

NAS 251

Introduction to RAID

Set up a storage volume
with RAID

ASUSTOR COLLEGE

COURSE OBJECTIVES

Upon completion of this course you should be able to:

1. Have a basic understanding of RAID and its different configurations
2. Be able to set up a new storage volume with RAID

PREREQUISITES

Course Prerequisites:

None

Students are expected to have a working knowledge of:

N/A

OUTLINE

1. Introduction to RAID

1.1 What is RAID?

1.2 The different RAID levels

2. Configuring your NAS

2.1 Creating a new RAID volume

1. Introduction to RAID

1.1 What is RAID?

RAID is a storage technology used to organize the data in your storage space (or storage volumes). RAID is short for redundant array of independent disks. It balances data protection, system performance, and storage space by determining how the storage system distributes data. Many different ways of distributing data have been standardized into various RAID levels. Each RAID level offers a tradeoff between data protection, system performance, and storage space. For example, one RAID level might improve data protection but reduce storage space. Another RAID level might increase storage space but also reduce system performance.

Striping

RAID is able to offer increased performance by using a data storage technique called striping. Data striping organizes the data on your hard disks in a way that allows for faster data access.

Mirroring

RAID offers increased data protection by using a data storage technique called mirroring. In mirroring, the data on your hard disks is replicated thereby producing data redundancy across your storage volume. This ensures greater protection for your data.

1.2 The different RAID levels

Below is a list of the different RAID levels that you can use with your ASUSTOR NAS.

Single: Only uses a single disk in the creation of storage space. This configuration does not offer any type of data protection.

JBOD: Uses a combination of two or more disks to create storage space. The total storage capacity is the capacities of all the disks added together. The advantage of this configuration is that it allows you to use different sized disks together and provides a large amount of storage space. The downside is that it does not offer any sort of data protection and has an access efficiency lower than RAID 0.

RAID 0: Uses a combination of two or more disks to create storage space. The total storage capacity is the capacities of all the disks added together. The advantage of this configuration is that it allows you to use different sized disks together and provides a large amount of storage space. The downside is that it does not offer any sort of data protection.

RAID 1: In RAID 1 your data is written identically on two disks, thereby producing a “mirrored set”. Exactly the same data is stored on the two disks at all times. RAID 1 protects your data from loss should one of your disks fail. RAID 1’s advantage is that it offers protection for your data by providing data redundancy. The downside of this configuration is that when combining two disks of differing sizes, the total storage space will be equal to the size of the smaller disk. Therefore, you will be unable to use a portion of the larger disk.

Total available storage space = (size of smaller disk) * (1)

RAID 5: Combines three or more disks to create a storage space that is able to support one failed disk. Should one of your disks fail, your data will still be protected from loss. In the event of disk failure, simply replace the failed disk with a new one. The new disk will automatically be accommodated into the RAID 5 configuration. The advantage of using RAID 5 is that it provides data protection through data redundancy. The downside to using RAID 5 is that when combining disks of differing sizes, the total storage space will be calculated based on the size of the smallest disk.

Total available storage space = (size of smallest disk) * (total number of disks – 1)

RAID 6: Combines four or more disks to create a storage space that is able to support two failed disks. Should two of your disks fail, your data will still be protected from loss. In the event of disk failure, simply replace the failed disks with new ones. The new disks will automatically be accommodated into the RAID 6 configuration. The advantage of using RAID 6 is that it is able to provide superior data protection through data redundancy. The downside to using RAID 6 is that when combining disks of differing sizes, the total storage space will be calculated based on the size of the smallest disk.

Total available storage space = (size of smallest disk) * (total number of disks – 2)

RAID 10 (1+0): Combines four or more disk to create a storage space that is able to support multiple failed disks (as long as the failed disks do not belong to the same “mirrored set”). RAID 10 provides the data protection of RAID 1 along with the access efficiency of RAID 0. With respect to data protection, RAID 10 uses the RAID 1 method of having the exact same data written identically on two disks, producing “mirrored sets”. These “mirrored sets” are then combined together in a RAID 0 configuration. RAID 10 requires an even number of four or more disks. When combining disks of differing sizes, the total storage space will be calculated based on the size of the smallest disk.

Total available storage space = (size of smallest disk) * (total number of disks / 2)

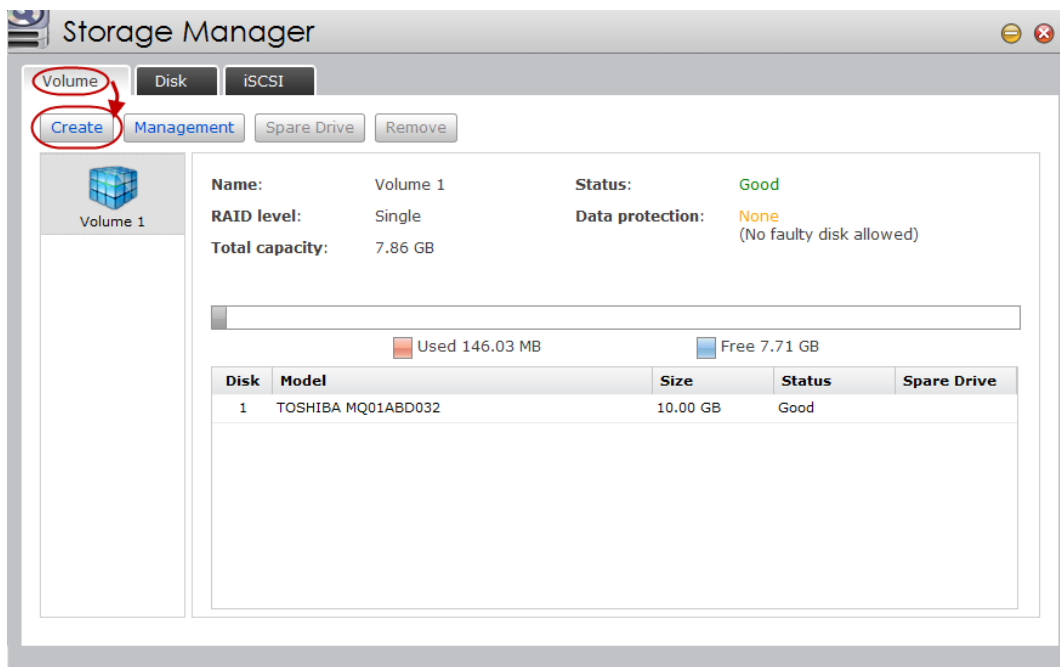
2. Configuring your NAS

2.1 Creating a new RAID volume

In this section we will go through the steps for creating a new storage volume with a RAID level. In the following example, the ASUSTOR NAS that we are using already has a storage volume set up with 1 hard disk. We have just inserted 2 **new** hard disks and will walk you through the process of creating a new storage volume using these 2 disks.

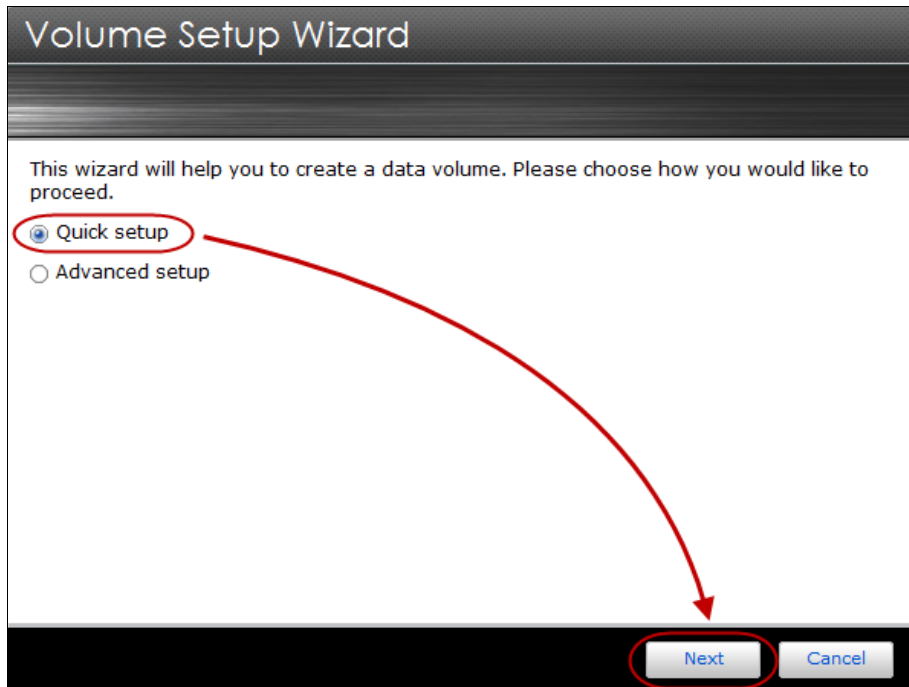
STEP 1

After inserting the 2 new hard disks into the ASUSTOR NAS open **[Storage Manager]**. Under the Volume tab you will see that there already is an existing "Volume 1" storage volume. Click on **[Create]** to begin the process of creating another storage volume.



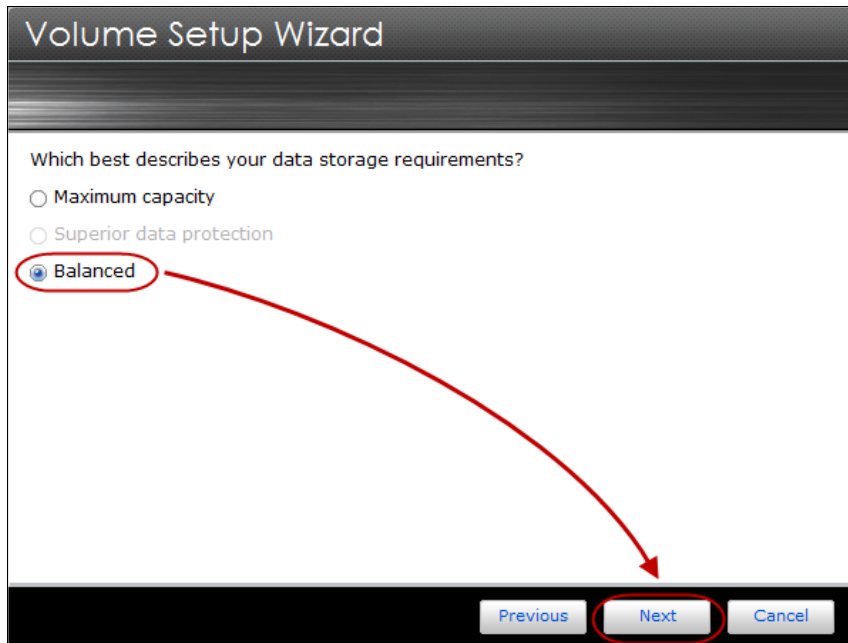
STEP 2

The Volume Setup Wizard window will now appear. Select the **[Quick setup]** radio button and click **[Next]**.



STEP 3

Select the **[Balanced]** radio button and click **[Next]**.



Note: At this screen you will be asked about your data storage requirements. The Volume Setup Wizard is generally able to offer you three different options to choose from. You can choose “Maximum capacity” if you wish to maximize the amount of storage space available, “Superior data protection” if you wish to have increased protection for your data or “Balanced” for a balance between storage capacity and data protection benefits. In our example we have decided to select “Balanced”.

Depending on the number of disks and the option that you select, the Volume Setup Wizard will then make a decision about the RAID level to use for the new volume. This is all summarized in the tables below.

MAXIMUM CAPACITY	
Number of Disks	RAID level
1	Single
2	RAID 0
3	RAID 0
4	RAID 0
5	RAID 0
6	RAID 0
7	RAID 0
8	RAID 0
9	RAID 0
10	RAID 0

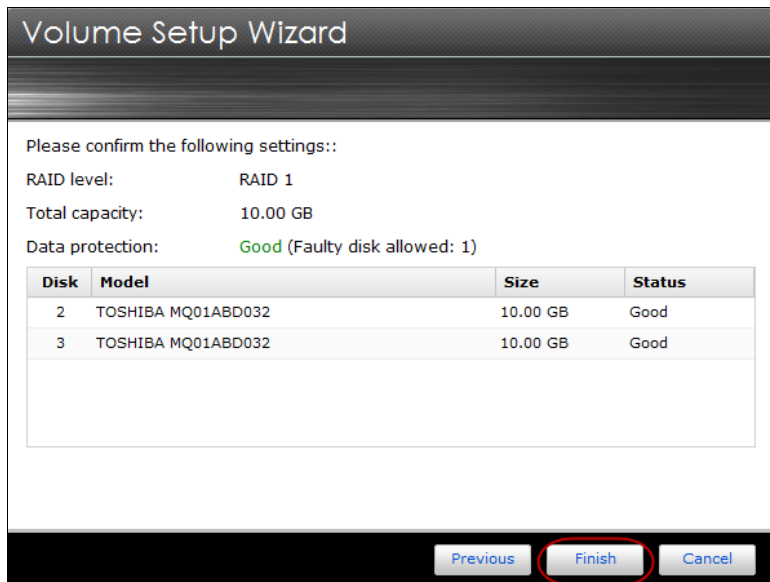
11	RAID 0
12	RAID 0

SUPERIOR DATA PROTECTION		
Number of Disks	RAID Level	Faulty Disks Tolerated
1	X	0
2	RAID 1	1
3	RAID 5	1
4	RAID 6	2
5	RAID 6	2
6	RAID 6	2
7	RAID 6	2
8	RAID 6	2
9	RAID 6	2
10	RAID 6	2
11	RAID 6	2
12	RAID 6	2

BALANCED		
Number of Disks	RAID Level	Faulty Disks Tolerated
1	X	0
2	RAID 1	1
3	RAID 5	1
4	RAID 5	1
5	RAID 5	1
6	RAID 5	1
7	RAID 5	1
8	RAID 5	1
9	RAID 5	1
10	RAID 5	1
11	RAID 5	1
12	RAID 5	1

STEP 4

Look over a final summary of your settings. You can see that the wizard has helped us to select the RAID 1 configuration for a balance between data protection and storage capacity. You can also see that RAID 1 permits 1 faulty disk. This means that in the event that one of the disks for this volume should fail, your data will still remain complete. Finally you can see the two disks that are ready to be used to create the new storage volume. Once you're ready, confirm your settings by clicking **[Finish]**.



STEP 5

You will now see the newly created "Volume 2" under the Volume tab of storage manager. You will also see that the new storage volume is still in the process of synchronizing. At this time your NAS will be ready for use. Please note that the time required for synchronization varies according to hard drive capacity.

