ZFS as in Zettabyte File System
- Now ZFS as in ”last” file system (you’ll need)
- Cross platform
  - `http://open-zfs.org`

What is ZFS? - Features

- Data Datasets
  - Partition and mount-point management
  - Snapshot target
- COW - Copy On Write
- Snapshots
- Metadata
  - Data about the dataset
  - User can create metadata
- RAID (0,1,10, RAIDZ[1-3])
  - RAIDZn - number of disks for parity
  - Hotswap (AHCI or other hotswap hardware)
- Replication
  - zfs end | receive
  - Save/restore to/from file
- File-backed devices

Snapshots - So What?

- Exact replica of file table at moment in time
- Nearly instantaneous, even for large data sets
- Recursive
- Enabled by COW -Block-level changes only
- Conceptually similar to a diff
  - More flexible since block level
  - ZFS doesn't need to know file format
- Can be aged out (using cron)

ZFS in FreeNAS

- Heart and primary differentiator of FreeNAS
- Used for drive and volume management
- Snapshots
- Key part of jails

Is FreeNAS for Home Use?

- Yes! And business, SOHO to Enterprise
- Numerous sites with servers in the 100s of TBs
- Houses like mine
- FreeNAS forums chock-a-block with home and SOHO users talking about ITX-based systems

Hardware (Minimum) Requirements

- Multi-core 64-bit processor
- 8 GB boot drive
  - Thumb drives welcome, encouraged
- 8 GB of RAM
- At least 1 storage disk
  - Multiple strongly encouraged
- FAQ
  - Doesn't ZFS require ECC RAM.
    - No. ECC helps with data integrity in the data center
    - Nice to hvae
  - I heard I need 32 GB+ of RAM. Do I?
    - 32 GB+ is nice because you get more read-caching
    - 8 GB is enough

Questions

- Questions - You have them, I may have answers

Contact Details

- Aaron Poffenberger
- akp@hypernote.com
- `http://akpoff.com`
- @akpoff
- This presentation, note on `http://akpoff.com`
- KG5DQJ

Resources and Additional Information

- `http://www.freenas.org`
- Hardware vendors
  - `http://www.ixsystems.com`

License and Credits

- Copyright Aaron Poffenberger
- Attribution 4.0 International (CC BY 4.0)
  - `http://creativecommons.org/licenses/by/4.0/`
- FreeNAS Logo Copyright iXsystems
  - `http://www.ixsystems.com`