Scale-Out Functionality User Guide (rev. v3 FW v3.02.00 and after)

Important Notes:

1. **The Client mode is the default mode.**
2. **The Scale-Out function can be setup as "Client-Server combo mode" or "Pure Server mode" of associate system.**
3. **Once the system has enabled the "Pure Server mode" of the Scale-Out function, all other services will be stopped.**
4. **It is recommended to use only identical HDD models in one NAS**
5. **If Auto Management is enabled, please ensure that the standby brick volume's size is equal or greater than the size of the damaged volume**
6. **It is recommended to use at least two Scale-Out systems to avoid a single point of failure.**
7. **Resetting a Scale-Out server will erase all data.**
8. **"Brick" means storage volume in the context of this manual, e.g. a formatted HDD or a RAID 1, etc.**
9. **Even though, theoretically a scale out compound can be realized over the internet with the use of VPNs, we recommend the usage in a local network environment with at least one Gigabit of bandwidth.**

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General Explanation of Scale Out

The Scale-Out function allows volume capacity to be expanded dynamically through connecting numerous independent Thecus NAS systems in the same network subnet. The most remarkable advantage concerning the Thecus Scale-Out function is that the expansion impact is minimal. Added capacity will be seamlessly integrated into the network storage, the data will be automatically redistributed to the new storage capacity and even single disks in existing NAS can be added to the scale out compound easily.

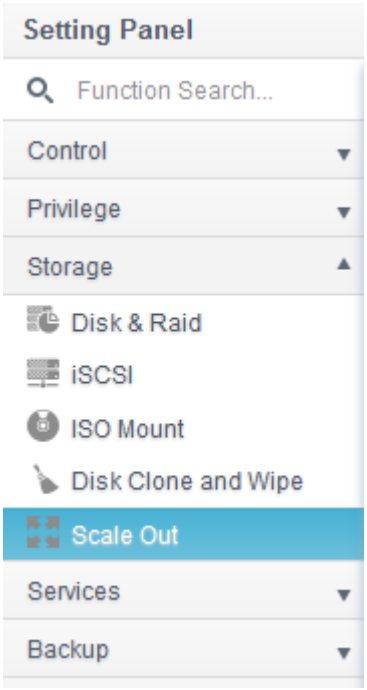
Also, since the data is distributed across devices, RAID system's redundancy becomes obsolete in many applications as the Scale-Out system offers redundancy (with the number of copies being selectable) across devices with the added advantage that data would be still accessible, even if a whole NAS unit becomes unavailable.
Scale-Out relies on a client-server architecture and it is recommended to use at least two Thecus NAS systems. One acts as a client and the other one as server. However, scale-out function can still work for single Thecus NAS device but requires at least 3 volumes.

To understand better how Scale-Out works and learn how to easily set it up, let's systematically go through the steps below.

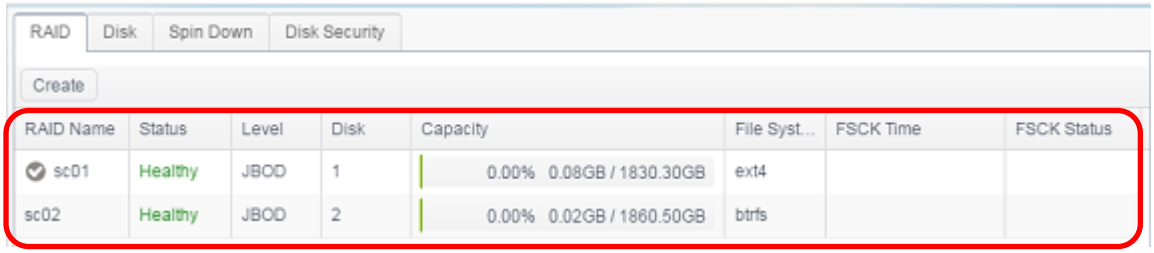
The Scale-Out function can be found under the "Storage" category in the "Setting" Panel.

First Steps and Scale-Out Mode

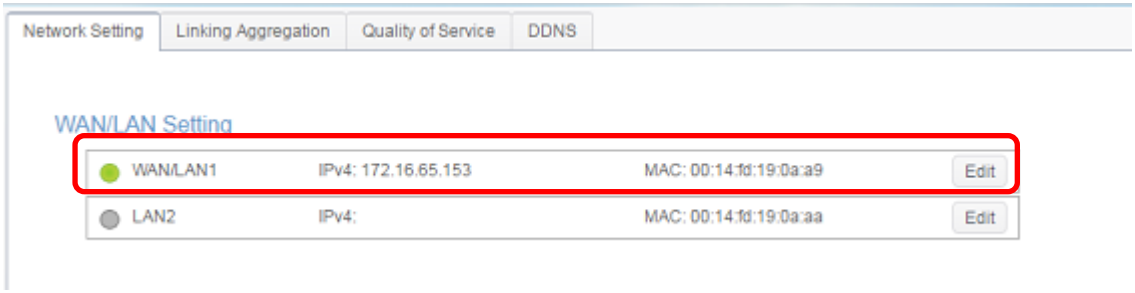
In this example, the Thecus N2810 and 2xN5810PRO will be used for the setting steps and actual usage. The N2810 will serve as the Scale-Out "client-server combo mode" and the other 2 units will act as Scale-Out servers.



To become the Scale-Out server, the user must have created a volume, which can be a RAID over several disks or a single disk classified as a JBOD (these creation functions are listed together in the RAID menu of the OS). The RAID volume can be created by following the standard creation procedure (please refer to the user manual) or by enabling "Auto Management", located in the advanced settings. For this sample unit we had a volume created before. Below you can find a screenshot of the RAID creation menu showing the volume status, which is a JBOD over two disks in our example case.



The system IP address is needed to let the Scale-Out client connect, so we have listed the system's IP address. The example system IP for this unit is 172.16.65.153.



Now, we can continue to set the Scale-Out functional role for this candidate. The Scale-Out functions can be found under the "Storage" category. Click on Scale-Out and the settings screen will appear as below. The default status of associated system of Scale-Out function is "Uninitialized". To enable the Scale-Out function, it needs to define the Scale-Out function mode either "Client-Server combo mode" or "Pure Server mode".

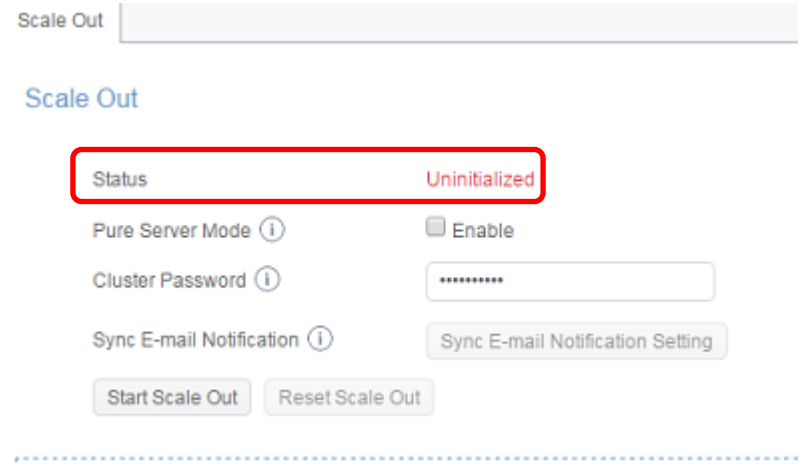
To have "Client-Server combo mode" enabled, simply click on "Start Scale-Out" button and leave "Pure Server mode" check box blank or checked on box to let system become "Pure Server mode". The major different in between "Client-Server combo mode" and "Pure Server mode" is "Client-Server mode" can act client and server roles at same time, it normally used in the single NAS environment and will expand capacity later. For "Pure Server mode" it is obviously only act as server role.

NOTE

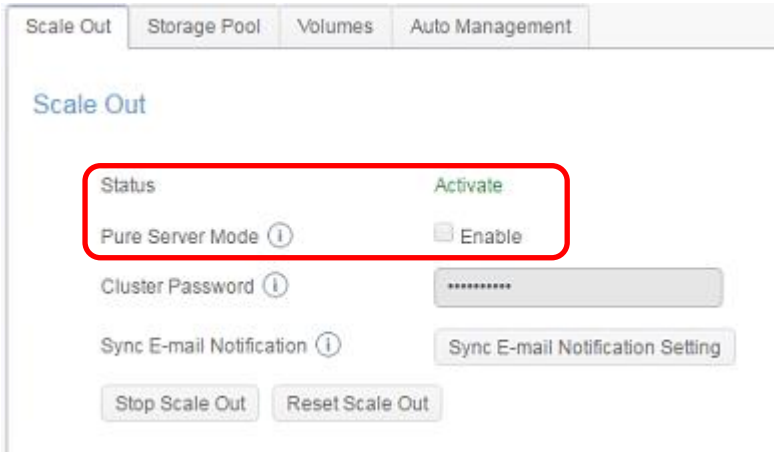
The Scale-Out "Client-Server mode" will have MASTER RAID volume of associate system remains in CLIENT mode. All other volumes will become to scale-out bricks.

The Scale-Out "Pure Server mode" will have all RAID volume of associate system become to scale-out bricks.

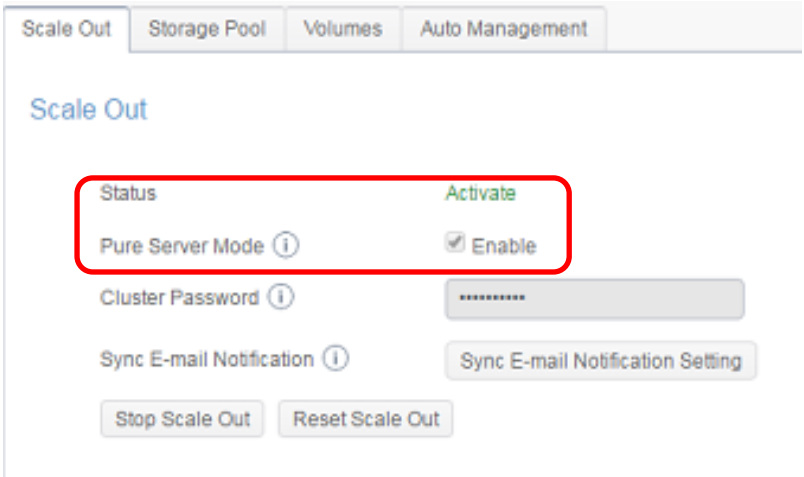
Scale-Out function default status: **Uninitialized**



Client-Server combo mode enabled. (Pure Server mode unchecked)



Pure-Server mode enabled.

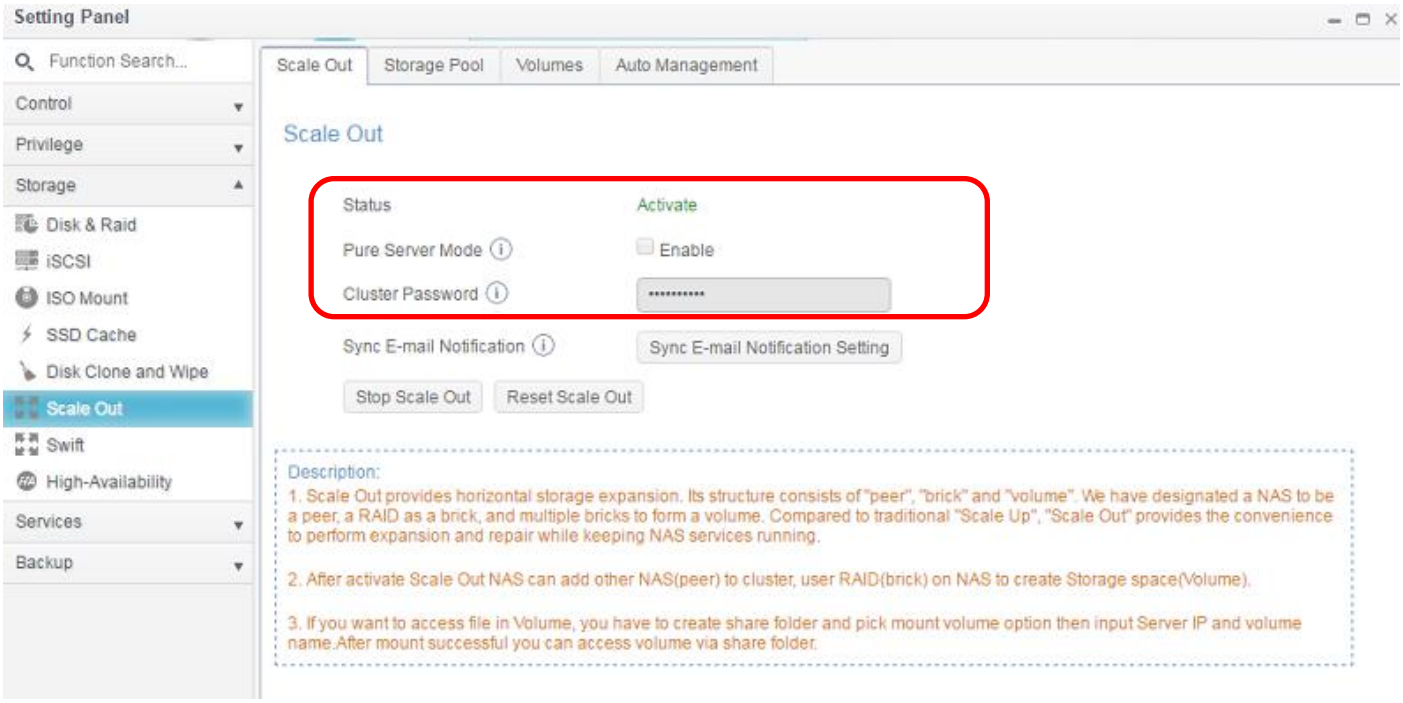


Enabling Scale-Out

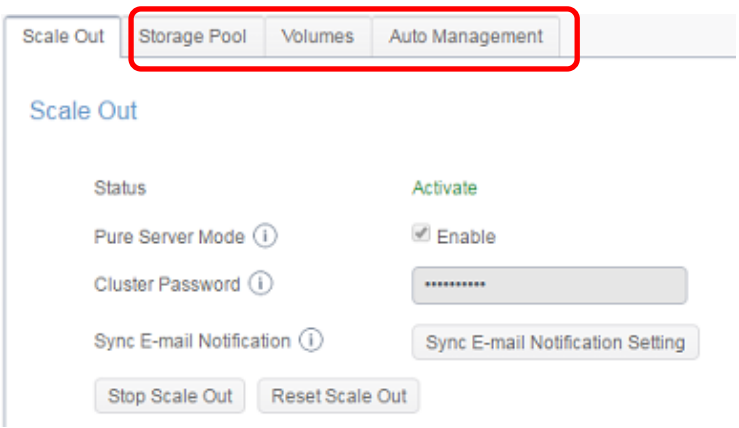
The default status of Scale-Out is uninitialized. To activate the Scale-Out function, choose the Scale-Out mode as described in the previous section and then please input a password in “Cluster Password”. Follow by clicking on the “Start Scale-Out” button. This cluster password is going to be

used for the scale-out server members to know each other and distinguish it from other Scale-Out groups.

If the Scale-Out “Pure-Server Mode” has been created, the system will log out automatically. Please login again and since the Scale-Out “Pure Server mode” has been enabled, you will notice that many functions have been disabled, such as iSCSI, samba, afp ftp, etc. If the “Client-Server mode” has selected, it can be carried on for other operations.



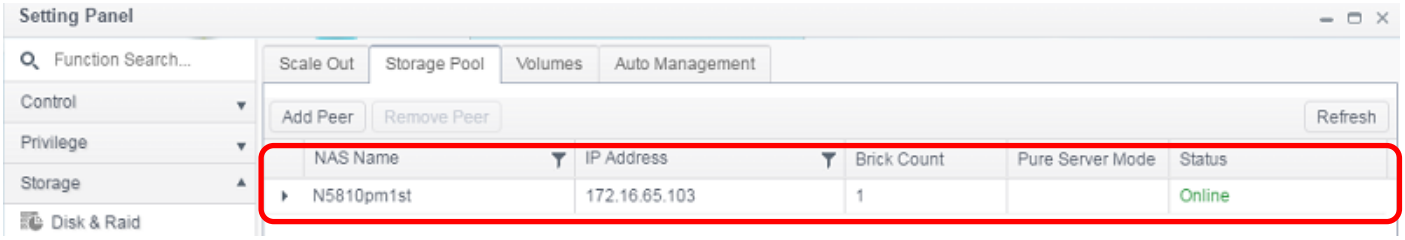
Once the Scale-Out function has been activated, more tabs will become available for further settings.



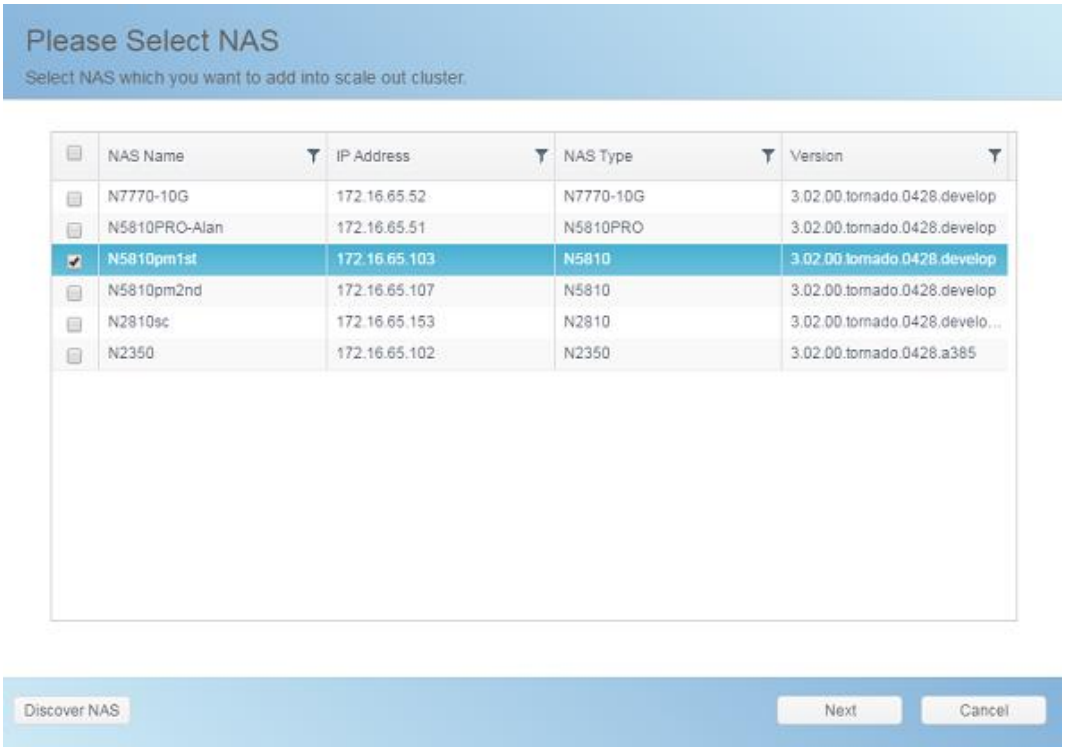
Storage Pool

“Storage Pool” is the tab that lists the available “Peers” for Scale-Out server members. The “Peers” can be seen as a single system. In the “Peer” information section, we can see that there is one

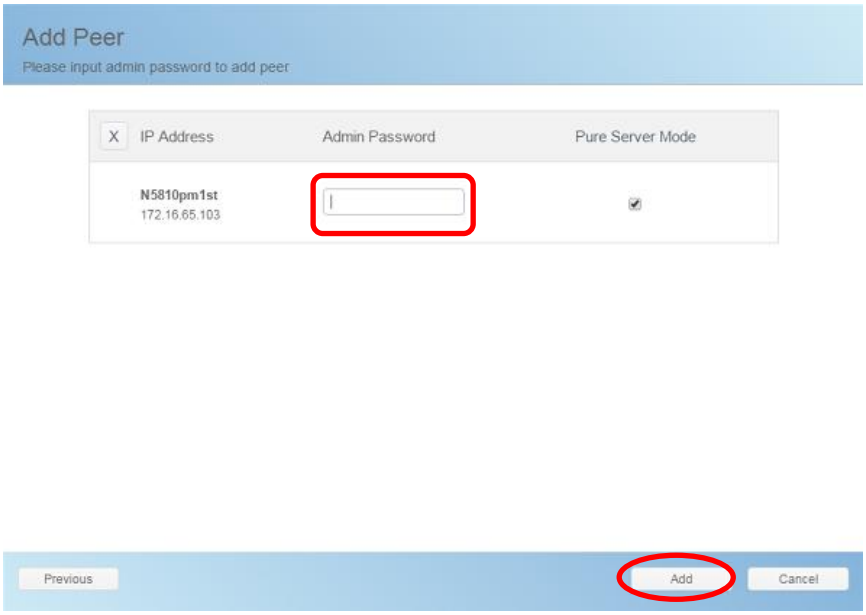
“Brick” available; the “Brick” can be seen as a “Volume” count of the associated system; this sample unit has 2 volumes created initially and Scale-Out has “Client-Server combo mode” selected. So the master RAID volume will keep as client mode to be used, and the other volume will become accessible to be used as a brick in Scale-Out. Look at the screenshot below for details



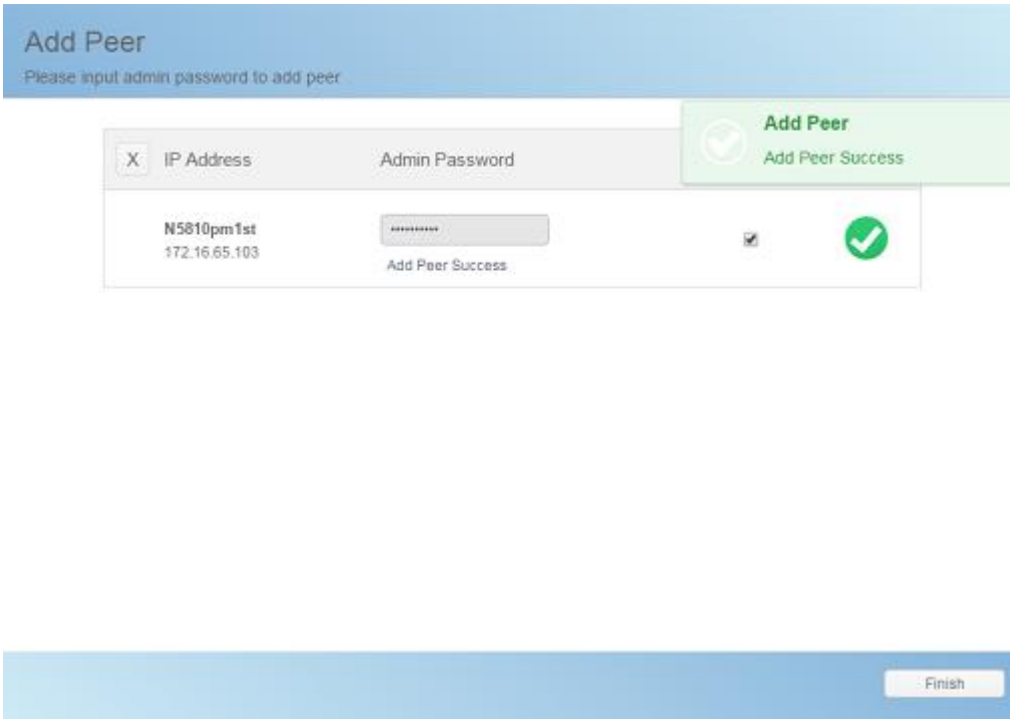
To add more “Bricks” from other systems, click on “Add Peer”, and the system will browse the local network and list all available “Peers” to choose from. See below for a sample list:



Let’s choose N5810pm1st, then click “Next”, the system will then require the admin’s password to gain permission to be added.

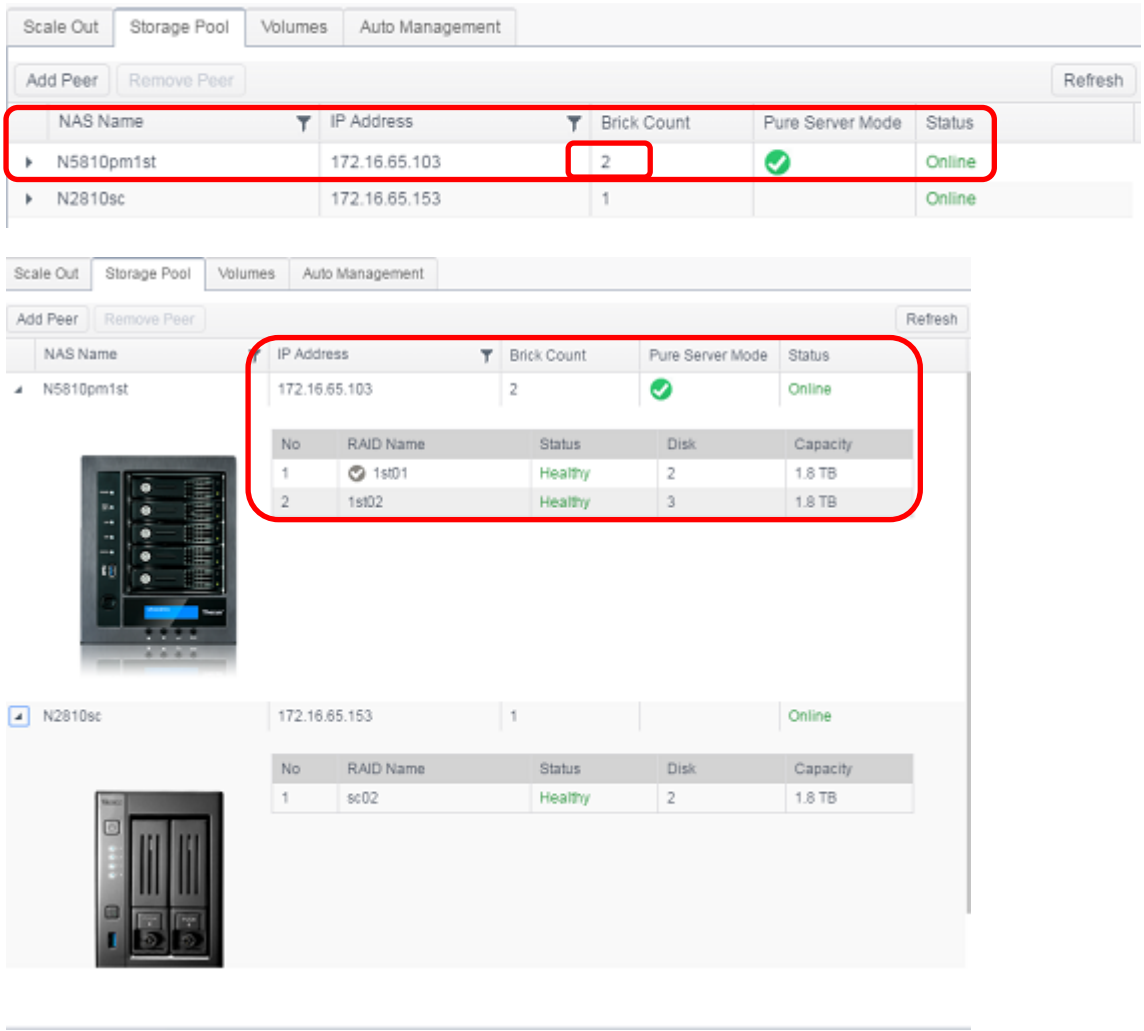


Input the admin's password of the associated system and then click the "Add" button.

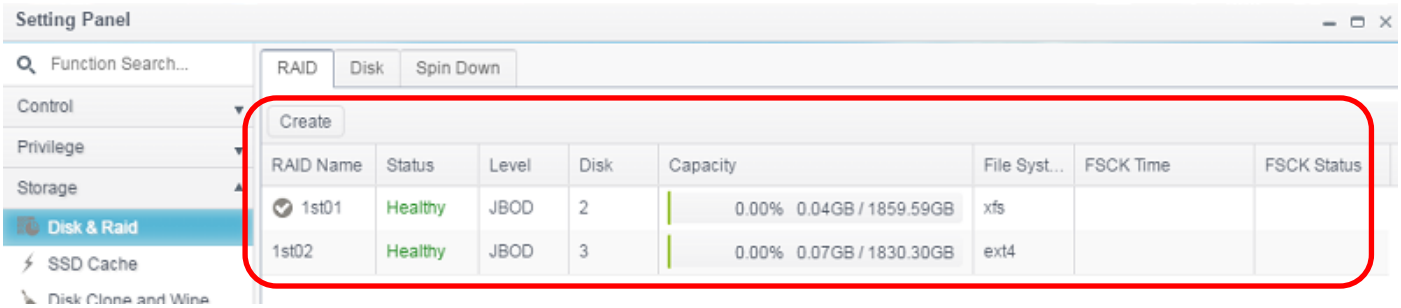


The system will start to communicate with the selected candidate and display a pop-up message once the operation has been completed. Since the system will need to enable the Scale Out role at the candidate's side, it may take a little while; therefore please be patient while the task is being completed.

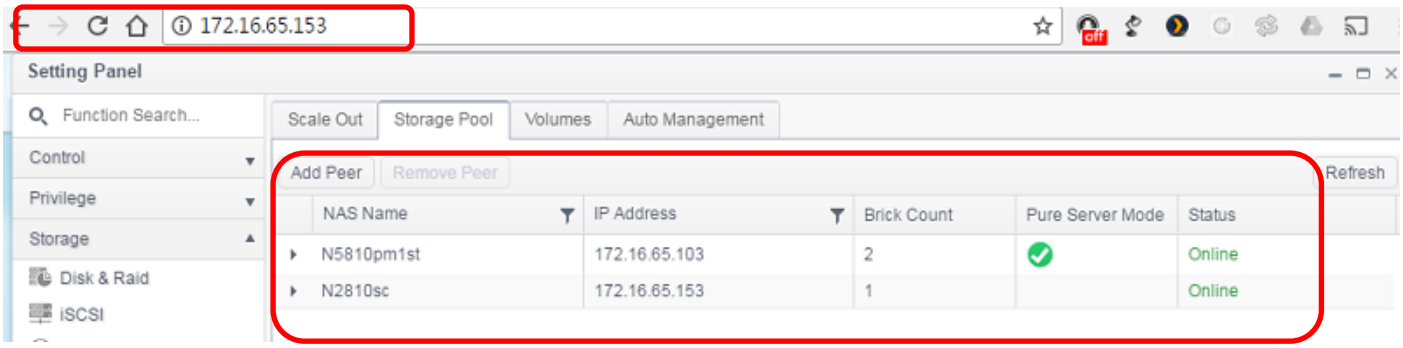
Now the storage pool will have a new Peer that will join two additional bricks (from N5810pm1st with "Pure Server mode enabled) to the storage pool. Please see below.

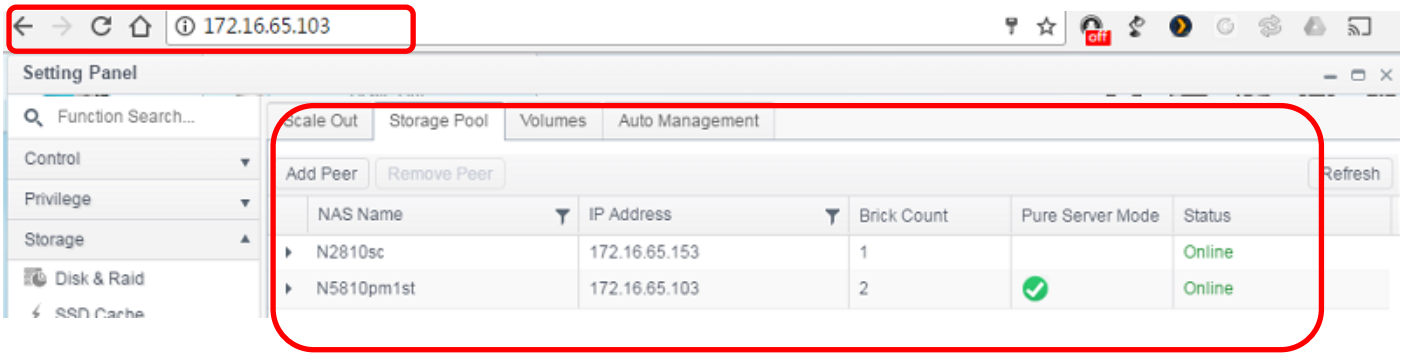


Let's check where these bricks have come from. Login to the just added NAS (http://172.16.65.103) (only in this example, your IP will differ) and check the RAID volumes and you will find that the volumes have joined the list of our Scale-Out bricks.



For the same Scale-Out server group, members will sync their settings periodically. As you can see, the first Scale-Out sample unit **N2810@172.16.65.153** and the joined peer **N5810pm1st@172.16.65.103** have the same "Storage Pool" lists.

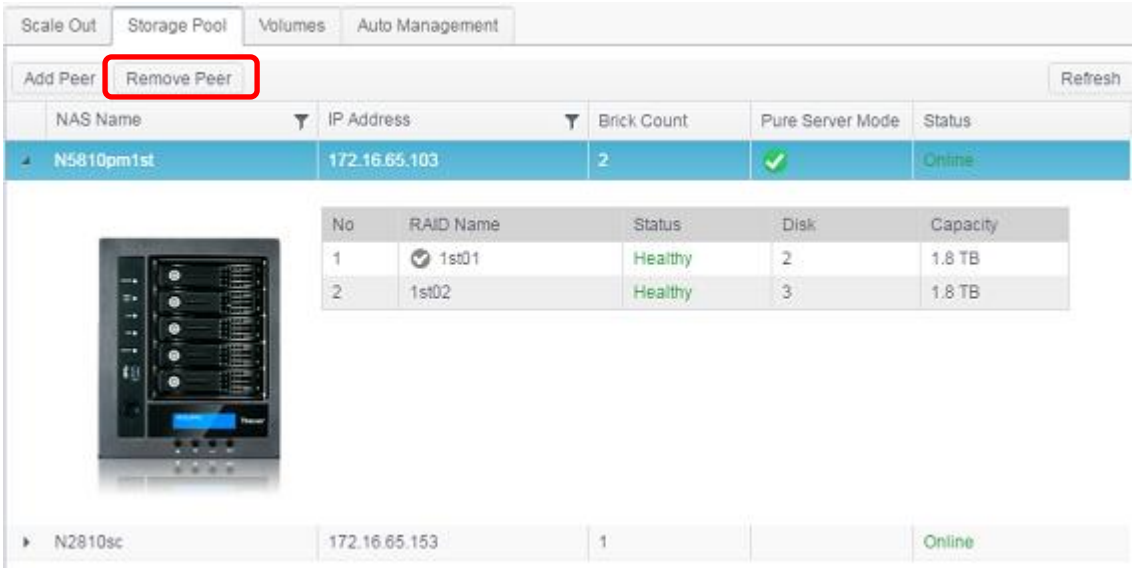




NOTE

The System will fail to add a Peer if:
1. The selected Peer is already being used in other scale out server group.
2. The input admin password is incorrect.
3. The selected system does not support scale out function.

To remove a “Peer” from the Scale-Out server group, select the associated “Peer” then click the “Remove Peer” button, then confirm.



NOTE

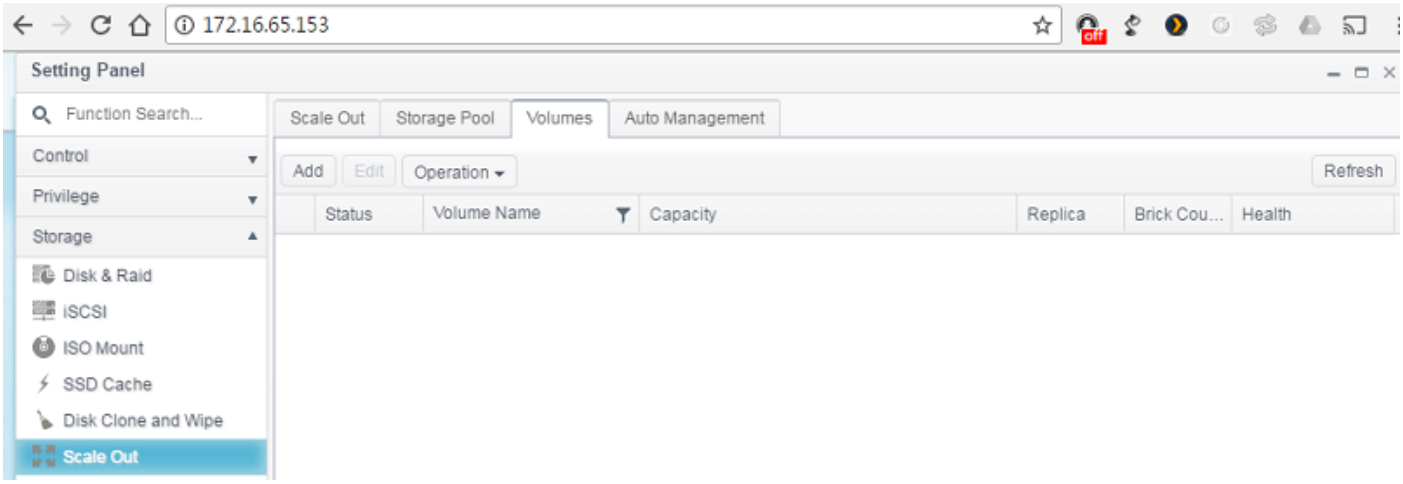
The Peer cannot be removed if it is at the localhost level.

Volumes

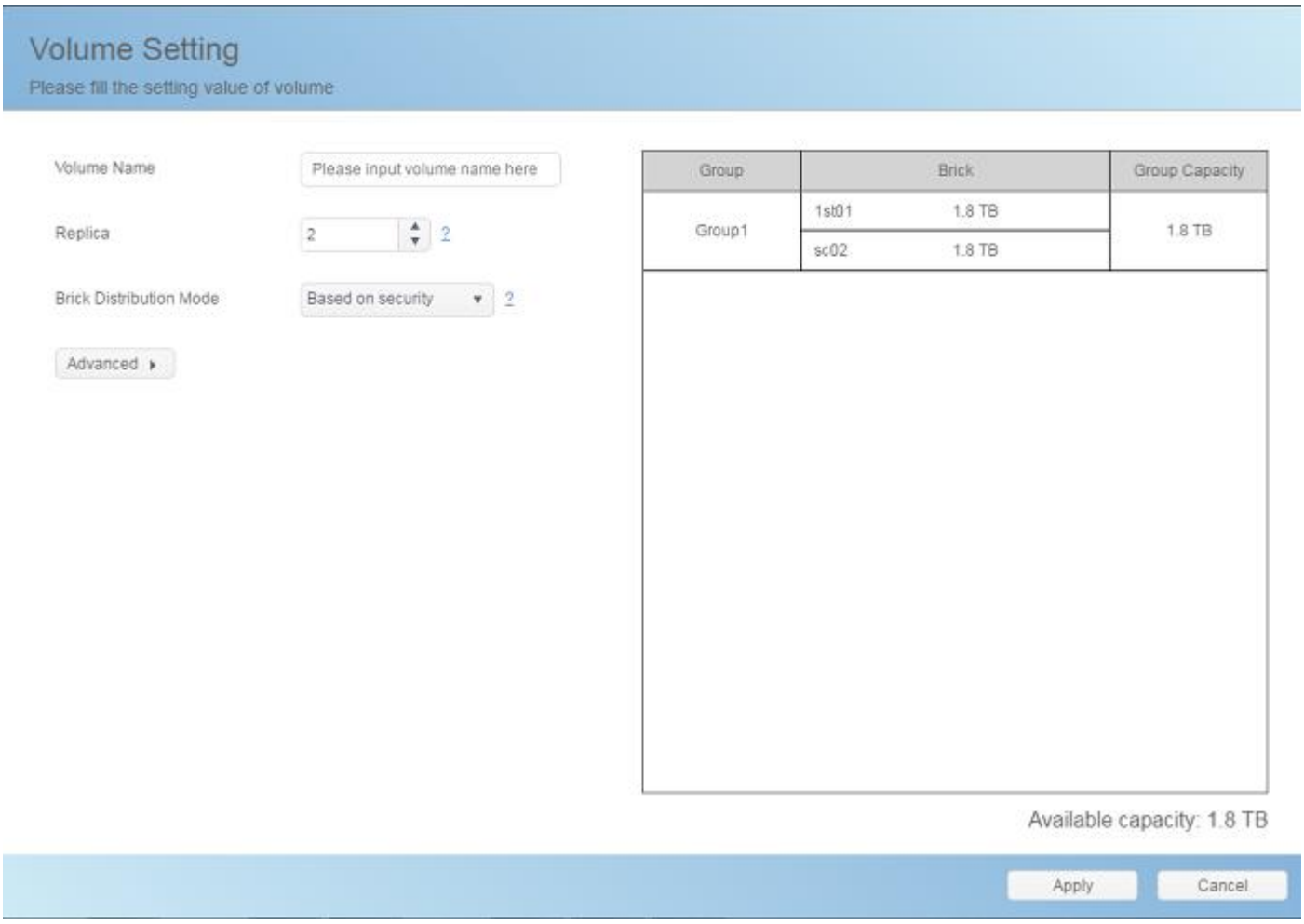
After the “Peer” and “Brick” setup has been completed, now we can create a “Scale-Out Volume” for Scale-Out client to connect with.

Add Scale-Out Volume:

The Scale-Out volume can be created in ANY Scale-Out server as long as it is in the same group. Let’s take our Scale-Out server with the IP http://172.16.65.153 (example) to create a first Scale-Out volume.



Click on “Add” and the “General Settings” screen will appear as below:

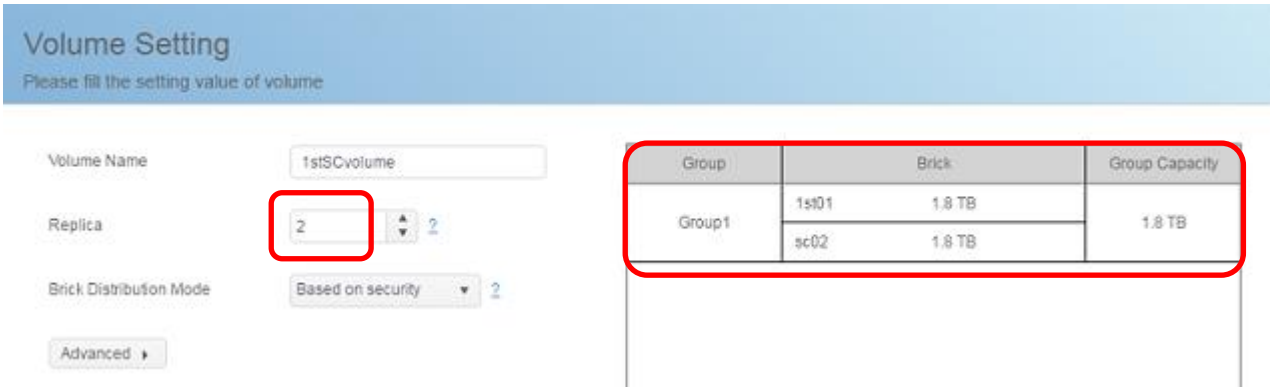


Steps:

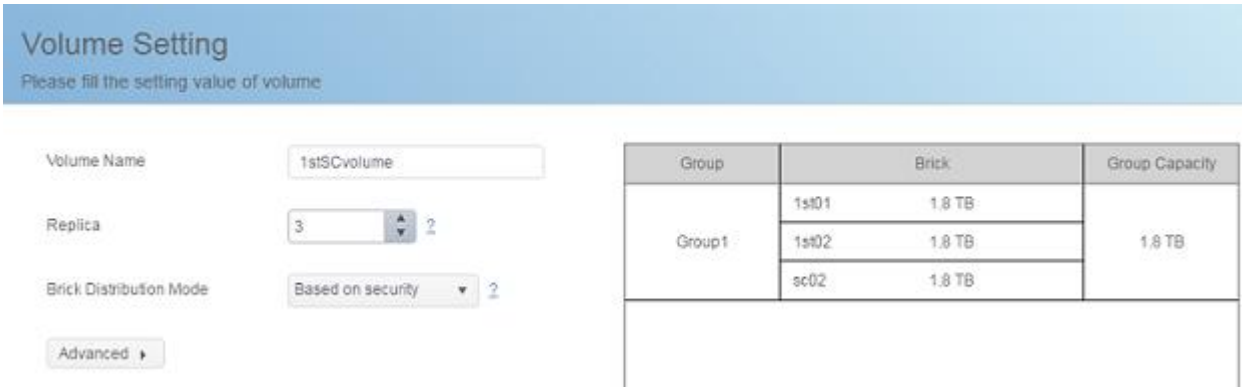
1. Input Volume Name: It is going to use this name to create the shared folder.

Let's take "1stSCvolume" input as an example.

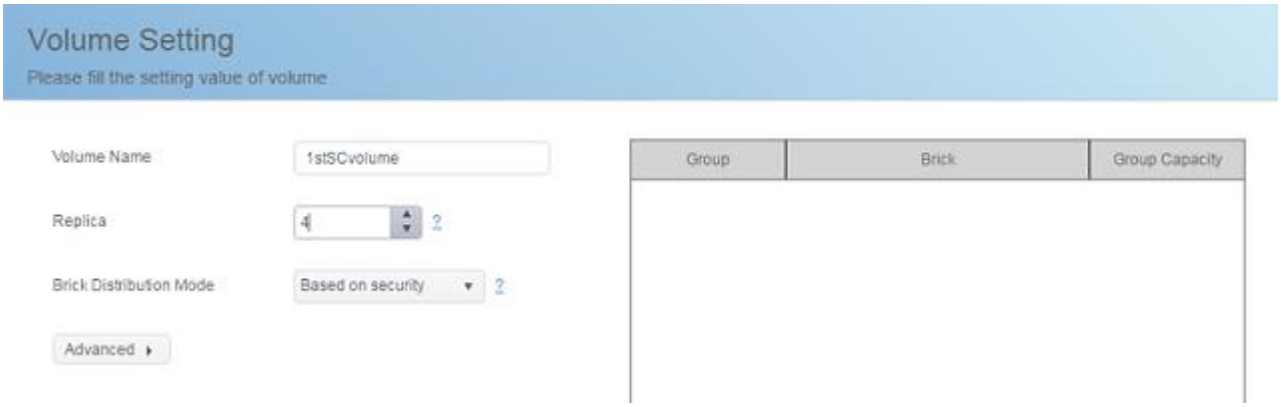
2. Replica: This is the setting for how many data copies that are going to be created per volume group. The default value is 2. So from this example, system will automatically allocate available bricks to meet the setting, so the count is 2 (N2810 x1 and N5810pm1st x1) and form Group1. If using the default value 3, then this volume will have 2 groups and each group having 3 data copies.



If set replica value 3, then this volume will have 3 data copies as system allocated bricks as shown below (N2810 x1 and N5810pm1st x2).



If set replica value 4, then the volume is unable to be created and no group will be listed.



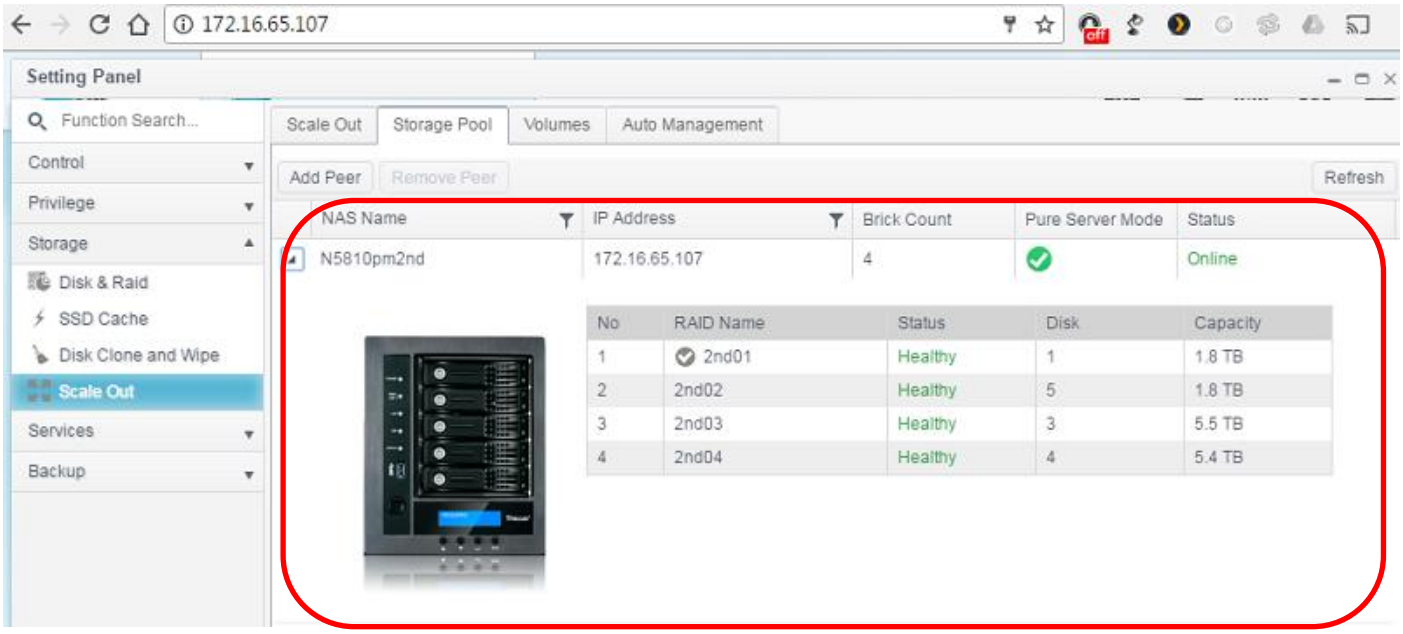
Please note, the total available bricks is 3 (N2810 x1 “Client-Server combo mode” and N5810pm1st x2 “Pure Server mode”). So to have replica value greater or equal 4 then added additional bricks are required.

NOTE

The example above features 3 available bricks but you could choose 2 or 3 replica values.
1. The available brick must be greater or equal than the replica or the volume won’t be created.
2. If setup two replicas and the available bricks are 4. The volume will have two groups. Data I/O will be read/written to this volume of two groups at the same time with two data copies.

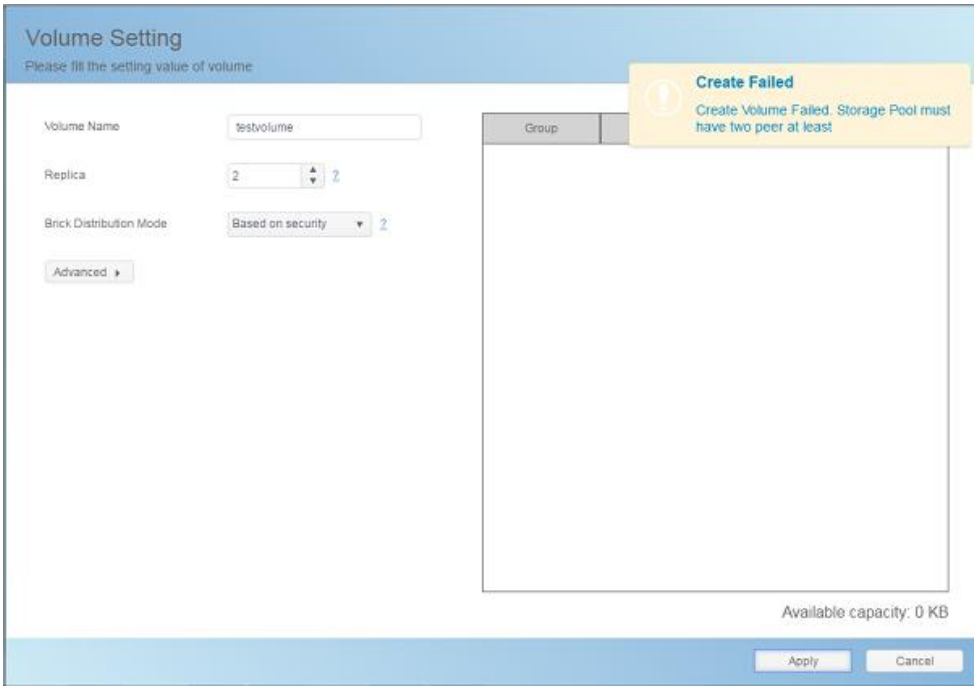
3. Brick distribution mode: There are 2 modes can chose, “Based on Security” and “Based on Capacity”.

Let’s take independent Scale-Out Server N5810pm2nd with 4 bricks to execute to show the behavior while applied in two different modes. This Scale-Out server has IP: 172.16.65.107 and 4 bricks available.



Based on Security mode: By choosing this mode, the system will require the available bricks to be from separate units. On the other hand, to choose this mode, it has to have 2 systems to meet the requirement or system will prompt an error message.

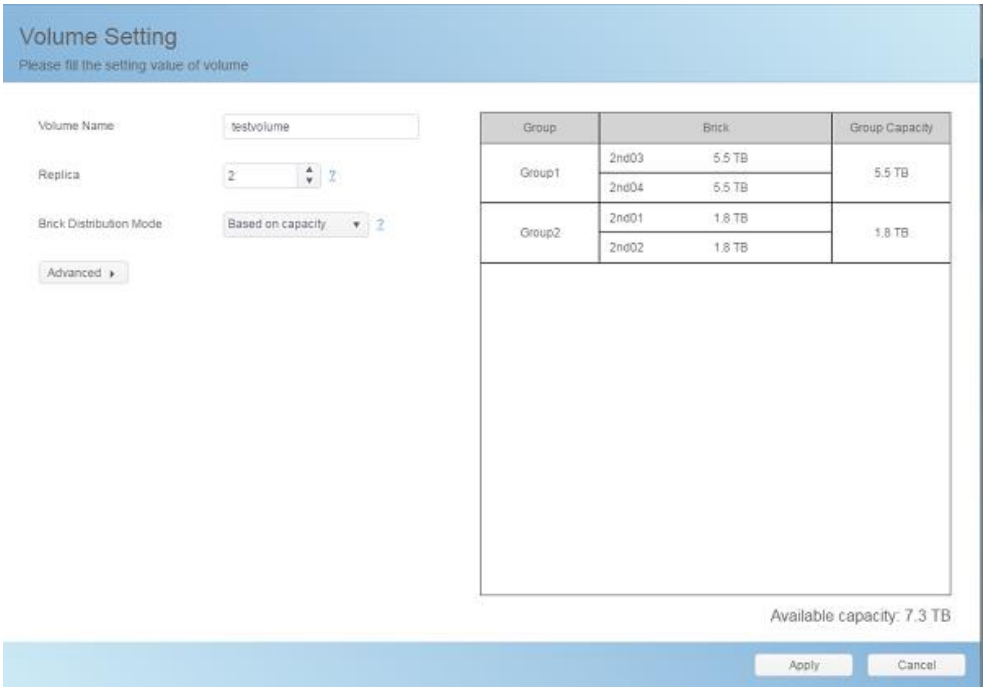
Below there is a screenshot to illustrate it did not have available brick to create Scale-Out volume in “Secure mode” and error message prompted.



Based on Capacity mode: By Choosing this mode, the system will allocate the maximum capacity from the available bricks to create Scale-Out volume. In this scenario it is unnecessary for the available bricks to be from separate systems but it could risky if system failure occurred.

An example of a system that is based on “Capacity mode” is shown below.

To create Scale-Out volume in 7.3TB with 2 groups.



NOTE

Once the Scale-Out volume mode has set, it can’t change or it needs to reset Scale-Out and re-initialize. .

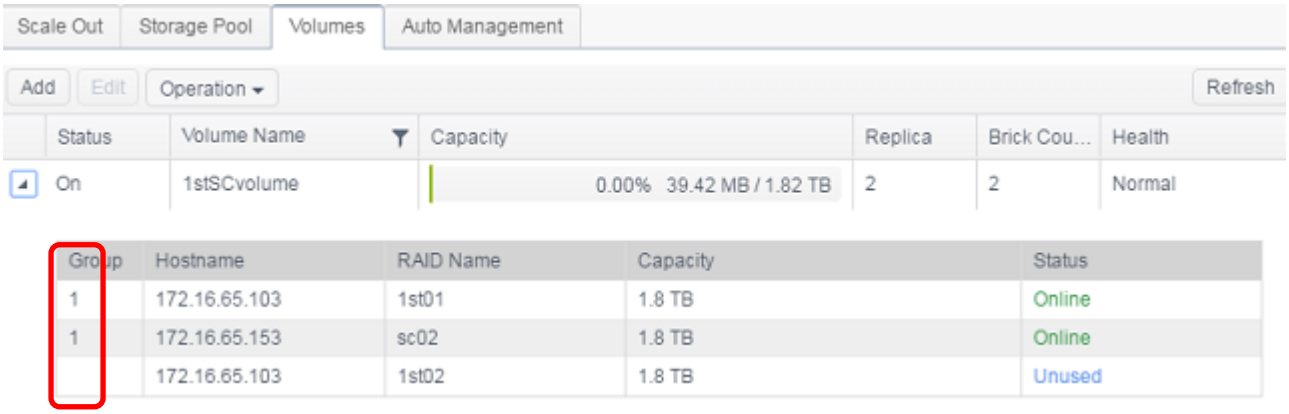
Click on Advanced, there are three more setting can be setup. In normal circumstance, it has no need to change and leave as default value.

4. Cache size: Size of the read cache, default value is 32MB.

5. Write Behind Cache Size: Size of the write-behind buffer Default value is 1MB.

6. IO (Input/Output) Thread Count: Number of threads in IO threads translates which are concurrently performed at a given time, default value is 16.

Click on ”Apply” button to confirm the settings, then you will have your first Scale-Out volume created, please look at the screenshot below.



This volume has 1 group and each group contains two data copies.

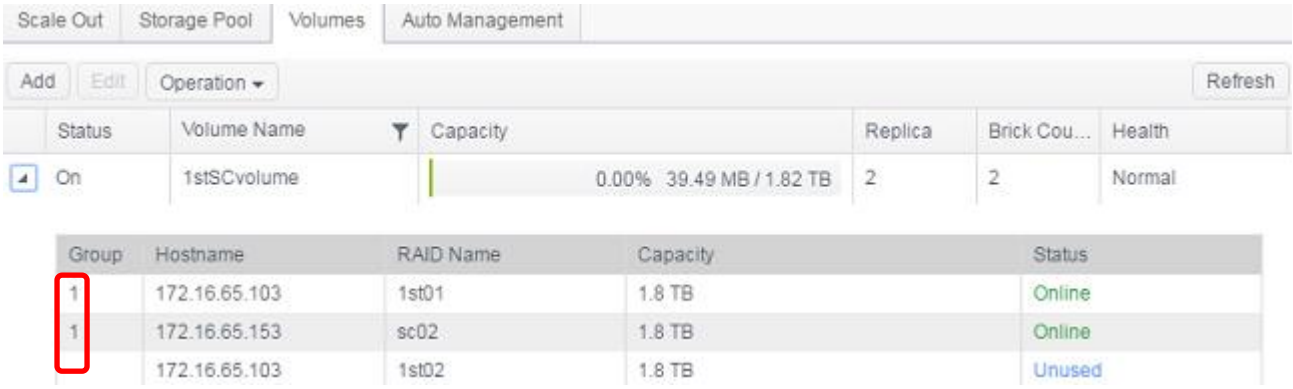
NOTE

The system will allocate bricks to volume groups automatically. This cannot be assigned manually.

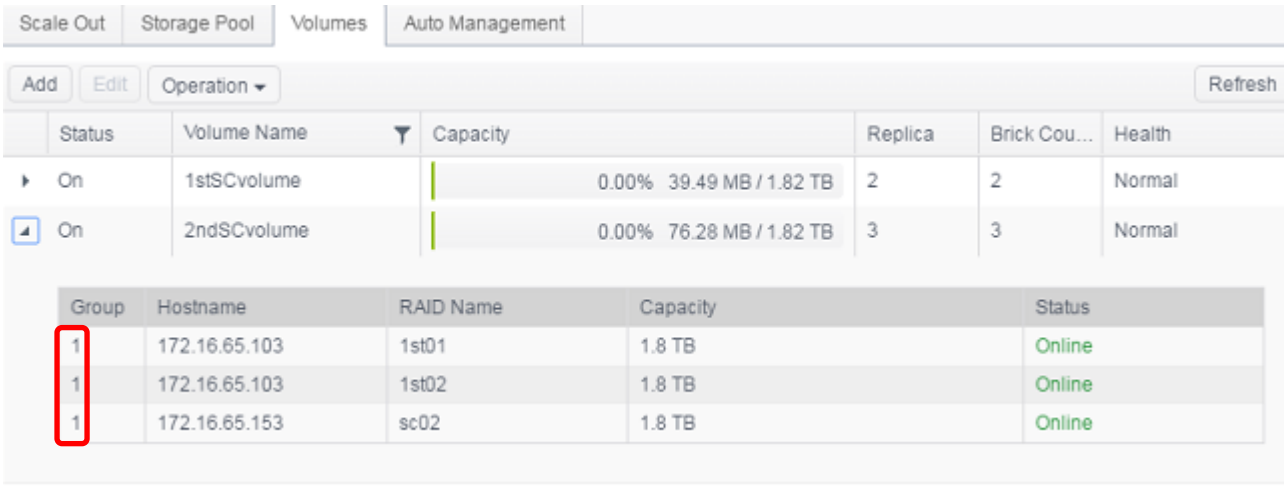
The Scale-Out volume capacity is optimized through thin-provisioning. Users can create as many Scale-Out volumes as needed.

Let’s create the 2nd Scale-Out volume with the name “2ndSCvolume” at replica level 3. Same steps as above have been taken as can be seen below.

First Scale-Out volume “1stSCvolume” in one group, two data copies.



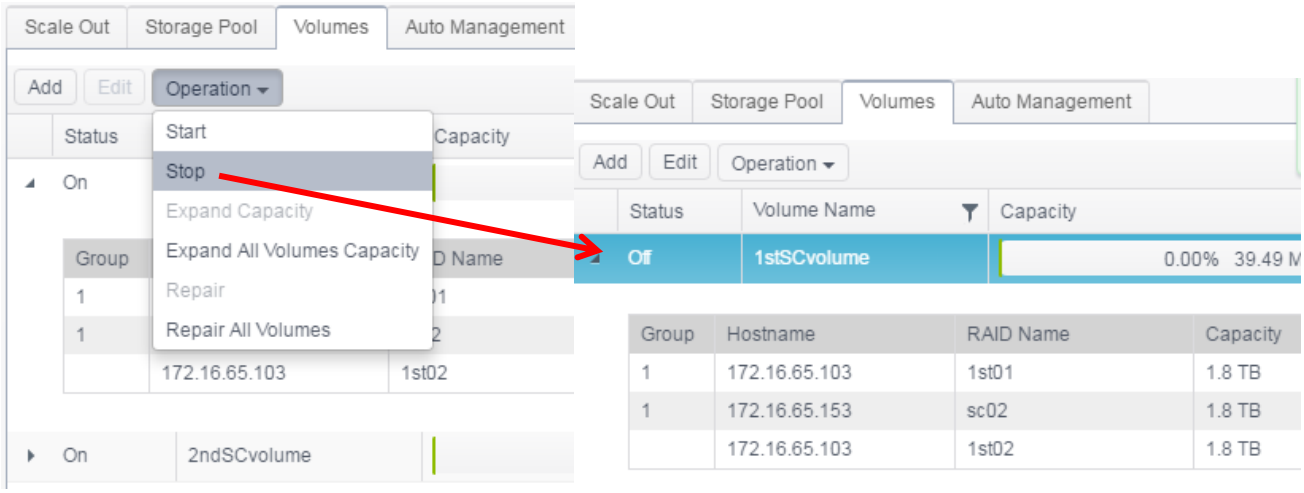
Second Scale-Out volume “2ndSCvolume” in one group, three data copies.



Volume Operation

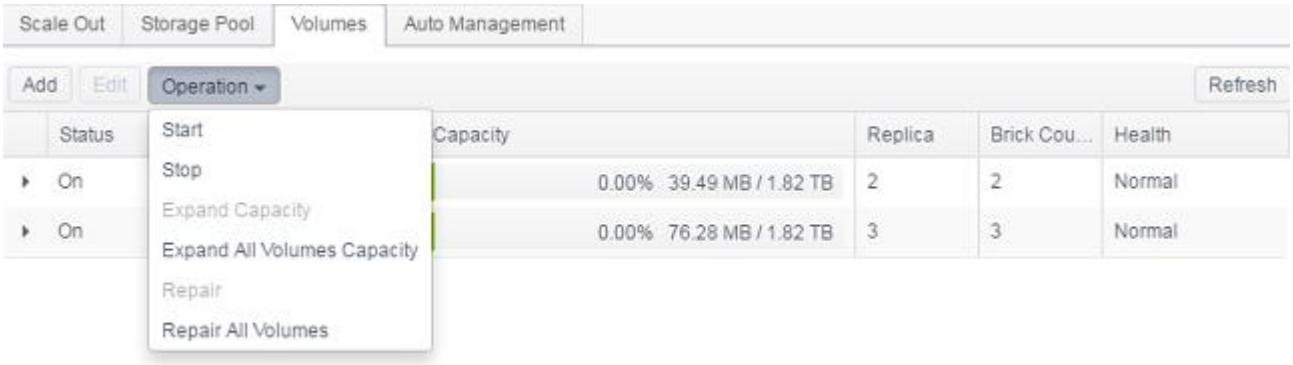
Volume Start and Stop:

The created Scale-Out volume can be stopped or started again by selecting it from the available list then clicking on the “Operation” button from sub menu bar. To stop a Scale-Out volume can be achieved by simply clicking on the “Stop” button. Once confirmed, the Scale-Out volume status will change its status to “Off” and will be inaccessible from the Scale-Out client. Vice versa, the Scale-Out volume can be started again by clicking on the “Start” button and the status will change to “On”.



Volume Expansion:

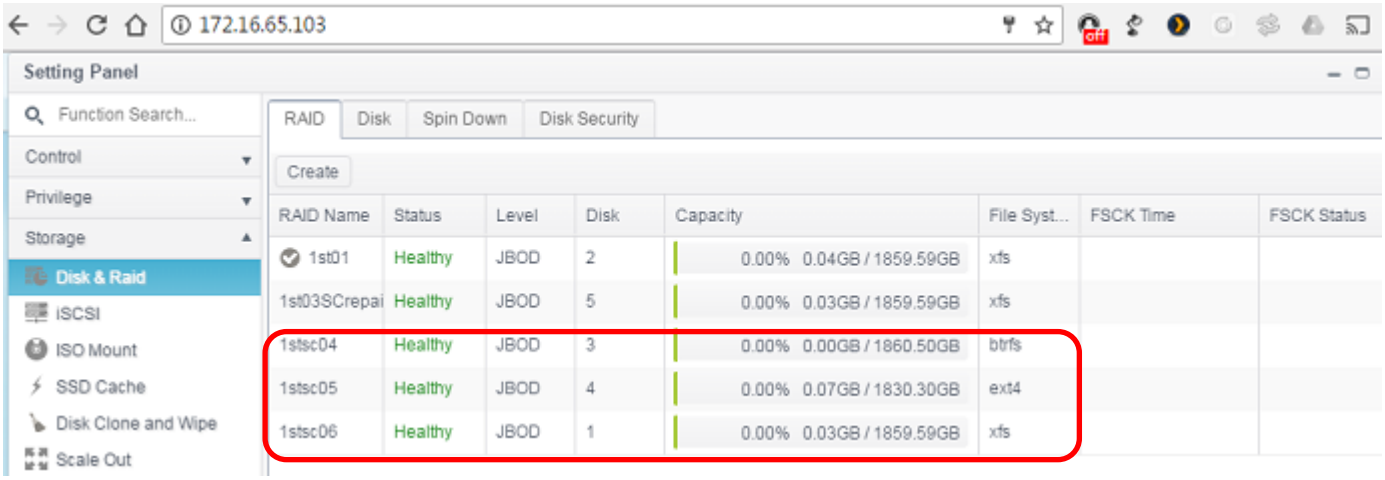
The great thing about Scale-Out is the capability of dynamic expansion. From sub menu tab click on “Operation” and it will show options dedicated to global capacity expansion and repairing.



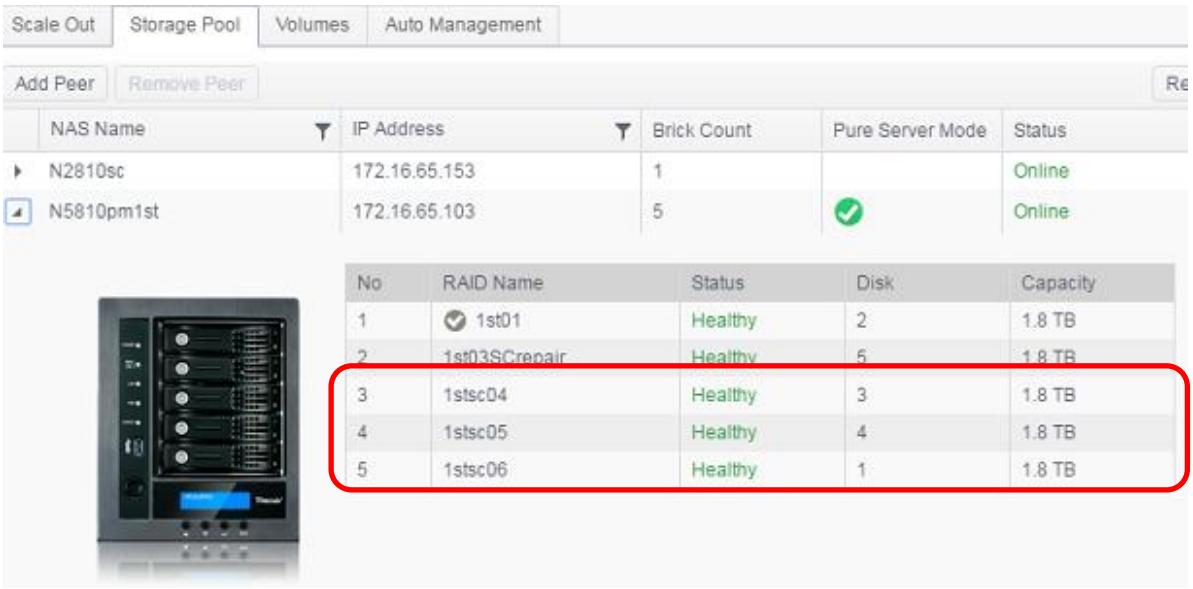
If the expansion is performed for a particular volume, select the associated volume and click on “Expand Capacity”, then the system will auto check available bricks and proceed with the volume expansion. If it is required, expand capacity for all volumes by choosing “Expand All Volume Capacity”.

Let’s create additional 3 RAID volumes from Scale-Out server N5810pm1st (172.16.65.103) and execute capacity expansion.

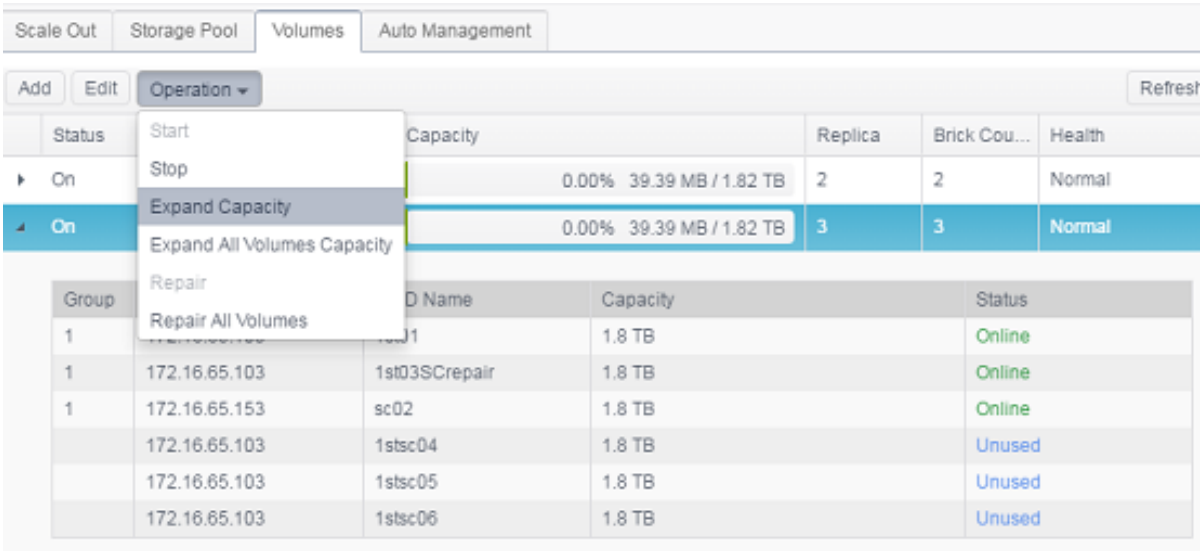
Additional 3 RAID volume has been created as shown in the red circle below:



Bricks for Scale-Out server N5810pm1st has become 5 numbers from the original 2.

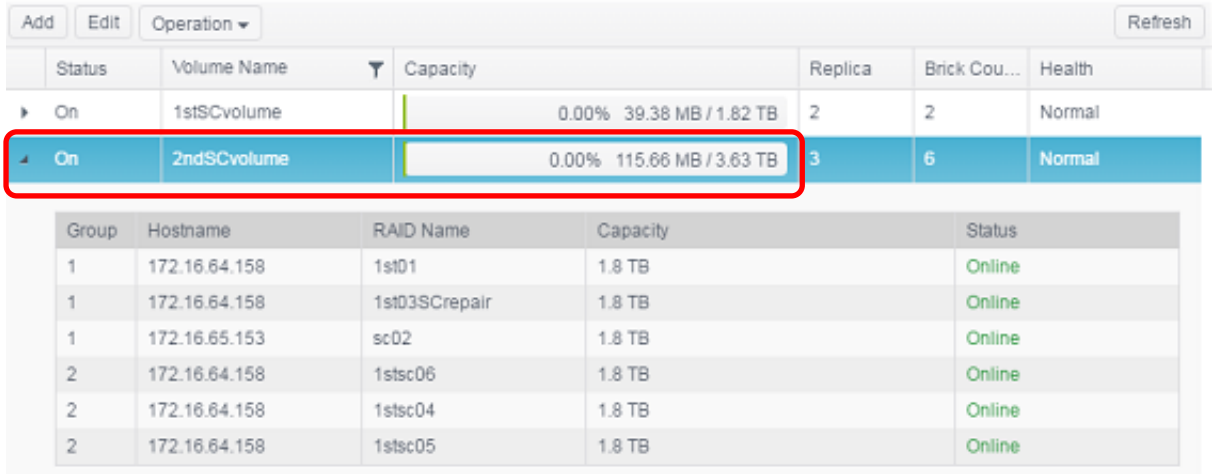


Select 2ndSCvolume and choose “Expand Capacity” from Operation dropdown list.



System will check available bricks and the Scale-Out mode. In this case, system has found 3 unused bricks and “Based Capacity mode” for this Scale-Out volume. It is now giving capacity expansion of an additional 1.8TB as shown below in green part.

After clicking on “Apply”, the capacity will be expanded from 1.8T -> 3.6T.



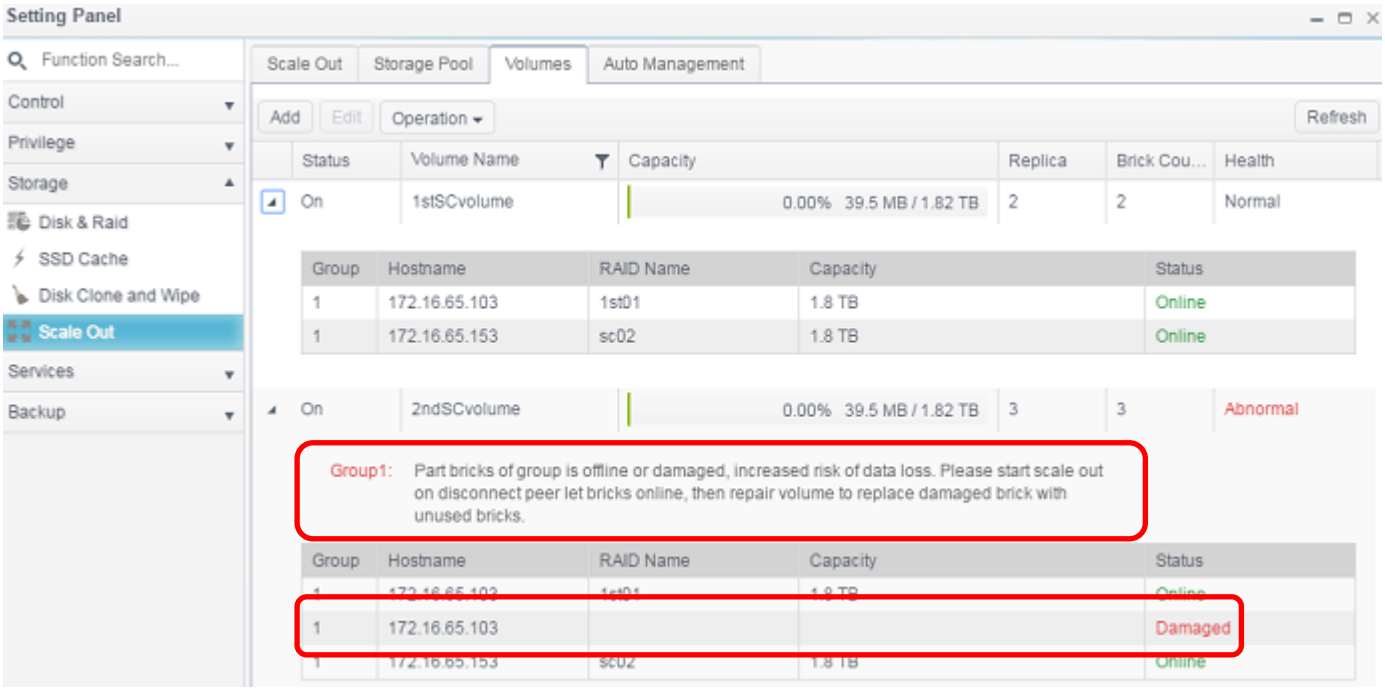
HINT

This expansion case is only applied to 2ndSCvolume because all available unused bricks are coming from one unit. And 1stSCvolume has volume mode “Based on Security mode” which required brick from different system.

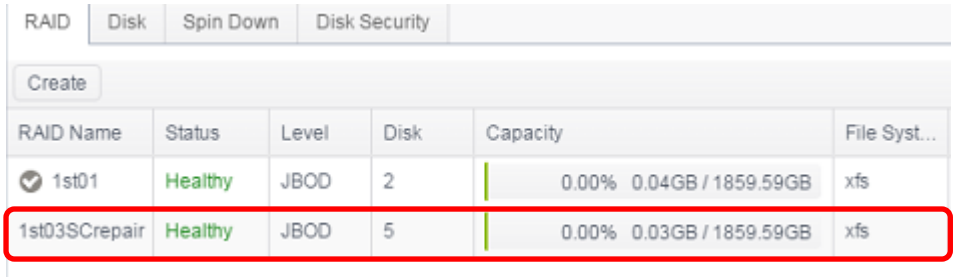
Volume Repair:

Other than using available bricks to expand volume capacity, it can be used to repair damage in the bricks. Following the same scenario as above, the user can select a particular one or all volumes to repair.

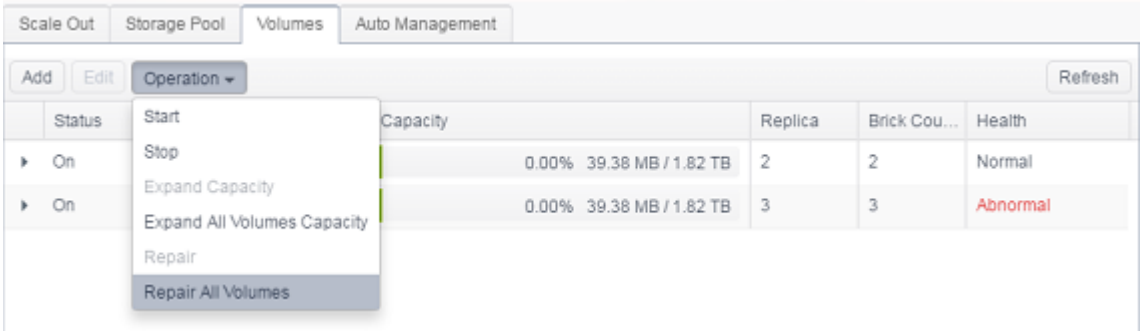
In the example below, one bricks is damaged on Peer 172.16.65.103 and the system has detected the issue, the volume status will show that the Scale-Out volume is ”Abnormal” and also lists the damaged brick.



Let’s repair the brick by replacing it with a new one. To do this, we have created a new volume named“1st03SCrepair” from Scale-Out server N5810pm1st.



The next step is to go to the Scale-Out volume setting page and choose “Repair All Volumes Capacity”.

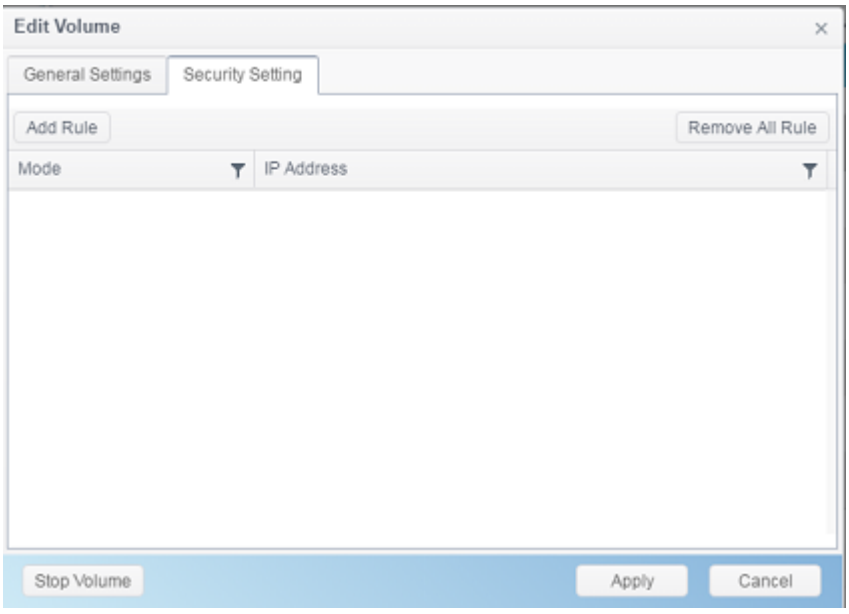


Now the volume has been repaired and is back to a healthy status.

Scale-Out Volume Editing:

The created Scale-Out volume can be edited by selecting it from the available list then clicking on the “Edit” button. The Scale-Out volume can be changed through some advanced setting pertaining to cache size, Write Behind Cache Size and IO Thread.

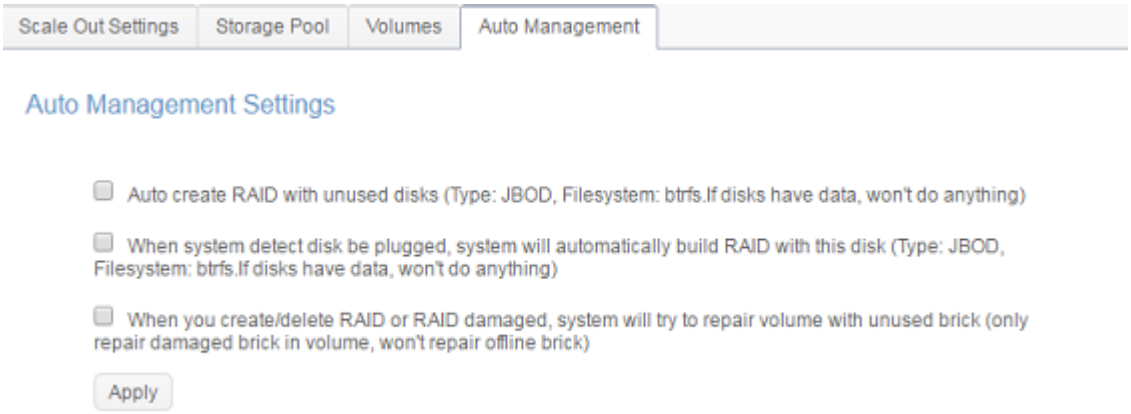
Rules to accept or reject connections can also be specified for the Scale-Out volume. Click on “Security Setting” and the screen below will appear.



Click on “Add Rule” to add a new connection definition or “Remove All Rules” to clear the list.

Auto Management

Scale-Out can be empowered to work smartly by enabling “Auto Management”. There are 3 different settings that can be enabled.

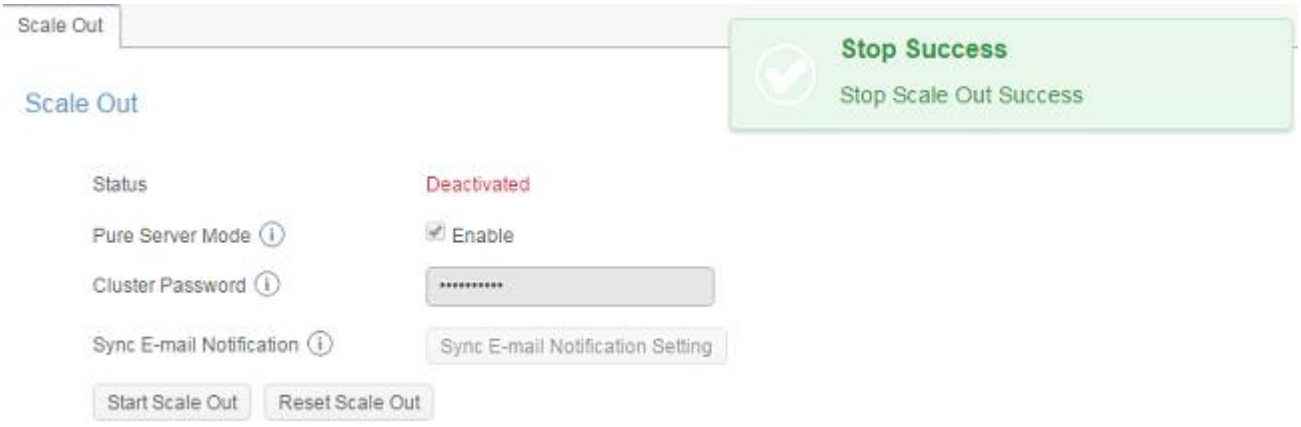


1. If scenario one is enabled, the system is cold booted with a disk installed (clean), then the RAID volume will be created automatically by default and this RAID volume will become an unused brick.
2. If the 2nd scenario is enabled, a disk is plugged in (hot plug-in, disk clean), then the system will create a RAID volume automatically and this RAID volume will become unused brick.
3. If any brick from volume group is damaged, the system will use unused bricks to repair it.

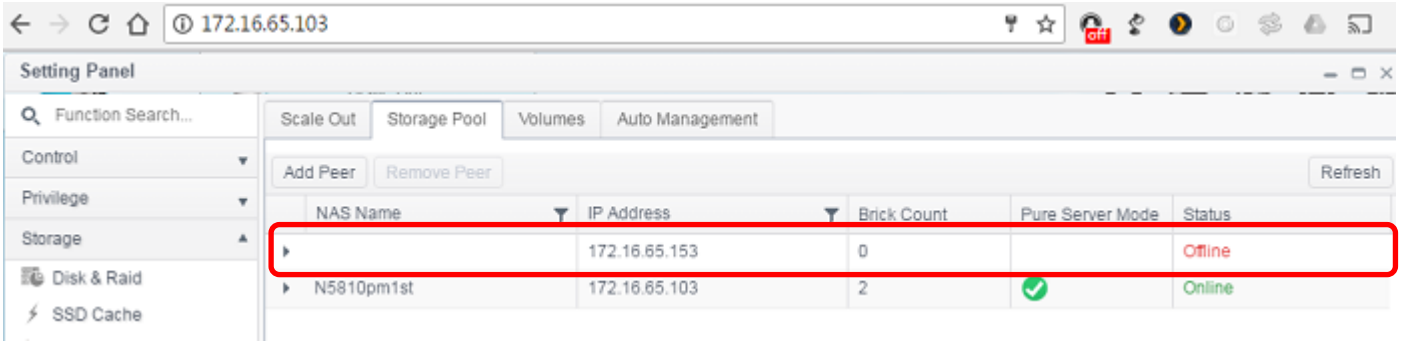
Stop Scale-Out

In any case, if the Scale-Out server needs to stop, click on the “Stop Scale-Out” button. The status for the Scale-Out server will change to “Offline”.

Example for stopping Scale-Out server on system IP 172.16.65.153:



If you now check on any member of the associated Scale-Out server group ex. 172.16.65.103 the status of the system IP 172.16.65.153 will be shown as “Offline”.

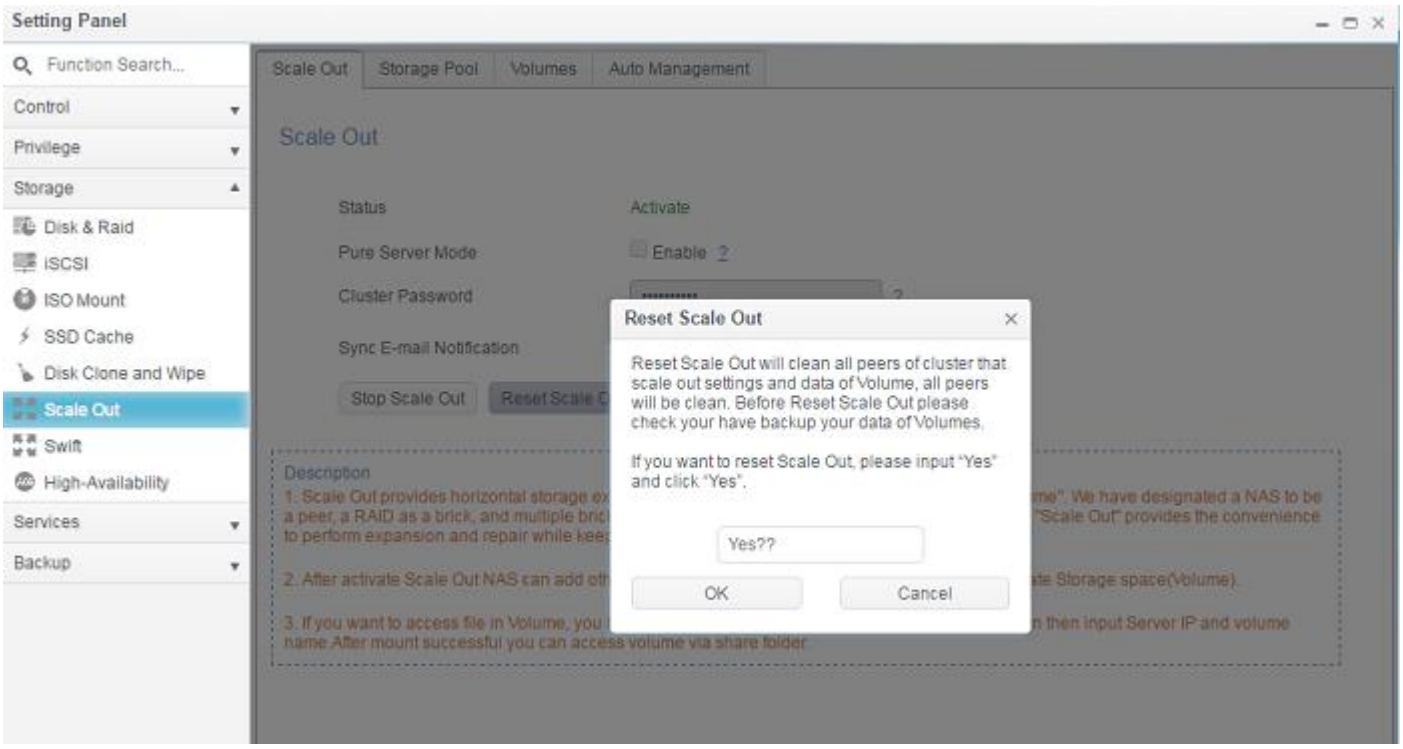


Stopping the Scale-Out server won’t affect any data existing in the Scale-Out server volumes. By Restart the Scale-Out server to put this Scale-Out member back to online status.

Reset Scale-Out

If the Scale-Out server needs to be removed from the Scale-Out group, click on “Reset Scale-Out” to apply.

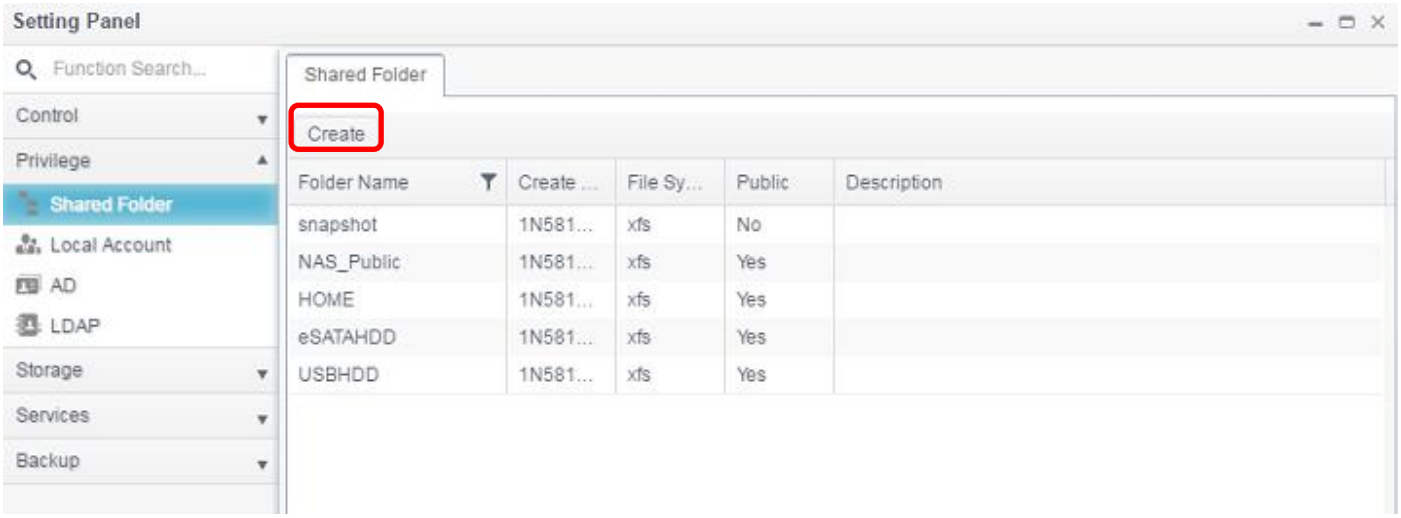
WARNING: Once it has been confirmed, all data inside the Scale-Out volumes will be destroyed completely and there is no way to get it back.



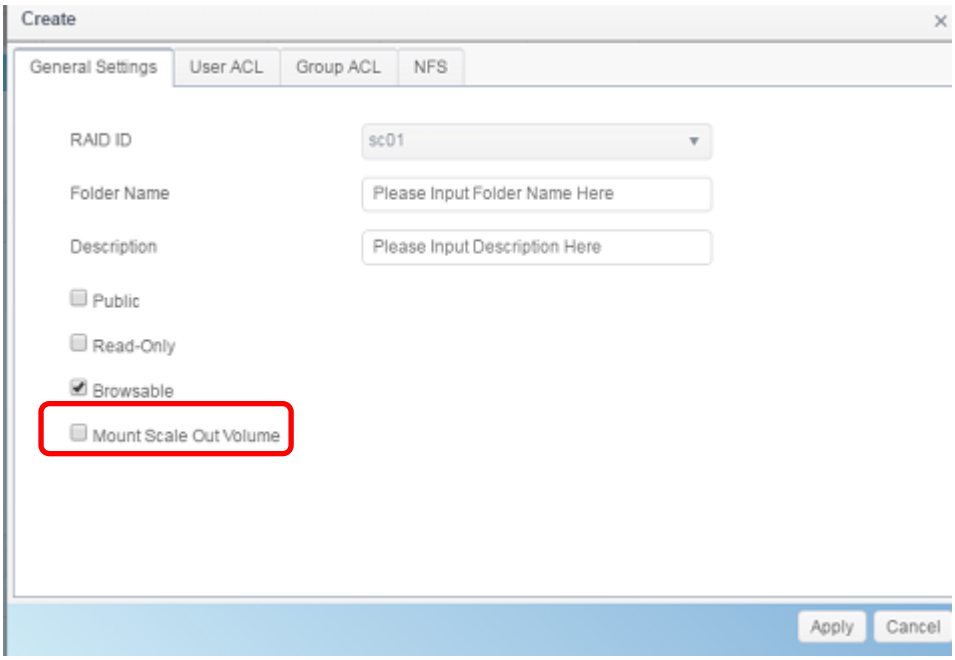
Create Scale-Out Shared Folder

After the Scale-Out server group setup has been completed, the Scale-Out volume will be ready to use. Next, we will go through how a Scale-Out client can connect to a Scale-Out volume.

Let's take an N2810 with the IP http://172.16.65.153 in Scale-Out client mode. The system has been created with Scale-Out "Client-Server combo mode", so it can be used as client role to access Scale-Out volume.
To connect with the Scale-Out volume, please go to "Share Folder" under "Privilege" in the Setting Panel.

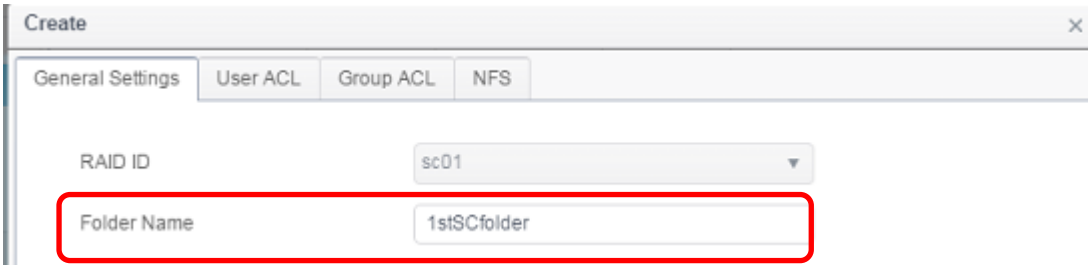


Click on "Create" and the screen will appear as below.



Steps:

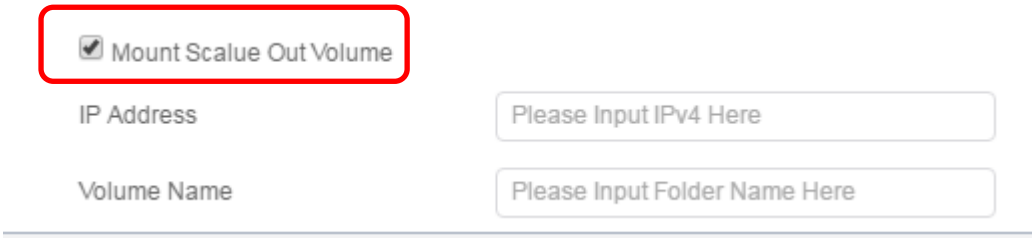
1. Folder name: To be seen on file protocol level access, let's choose "1stSCfolder" as a folder name.



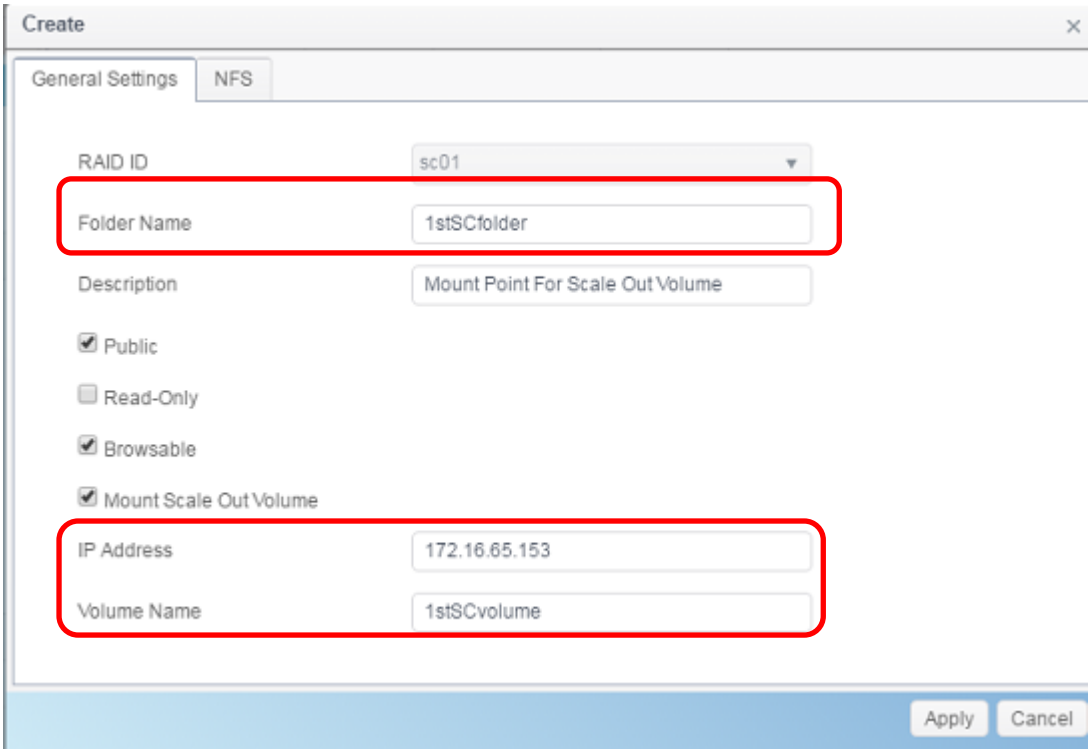
2. Description: Fill in if needed.

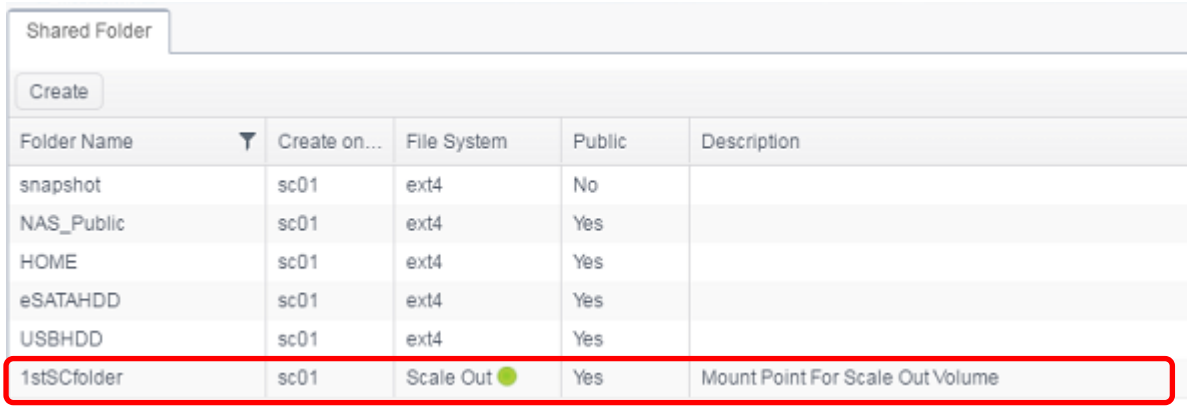
3. Public/Read-Only/Browseable: enable/disable as needed.

4. Mount Scale-Out Volume: **Enable** this one and input the Scale-Out Volume IP address and Volume Name.

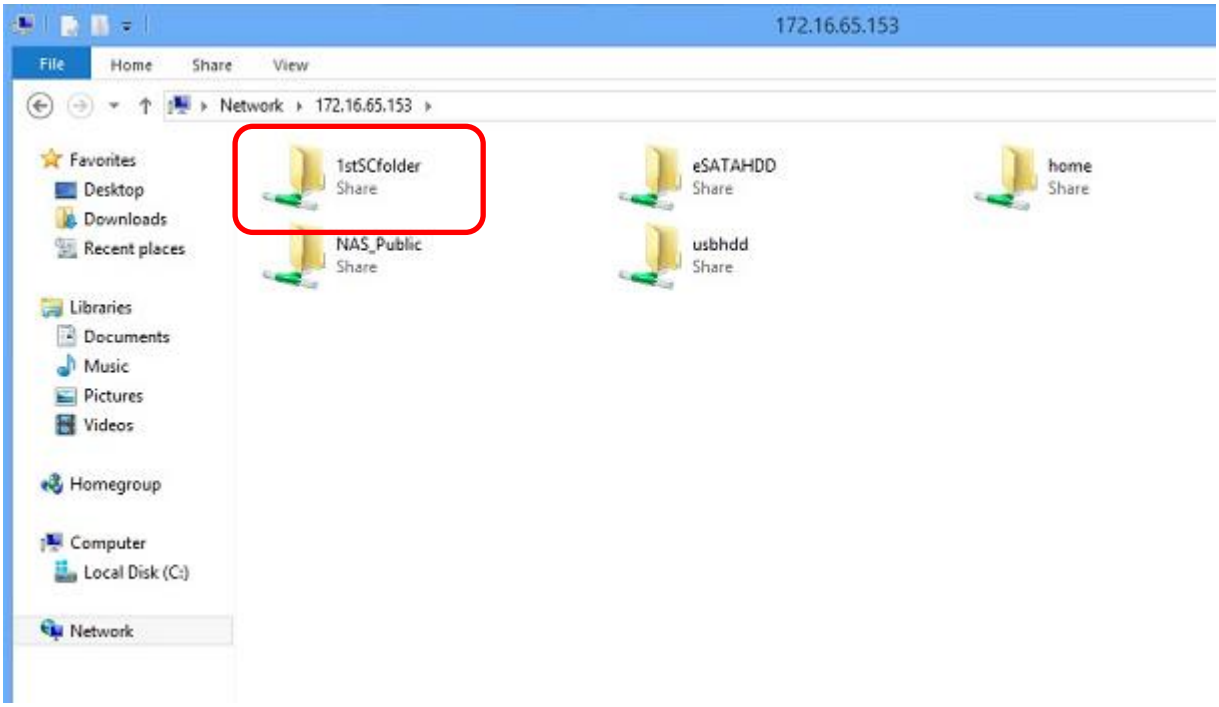


The IP address can be that of any Scale-Out server member, we have 172.16.65.153 and 172. 16.65.103. The volume names are those we have created earlier; they are "1stSCvolume" and "2ndSCvolume". Let's fill in 172.16.65.153 and "1stSCvolume" then click Apply





Now in the shared folder list,"1stSCfolder" has been added. It can be used just like a standard shared folder. Let's connect via Windows and we will see that "1stSCfolder" is there; please refer to the screenshot below. Surely you could use the same steps to create more Scale-Out folders, even using the same storage resources.



Support

If you have questions, encounter technical difficulties or need assistance with your NAS or setting up Scale-Out, please contact Thecus technical support under: http://www.thecus.com/sp_tech.php