

## FreeNAS Guide for creating an iSCSI target of a ZFS RAIDz1 File System

by Mujahid Arshad (Jazz)

Version 0.1

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This guide will try to demonstrate the steps I went through to create an iSCSI Target of a ZFS RAID1 File System using FreeNAS.

I am by no means a FreeNAS expert nor for that matter a BSD guru or technical master so for any mistakes in explanations or steps I give my humble apologies and for the technical mastery and successes I have had in settings this up I would like to kindly thank Olivier Cochard-Labbe, Gary Sims, the FreeNAS and BSD Community for all their help.

### My Setup

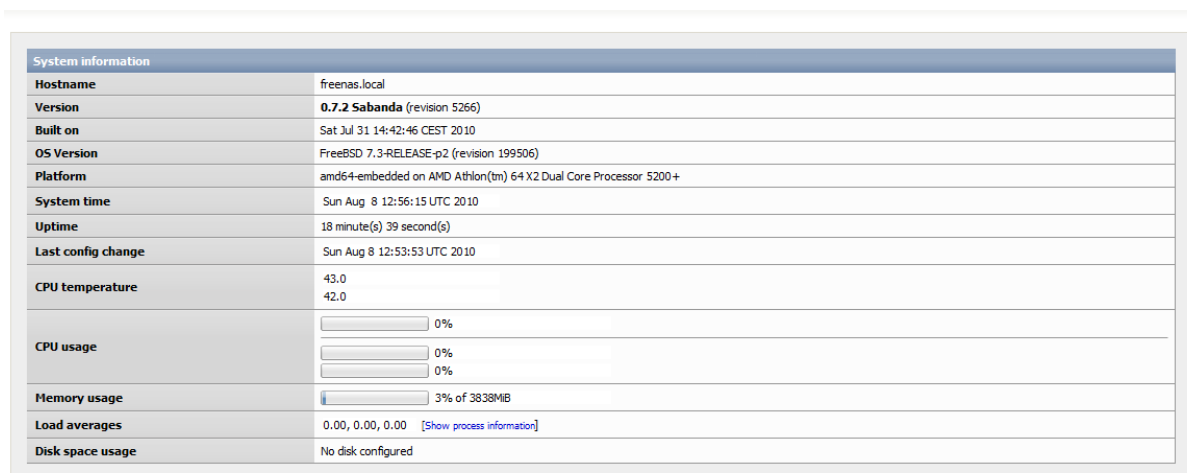
Here is my current setup

AMD Athlon(tm) 64 X2 Dual Core Processor 5200

4GB of RAM.

4 x 2TB Hard drives.

Running FreeNAS 0.7.2 Sabanda (Revision 5266) from a USB Stick.

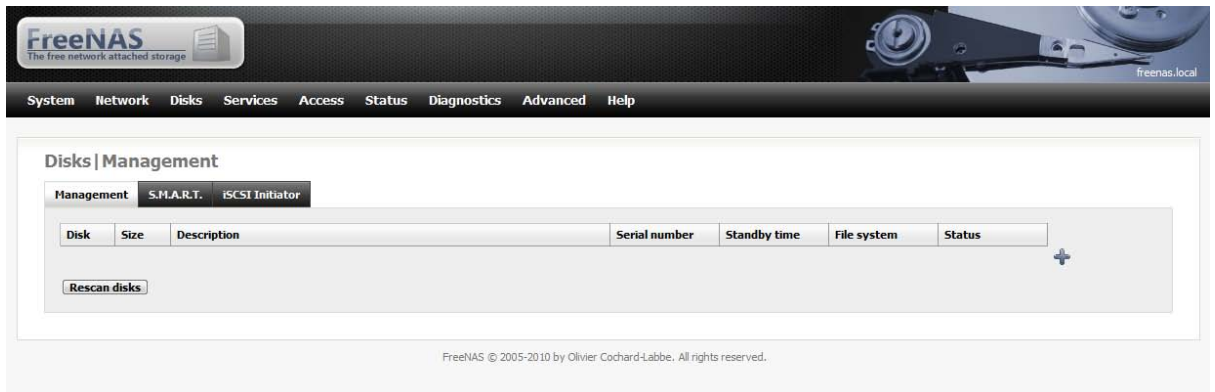


System information	
Hostname	freenas.local
Version	0.7.2 Sabanda (revision 5266)
Built on	Sat Jul 31 14:42:46 CEST 2010
OS Version	FreeBSD 7.3-RELEASE-p2 (revision 199506)
Platform	amd64-embedded on AMD Athlon(tm) 64 X2 Dual Core Processor 5200+
System time	Sun Aug 8 12:56:15 UTC 2010
Uptime	18 minute(s) 39 second(s)
Last config change	Sun Aug 8 12:53:53 UTC 2010
CPU temperature	43.0 42.0
CPU usage	<input type="text" value="0%"/> 0% <input type="text" value="0%"/> 0% <input type="text" value="0%"/> 0%
Memory usage	<input type="text" value="3% of 3838MB"/> 3% of 3838MB
Load averages	0.00, 0.00, 0.00 <a href="#">[Show process information]</a>
Disk space usage	No disk configured

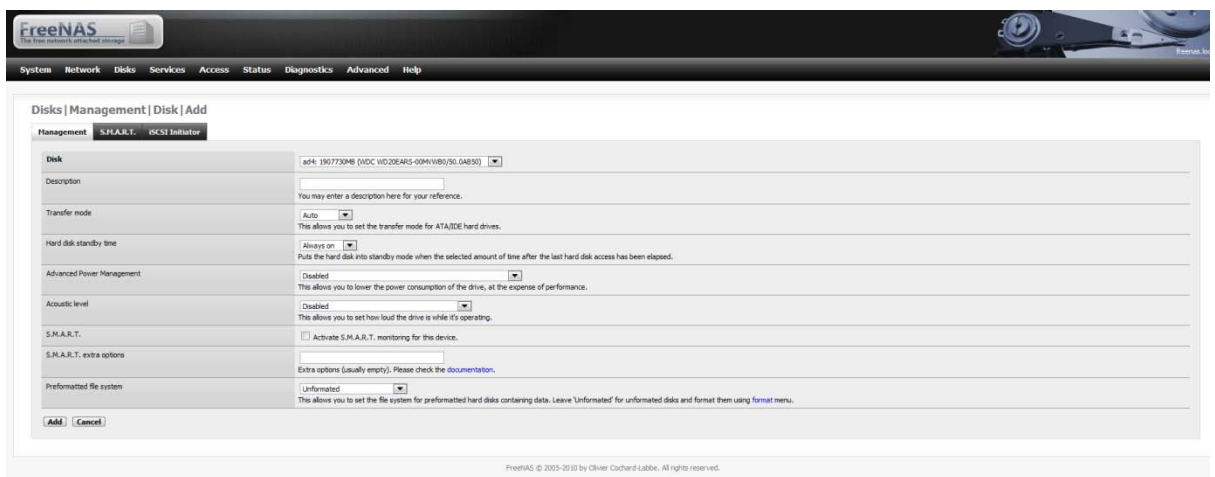
My 4 x 2 Terabyte drives are in no HARDWARE RAID configuration. This is important as ZFS employs its own RAID structure in its file system so the BIOS had its RAID settings disabled (This is what worked for me).

## Adding Discs to FreeNAS

1. Go to Discs Tab at the top navigation bar and then management in the dropdown.



2. Click the add sign "+". This will load up the Disk Add Page.



3. Add the Drive.
4. Give it a Description
5. I left the following setting in their default position but depending on your configuration you can change them.
  - i. Transfer Mode at Auto.
  - ii. Hard Disk Standby Time to "Always on"
  - iii. Advanced Power Management to "Disabled"
  - iv. Acoustic Level.
  - v. S.M.A.R.T NOT Ticked.
6. Preformatted file System was left to Unformatted.  
By setting this to Unformatted we can use the format option in FreeNAS.
7. Click the Add button.

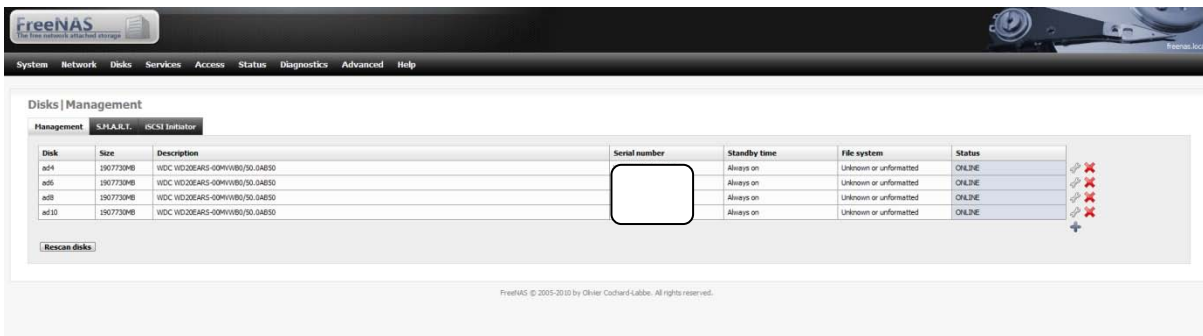


8. Click Apply Changes.

I repeated this process (steps 2 – 8) for the remaining three drives.

I DID NOT ADD MY USB stick as this holds FreeNAS and I don't want that to be formatted by ZFS etc.

All drives should now appear in the disc Management Page.

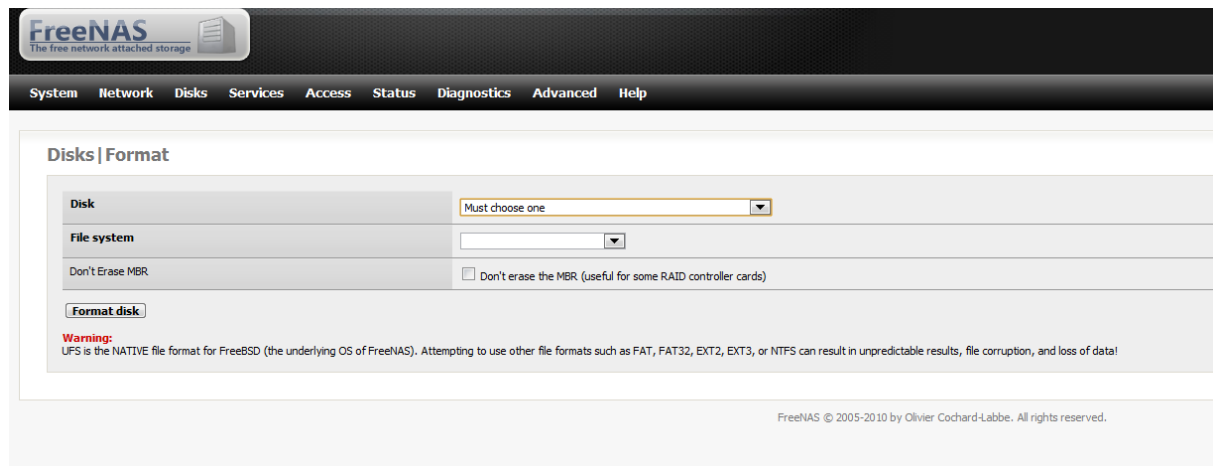


All Drives should appear as "ONLINE"

## Formatting Drives

When all the drives are added I now format them into ZFS.

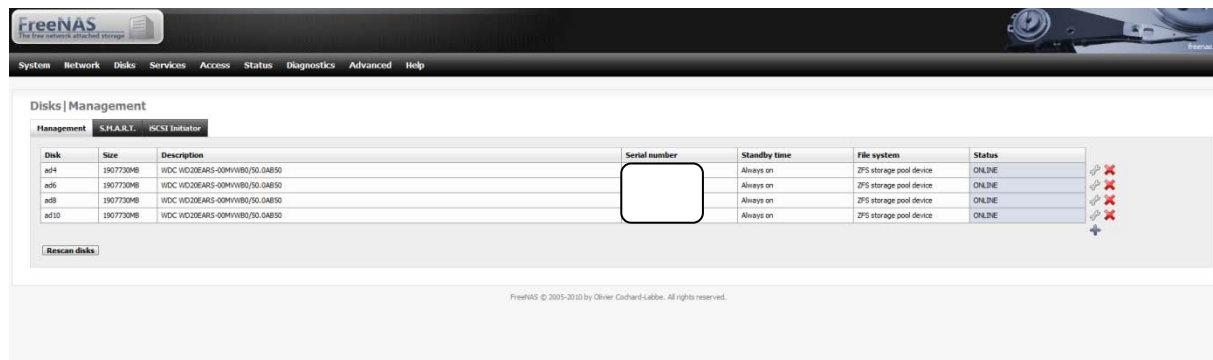
1. Go to Discs Tab on Top Navigation Bar and select Format.



2. Select Drive which should now appear in the dropdown.
3. Select ZFS Storage Pool Device for the File System.
4. I erased my MBR so left the "Don't Erase MBR" Setting UNCHECKED
5. Select Format Disk.

Repeat steps 2-5 for all additional drives that you have.

Go back to Disks Tab on Top navigation Bar and select Management again to check that the formatting all drives was successful.



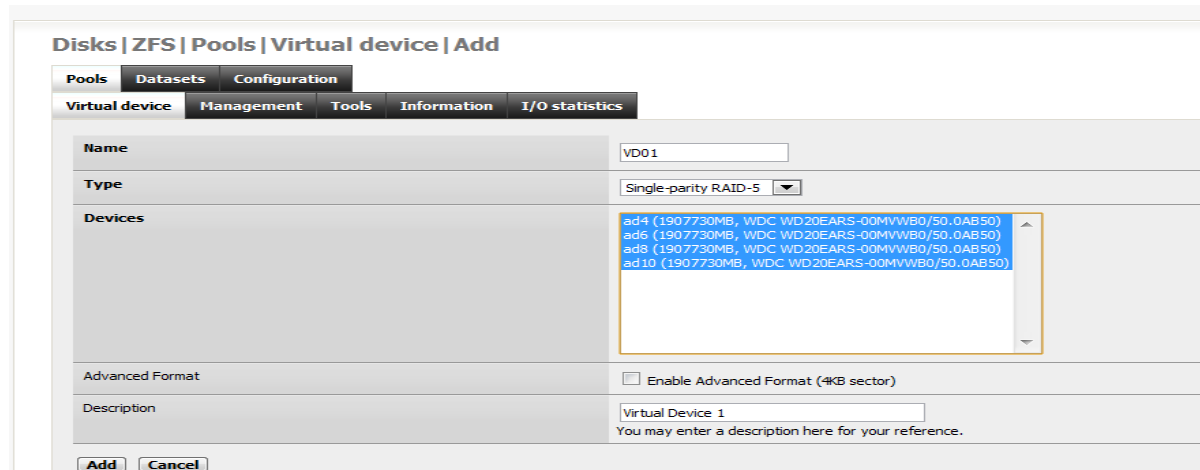
### Creating a ZFS Virtual Device.

Once you have got FreeNAS to recognise and present your drives in the we will now create a virtual device consisting of these drives.

1. Go to Disks in the Top navigation Bar and select ZFS.
2. Click on the Virtual Device Tab.



3. Click on the Add sign.



4. Enter a Name. (I called mine VD01)
5. Select a Type (I personally selected Single Parity Raid 5 which is RAIDz1 in ZFS speak)
6. Now select ALL the DEVICES SO THEY TURN BLUE!! OTHERWISE YOU WILL GET AN ERROR.
7. I didn't select Advanced Format.
8. Enter a Description
9. Click the Add Button.
10. After clicking the Add button you will now be returned to the Virtual Device page in ZFS.



Now the drives have been added to FreeNAS they still have to be available to FreeNAS to manage.

Going to Status on the top navigation bar and selecting System you will see the Disc you have been setting up are still not here "No Disc Configured".

<b>Load averages</b>	0.00, 0.00, 0.00 <a href="#">[Show process information]</a>
<b>Disk space usage</b>	No disk configured

### Adding device to ZFS Management page

1. Go to Disks Tab in the Top navigation bar and select ZFS. This will load up the management page.



2. Now click the Add Button.

Disks | ZFS | Pools | Management | Add

Pools Datasets Configuration

Virtual device Management Tools Information I/O statistics

Name

Virtual devices

Root

Creates the pool with an alternate root.

Mount point

Sets an alternate mount point for the root dataset. Default is /mnt.

Description

You may enter a description here for your reference.

3. Enter a Name ( I gave mine the exact same name as what I gave the Virtual Device: VD01)
4. SELECT THE VIRTUAL DEVICE SO IT IS TURNED BLUE!!! AGAIN THIS HAS TO BE SELECTED.
5. I kept these options as default
  - i. Root
  - ii. Mount Point
6. I entered a name for the Description.
7. Click the Add Button

You will then be returned to the Management Page.

Disks | ZFS | Pools | Management

Pools Datasets Configuration

Virtual device Management Tools Information I/O statistics

**The configuration has been changed. You must apply the changes in order for them to take effect.**

Name	Size	Used	Free	Capacity	Health	AltRoot
VD01	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown

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Everything is listed as UNKNOWN. DO NOT WORRY. YOU MUST APPLY THE CHANGES!

8. Click the Apply Changes Button!

Disks | ZFS | Pools | Management

Pools Datasets Configuration

Virtual device Management Tools Information I/O statistics

**The changes have been applied successfully.**

Name	Size	Used	Free	Capacity	Health	AltRoot
VD01	7.20T	103K	5.94T	0%	ONLINE	-

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9. Now all the values should have changed and the virtual device is now online.

Just to make sure. Go back to Status in the Top navigation Bar and then System.

<b>Disk space usage</b>	<b>VD01</b>	0% of 7.25TB
	Total: <b>7.25T</b>   Used: <b>103K</b>   Free: <b>5.34T</b>   State: <b>ONLINE</b>	

10. Take note of the FREE space! You will need this value for later.

## Create an iSCSI target

Now with the disc managed and configured correctly in ZFS we are now going to create an iSCSI Target.

1. Go to Services in the Top navigation bar and select iSCSI target.

2. The iSCSI Target click on enable so it has a tick inside.

3. Leave everything else alone.

4. Click Save and Restart.

## Adding a Portal

This will allow you to configure how the iSCSI target will be seen or reported as on the network.

Now click on Portals tab.

1. Click the Add sign.
2. For the benefit of this document I left it at its default which is to allow it to be accessed VIA any IP address that the FreeNAS machine is configured with.

Services | iSCSI Target | Portal Group | Add

Settings Targets Portals Initiators Authn Media

Tag number: 1  
Numeric identifier of the group.

Portals: 0.0.0.0:3260  
The portal takes the form of 'address:port', for example '192.168.1.1:3260' for IPv4, '2001:1088:1::1:3260' for IPv6, the port 3260 is standard iSCSI port number. For any IPs (wildcard address), use '0.0.0.0:3260' and/or ':::3260'. Do not mix wildcard and other IPs at same address family.

Comment: You may enter a description here for your reference.

Add Cancel

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3. Click Add Button.
4. Click Apply Changes in the Portal Group Page.

Services | iSCSI Target | Portal Group

Settings Targets Portals Initiators Authn Media

The configuration has been changed. You must apply the changes in order for them to take effect.

Apply changes

Portal Group	Tag	Portals
	1	0.0.0.0:3260

A Portal Group contains IP addresses and listening TCP ports to connect the target from the initiator.

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## Adding an Initiator

Initiators are systems that can access an iSCSI target (in this case your ZFS storage we created above) here you can specify which machines via IP can initiate a communication with the iSCSI target.

1. Click on the Initiators Tab.

Services | iSCSI Target | Initiator Group

Settings Targets Portals Initiators Authn Media

Initiator Group

Initiator Group	Tag	Initiators	Networks
		ALL	

A Initiator Group contains authorized initiator names and networks to access the target.

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2. Click Add sign.

Services | iSCSI Target | Initiator Group | Add

Settings Targets Portals Initiators Authn Media

Tag number: 1  
Numeric identifier of the group.

Initiators: ALL  
Initiator authorised to access to the iSCSI target. It takes a name or 'ALL' for any initiators.

Authorised network: ALL  
Network authorised to access to the iSCSI target. It takes IP or CIDR addresses or 'ALL' for any IPs.

Comment: You may enter a description here for your reference.

Add Cancel

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3. Here again I left everything how it is and clicked on "Add". (Anything can access it)





4. Click "Apply Changes"

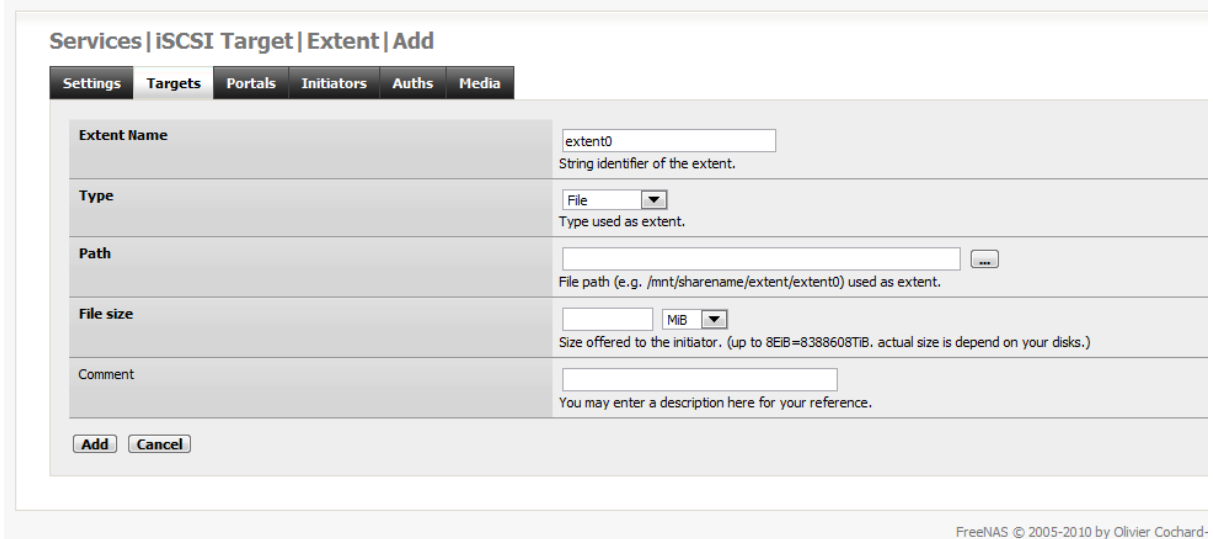
## Create an Extent

To create an iSCSI Target you must create an extent first.

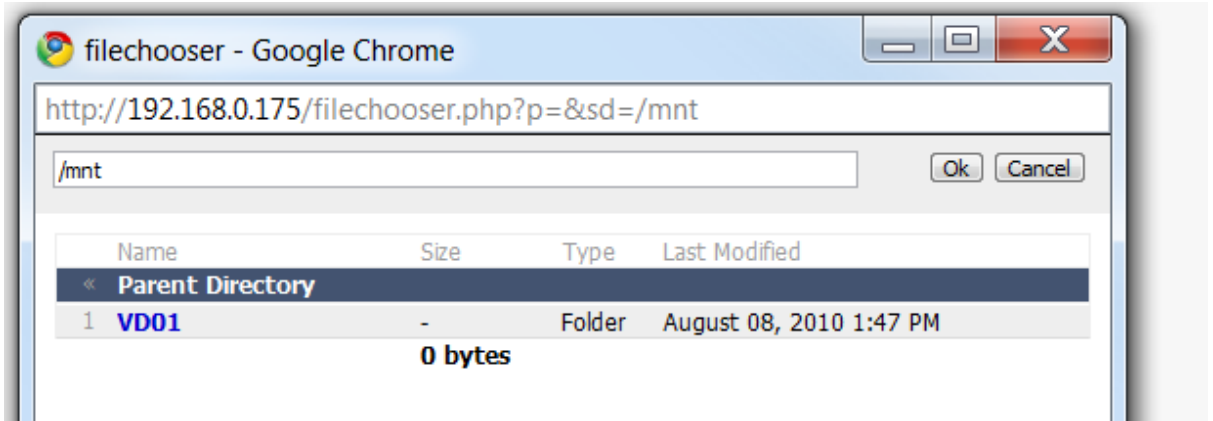
1. Go to the Target Tab.



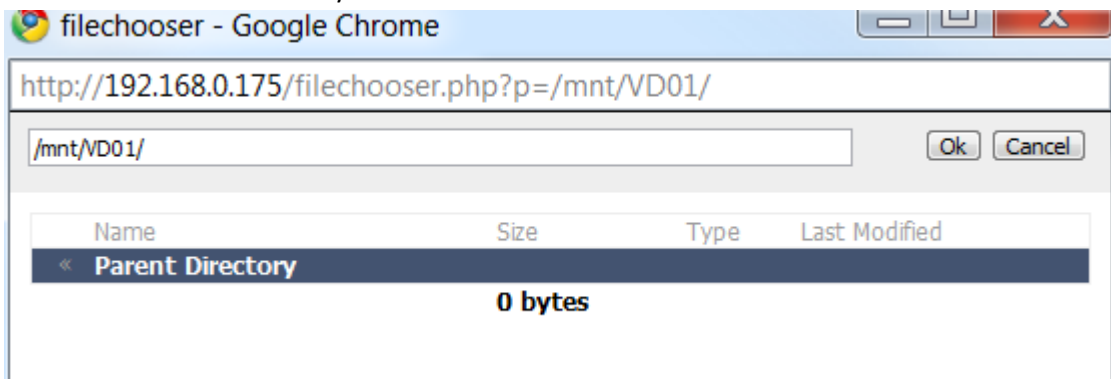
2. Click on Add Sign in Extent.



3. Give the extent a name I left mine as extent0.
4. In 0.7.2 of FreeNAS with ZFS the TYPE Dropdown. "ZFS Volume" option in the dropdown did not work for me! SO KEEP IT AS FILE.
5. Click on the button with the 3 dots on it "..." and a new pop up will appear as we cannot use the ZFS volume we have to point to the correct directory and create a file which will essentially be the drive you will be writing to.

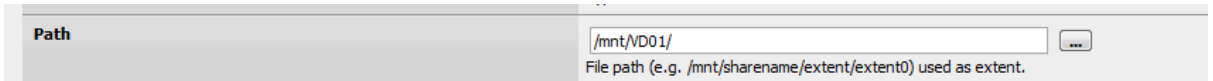


6. Earlier we created a device called VD01 which is presented here as a folder.
7. Select VD01 or the name of your Virtual Device.

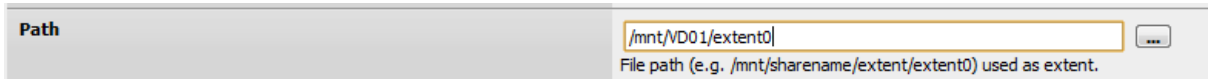


8. This will change the path from /mnt/ to /mnt/VD01/ in the address bar at the top.
9. Click ok.

This will appear in the Target Add page.



10. Add to the path field "extent0"



11. File Size: Here is the big problem DO NOT USE AUTO it does not work with ZFS. You will get message later on when trying to "apply changes" such as

Error: The changes could not be applied (error code 1).

And in the logs (Top navigation Bar Diagnostics: Logs) you will get messages such as

Aug 8 14:44:09	freenas	root: Failed to restart service iscsi_target
Aug 8 14:44:09	freenas	istgt[19293]: istgt.c:1618:main: ***ERROR*** istgt_lu_init() failed
Aug 8 14:44:09	freenas	istgt[19293]: istgt_lu.c:1863:istgt_lu_init: ***ERROR*** lu_add_unit() failed
Aug 8 14:44:09	freenas	istgt[19293]: istgt_lu.c:1604:istgt_lu_add_unit: ***ERROR*** LU1: LUN0: Auto size error (/mnt/VD01/extent0)
Aug 8 14:44:09	freenas	istgt[19293]: istgt version 0.3 (20100707)
Aug 8 14:44:09	freenas	istgt[19165]: istgt version 0.3 (20100707) exiting

LU1: LUN0: Auto size error (/mnt/VD01/extent0)

You must put in an approximate size.

So do you remember earlier when I asked you to note down the free space in the Status System Page?

**Disk space usage** **VD01**  
0% of 7.25TB  
Total: **7.25T** | Used: **103K** | Free: **5.34T** | State: **ONLINE**

Here I have 5.34T which is 5.34 Tb of free space this is what we will present to the iSCSI Initiators as free space.

12. In File size as it only accepts numbers and not Decimal point enter the value in a whole number with the correct units attached.

I cannot add 5.34Tb so I added 5468Gb (5.34 x 1024(number of Gb in a Tb) I might lose a tiny bit of space but for this document I will allow it.

**Path**    
File path (e.g. /mnt/sharename/extent/extent0) used as extent.

**File size**     
Size offered to the initiator. (up to 8EiB=8388608TiB. actual size is depend on your disks.)

13. Add a comment

14. Click "Save" Button

15. Click "Apply Changes" on the Services | iSCSI Target | Target Page.

Services | iSCSI Target | Target

Settings Targets Portals Initiators Auths Media

The changes have been applied successfully.

Targets							
Extent	<table border="1"><thead><tr><th>Name</th><th>Path</th><th>Size</th></tr></thead><tbody><tr><td>extent0</td><td>/mnt/VD01/extent0</td><td>5468GB</td></tr></tbody></table>	Name	Path	Size	extent0	/mnt/VD01/extent0	5468GB
Name	Path	Size					
extent0	/mnt/VD01/extent0	5468GB					

Extents must be defined before they can be used, and extents cannot be used more than once.

Target													
	<table border="1"><thead><tr><th>Name</th><th>Flags</th><th>LUNs</th><th>PG</th><th>IG</th><th>AG</th></tr></thead><tbody><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr></tbody></table>	Name	Flags	LUNs	PG	IG	AG						
Name	Flags	LUNs	PG	IG	AG								

At the highest level, a target is what is presented to the initiator, and is made up of one or more extents.

**Note:**  
To configure the target, you must add at least Portal Group and Initiator Group and Extent.  
Portal Group which is identified by tag number defines IP addresses and listening TCP ports.  
Initiator Group which is identified by tag number defines authorized initiator names and networks.  
Auth Group which is identified by tag number and is optional if the target does not use CHAP authentication defines authorized users and secrets for additional security.  
Extent defines the storage area of the target.

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## Adding a Target

All that is left is to add a target

1. Click on the Add sign for adding a target.

Services | iSCSI Target | Target

Settings Targets Portals Initiators Auths Media

The changes have been applied successfully.

Targets							
Extent	<table border="1"><thead><tr><th>Name</th><th>Path</th><th>Size</th></tr></thead><tbody><tr><td>extent0</td><td>/mnt/VD01/extent0</td><td>5468GB</td></tr></tbody></table>	Name	Path	Size	extent0	/mnt/VD01/extent0	5468GB
Name	Path	Size					
extent0	/mnt/VD01/extent0	5468GB					

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Services | iSCSI Target | Target | Add

Settings Targets Portals Initiators Auths Nodes

**iSCSI Target**

**Target Name** disk0  
Base Name will be appended automatically when starting without Tag.

**Target Alias**  
Optional user friendly string of the target.

**Type** Disk  
Logical Unit Type mapped to LUN.

**Flags** Read/Write (rw)

**Portal Group** Tag 1  
The initiator can connect to the portals in specific Portal Group.

**Initiator Group** Tag 1  
The initiator can access to the target via the portals in specific Initiator Group.

**Comment**  
You may enter a description here for your reference.

---

**Storage**

**Extent** extent0 (jmnt/100/extent0)  
The storage area mapped to LUN.

---

**Advanced settings**

**Auth Method** Auto  
The method can be accepted by the target. Auto means both none and authentication.

**Auth Group** name  
The initiator can access to the target with correct user and secret in specific Auth Group.

**Initial Digest** Auto  
The initial digest mode negotiated with the initiator.

**Queue Depth** 0  
The number of outstanding commands queuing with specified depth. The recommended queue depth is 32.

**Inquiry Vendor**   
You may specify as SCSI INQUIRY data. Empty as default. (up to 8 ASCII chars)

**Inquiry Product**   
You may specify as SCSI INQUIRY data. Empty as default. (up to 16 ASCII chars)

**Inquiry Revision**   
You may specify as SCSI INQUIRY data. Empty as default. (up to 4 ASCII chars)

**Inquiry Serial**   
You may specify as SCSI INQUIRY data. Empty as default. (up to 16 ASCII chars)

**Logical Block Length** 512B / block  
You may specify logical block length (512 by default). The recommended length for compatibility is 512.

- Give it a Target Name if you want too I called my LUN0 or you can leave it as disk0
- Leave all settings how they are and go down to ADD Button at the bottom.

Services | iSCSI Target | Target

Settings Targets Portals Initiators Auths Nodes

The configuration has been changed.  
You must apply the changes in order for them to take effect.

**Apply changes**

**Targets**

Extents	Name	Path	Size
	extent0	/jmnt/100/extent0	1460GB

Extents must be defined before they can be used, and extents cannot be used more than once.

Target	Name	Flags	LUNs	PG	IG	AG
	iqn.2007-09.jp.ne.peach.target.LUN0	rw	LUN0=jmnt/100/extent0	1	1	none

At the highest level, a target is what is presented to the initiator, and is made up of one or more extents.

**Notes:**  
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Portal Group which is identified by tag number defines IP addresses and listening TCP ports.  
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- Click on "Apply Changes".

That is it!

All that is left is connecting to the iSCSI Target.

There is a wealth of information on this. So I will leave you to Google that one.

I hope this document helps and if anyone has any comments or criticisms please let me know as it my first document.

Cheers again.

Mujahid Arshad (Jazz)

yoyojazz on the FreeNAS Forums.

## **References**

### **Books:**

Book Title: Learning FreeNAS by Gary Sims

**Language** : English

**Paperback** : 244 pages [ 235mm x 191mm ]

**Release Date** : August 2008

**ISBN** : 1847194680

**ISBN 13** : 978-1-847194-68-8

### **YouTube:**

**Preview of ZFS on FreeNAS 0.7 Server** :<http://www.youtube.com/watch?v=16v4jNYHOGI>

**Author** : learnfreenas (Gary Sims)

### **Articles:**

<http://virtual3c.blogspot.com/2009/08/setting-up-iscsi-drives-using-freenas.html>

**Posted by** Oliver Hewitt

## **Thanks**

All the above resources were key into me writing this document so all thanks go to these guys.

Not to leave anyone out the Guys in the FreeNAS forums and FreeBSD Forums..... Thank you ☺