INSTALLATION AND USER'S GUIDE FOR SANBOLIC® MELIO™

(Melio 3.5)

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Sanbolic® Melio™ Installation and User's Guide

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About Sanbolic® Melio™

Sanbolic **Melio** is a software-based product suite that augments existing application, server and storage infrastructures to alleviate the unintended consequences of virtualization. Comprised of advanced software components that work together to share storage and simplify data and storage management, Melio enhances the performance, scalability and availability of enterprise workloads in virtual datacenters and private cloud deployments.

At the core of Melio is an all-purpose, 64-bit, symmetrical cluster file system called *Melio FS*™ that allows multiple Windows® servers to share simultaneous read/write access to data stored on the same partition or Logical Unit Number (LUN) on SAN (block-based) storage.

A cluster volume manager called *Melio Volume Manager* is also included in Melio. Melio Volume Manager greatly simplifies management of Melio shared volumes while enabling advanced storage management functionality designed for enterprise and private cloud environments.

Installation and Setup of Melio

The following sections provide instructions for installing and using the Melio software to create shared storage for Windows® platforms.

Minimal System Requirements:

- Pentium IV class processor or equivalent
- 512 MB RAM
- 24 MB free disk space
- LAN (TCP/IP) connection
- SVGA - min 800x600, 256 colors
- Block-based storage (i.e., iSCSI, Fibre Channel, Infiniband, etc.)

Supported Operating Systems:

- Windows Server 2003 x64
- Windows Server 2003 R2 x64
- Windows Server 2008 x86, x64
- Windows Server 2008 R2

Note: Windows Server 2003 x86 and Windows Server 2003 R2 x86 are not supported.

Note: Melio 3.5 requires .NET Framework 3.5 SP1. Please ensure that .NET Framework 3.5 SP1 is installed on your computer *prior* to installing Melio 3.5.

Recommendations:

- Melio uses a proprietary communications protocol (based on TCP and UDP) for file system and volume management. To mitigate or remove the potential for heavy network traffic to adversely affect Melio communications, Sanbolic *strongly* recommends the use of a private or stand-alone network for Melio. This dedicated network can be created using a crossover cable for a two-server cluster or an Ethernet switch for clusters comprised of three or more servers.

- To achieve even greater levels of performance, scalability and availability, while simplifying the management of Melio shared storage, Sanbolic *strongly* recommends using Melio Volume Manager to create and manage Melio shared volumes. Designed for shared storage, Melio Volume Manager allows administrators to create basic partitions, volume sets, stripe sets and mirror sets and take advantage of advanced storage features such as RAID1, RAID10, live storage migration and dynamic volume expansion.

Installation Checklist:

- Using an account with local administrator privileges, log on to the system in which Melio is going to be installed.
- Verify that the Windows Management Instrumentation (WMI) service is running.
- Verify that the system has IP connectivity to the network that will be used for Melio communications.
- Using the instructions provided by the manufacturer of your storage hardware, install and connect your storage hardware to the servers that will be running Melio. Once you've confirmed the storage hardware is operating correctly, create one or more LUNs and map them to the servers. Check the event logs on the servers for any storage connection-related error messages and resolve all reported errors prior to installing Melio.
- Verify that the LUN(s) to be formatted with Melio FS is seen by Windows. To accomplish this, open a DOS prompt and enter the following commands:
    - *diskpart* <enter>
    - *list disk* <enter>
- You should see the LUN(s) in the list of disks. If not, check the connection(s) between the server(s) and the storage and confirm that the LUN(s) has been mapped to the server(s) from the storage.
- Verify that the LUN(s) to be formatted with Melio FS is not configured for "Read-only" mode. To accomplish this, enter the following commands in diskpart:
    - *select disk #* <enter> (# equals the number assigned to the LUN)
    - *attributes disk* <enter>

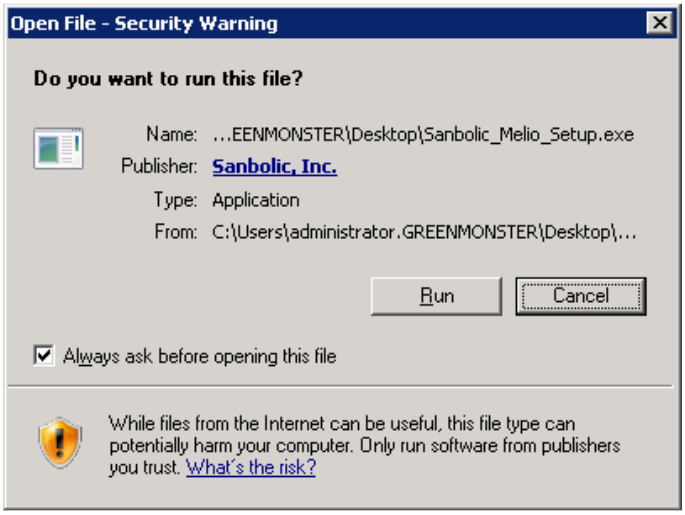
  If the LUN(s) is set to "Read-only" mode, enter the following command:
    - *attributes disk clear readonly* <enter>
    - *attributes disk* <enter>

  The LUN(s) should now appear with "Read-only" set to "No".
- Download and save the Melio setup program on the desktop of your servers.
- If a prior version of Melio is already installed, please refer to Tech Brief http://blog.sanbolic.com/?p=2096 to review best practices for upgrading your Melio software.
- Beginning with Melio 3.5, licensing is now volume-based rather than server-based. Please refer to Tech Brief http://blog.sanbolic.com/?p=2155 to learn more about licensing your Melio 3.5 software.

Installation

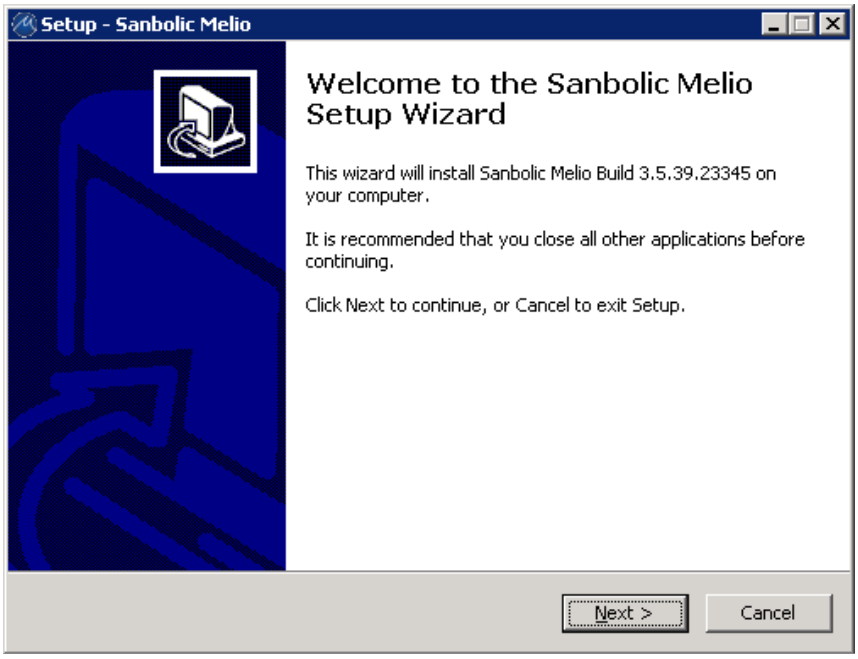
Double-click the Melio setup program on a server running one of the supported operating systems listed under the **Supported Operating Systems** section on the previous page.

A security warning will be displayed:

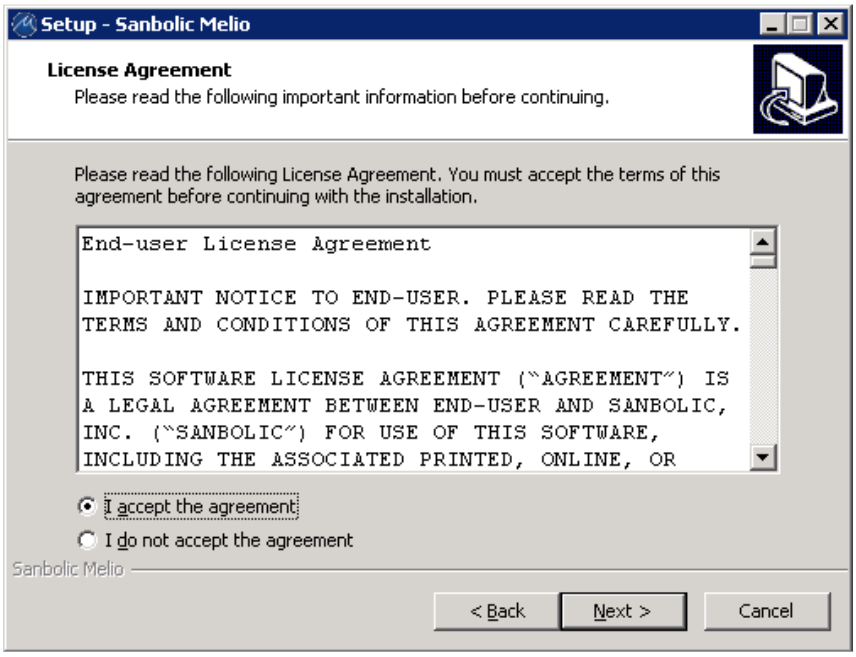


Click “Run” to proceed with the installation.

A "Welcome" screen will be displayed:

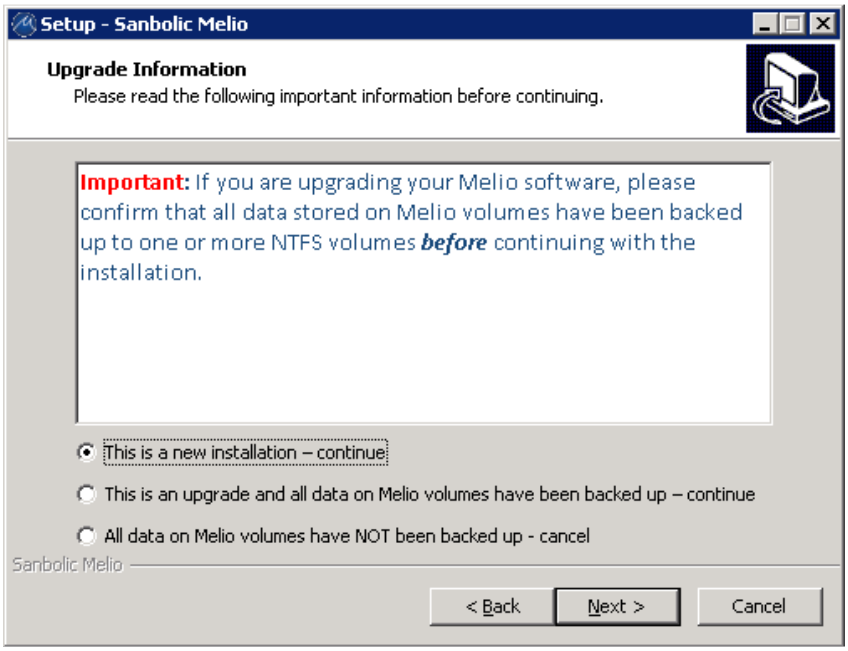


Click “Next” to continue with the installation.



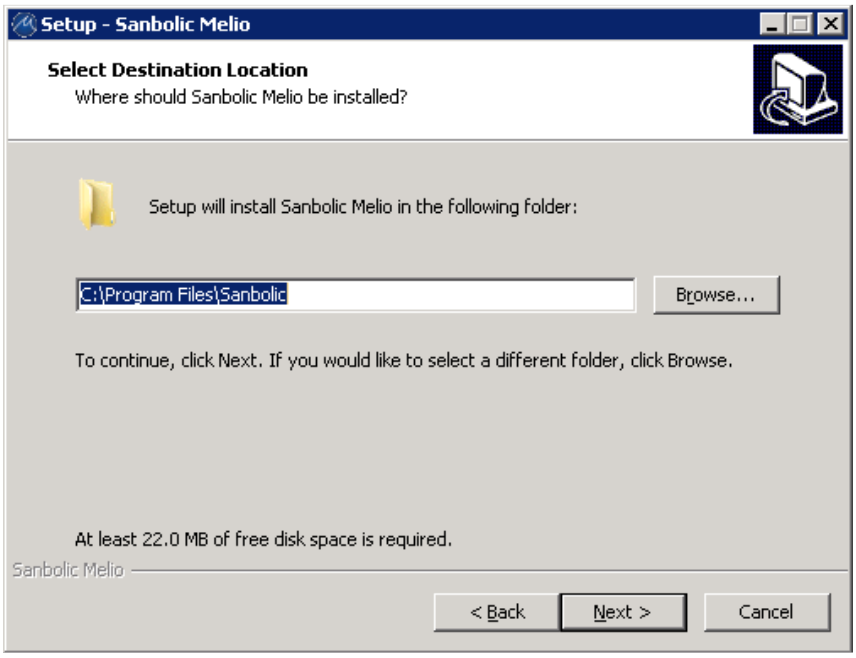
Select “I accept the agreement” to accept the license agreement and click “Next” to continue.

The “Upgrade Information” window will appear:

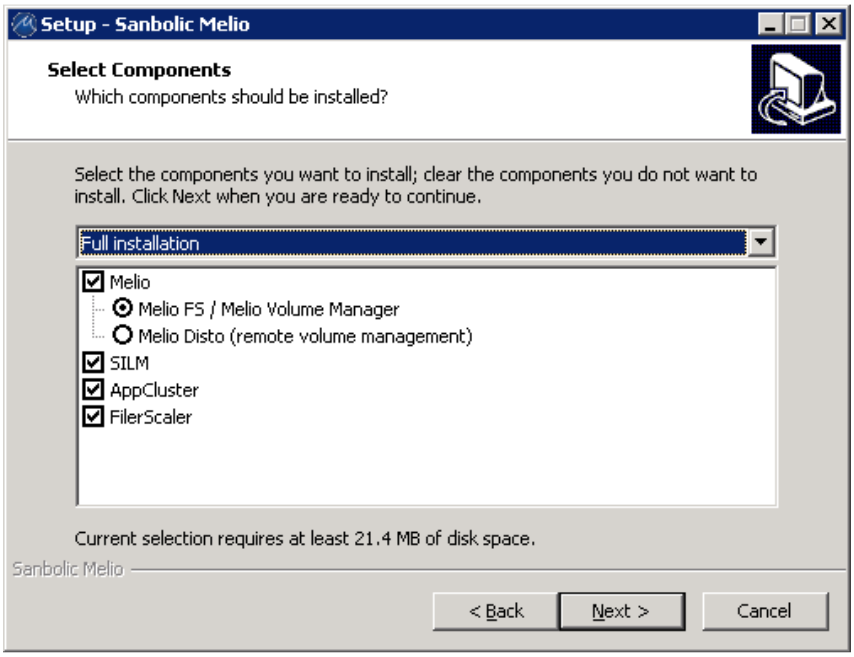


If Melio is being installed for the first time, select “This is a new installation – continue” and click “Next”.

If a prior version of Melio is already installed and you are running the Melio setup program to upgrade the Melio software, please refer to Tech Brief http://blog.sanbolic.com/?p=2096 to review best practices for upgrading your Melio software.



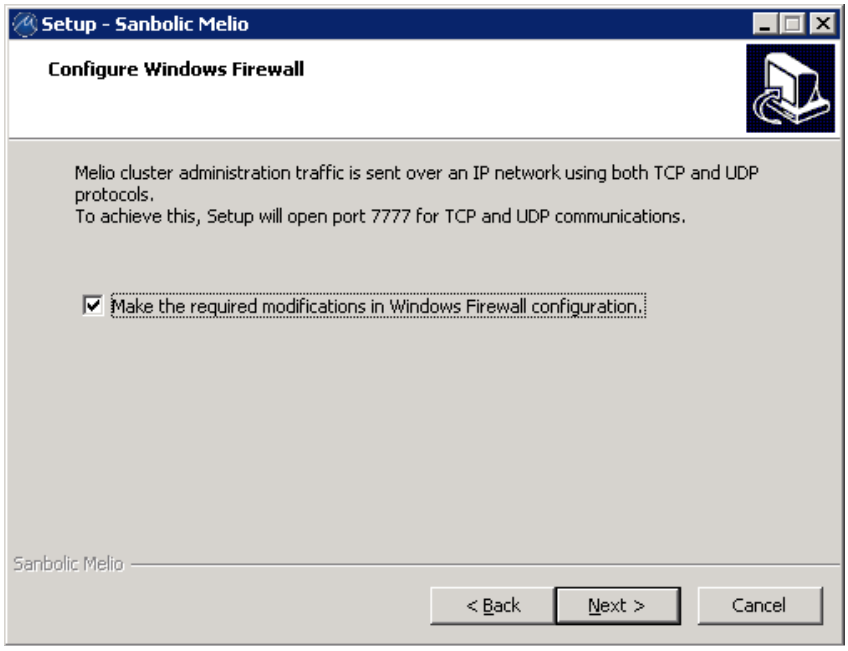
In the “Select Destination Location” window, select an installation folder for the Melio software and click “Next”.



Select the components you would like to install and click “Next”.

Note: In order to use the Melio software, at a minimum the radio button for Melio FS / Melio Volume Manager must be selected.

In the “Configure Windows Firewall” window, leave the default option to open port 7777 for TCP and UDP communications checked to allow the Melio software to function properly.

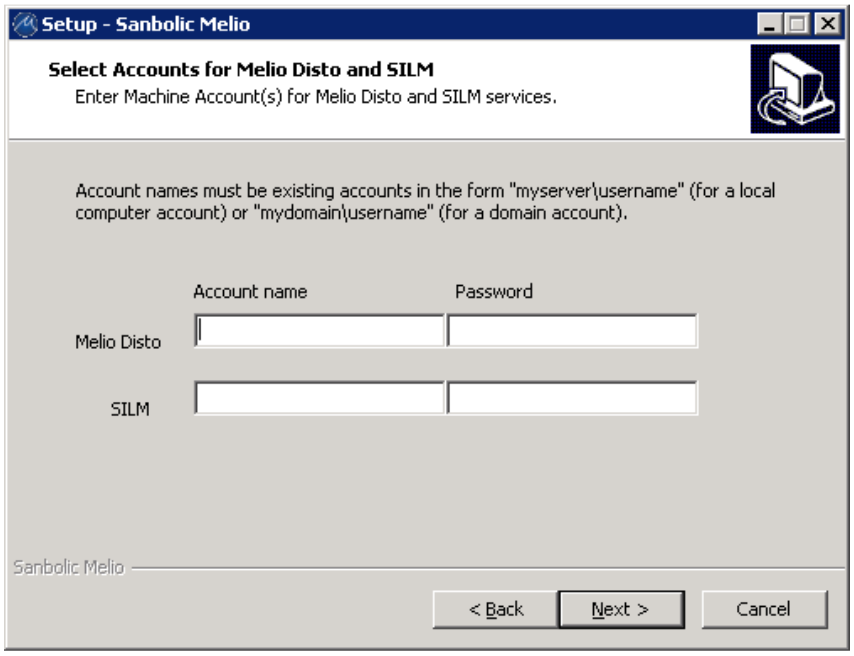


Note: If you decide to change the IP/port pair (socket) used by Melio at a later time, the Melio software will automatically reconfigure Windows Firewall to accommodate for the new settings.

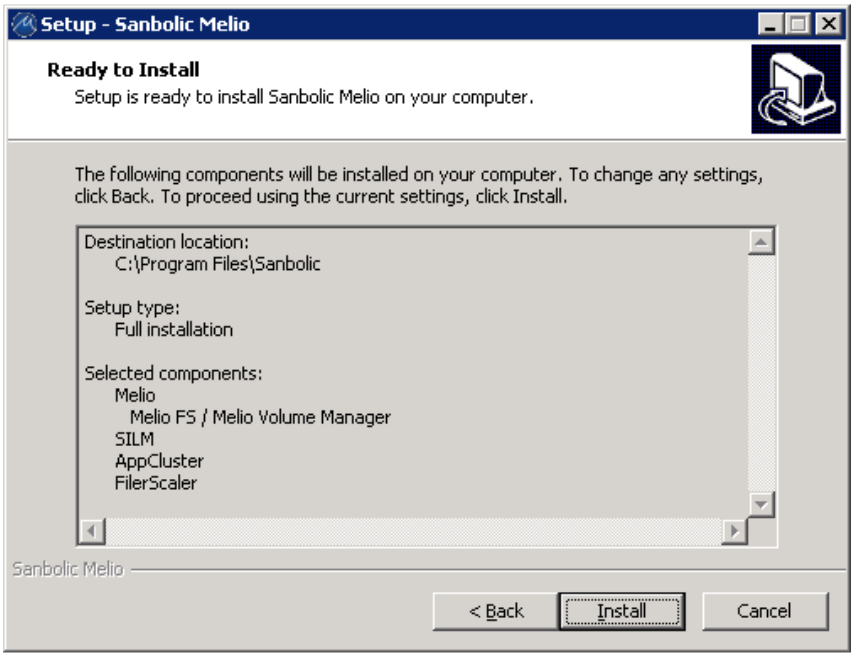
If you are using a third party firewall, you will need to configure the port exceptions manually to ensure the Melio instances running on the servers are able to communicate with one other.

Note: If any instance of Melio is unable to communicate with the Melio instances running on the other servers in a cluster, that server will not be able to access any volumes formatted with Melio FS.

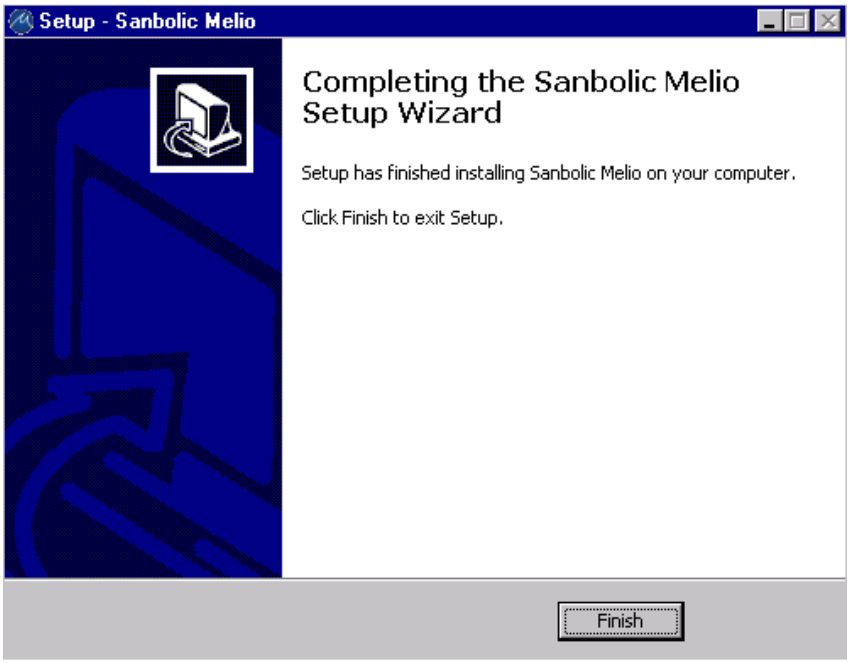
Click “Next” to continue.



In the “Select Accounts for Melio Disto and SILM” window, enter the machine account(s) that will be used by the Melio Volume Manager to manage Melio shared volumes and the SILM™ data mover utility to copy or move files based on user-defined policies (see SILM Users Guide) and click “Next”.



In the “Ready to Install” window, click “Install” to install the selected components.



Click “Finish” to complete the installation of Melio.

After the setup program is completed, the Melio FS kernel driver will start.

Note: All Melio components selected during the installation will appear under the Start menu (*Start > All Programs > Sanbolic*).

Repeat the installation process on all computers that will share access to Melio volumes.

Once Melio is installed on all computers, proceed to **Managing a disk with Melio Volume Manager** (below) to create your shared storage.

Trial Version

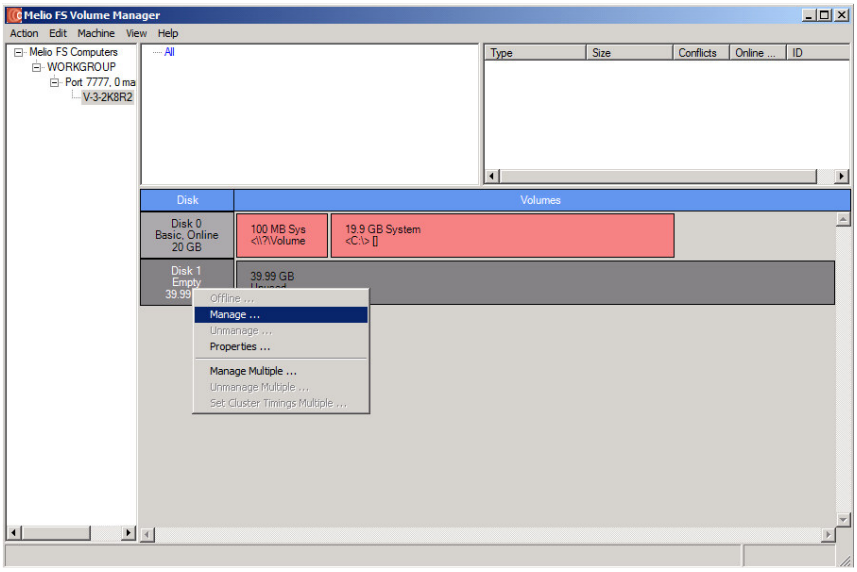
During the Melio software evaluation you will receive a trial key that activates the Melio software on a per volume basis. With the trial key, you can activate a maximum of two volumes for 15 days. Upon trial expiration, all Melio shared volumes will transition to “read-only” mode and only one server will be allowed to access the volumes.

Managing a disk with Melio Volume Manager

Note: Prior to managing a disk with Melio Volume Manager, at least one partition (LUN) on your SAN storage must be provisioned and presented to every computer running the Melio software.

Launch the Melio Volume Manager (*Start > All Programs > Sanbolic > Melio Volume Manager*).

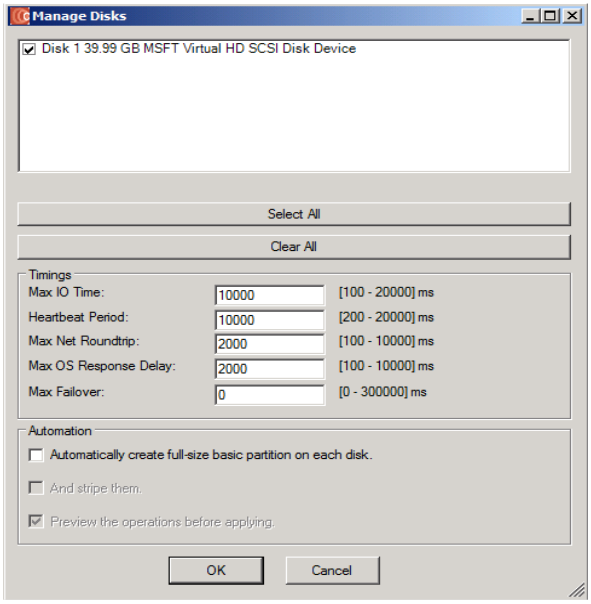
By default, the local computer running Melio will be displayed on the left-hand side of the Melio Volume Manager console. (See illustration on following page.)



Right-click on the disk label on the left-hand side of the lower window pane and select “Manage” to manage a single disk or “Manage Multiple” to manage multiple disks.

A pop-up window will appear asking you to select the disk(s) that you want Melio Volume Manager to manage.

Note: Unless advised by Sanbolic Technical Support, you should NOT make any changes to the values of the parameters listed under the “Timings” section. The default values are designed to work under the majority of use cases. (Descriptions for these parameters are provided later in this manual.)

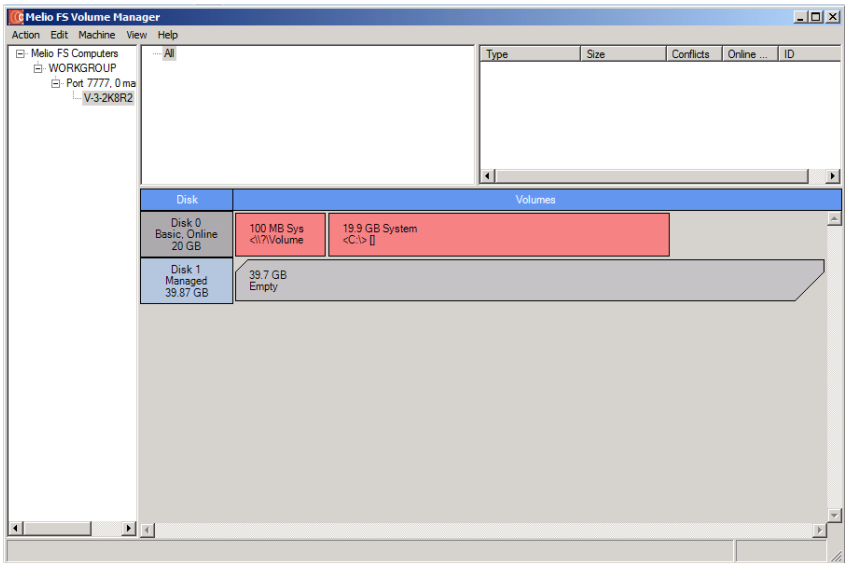


Select the disk(s) to manage and click “OK.”

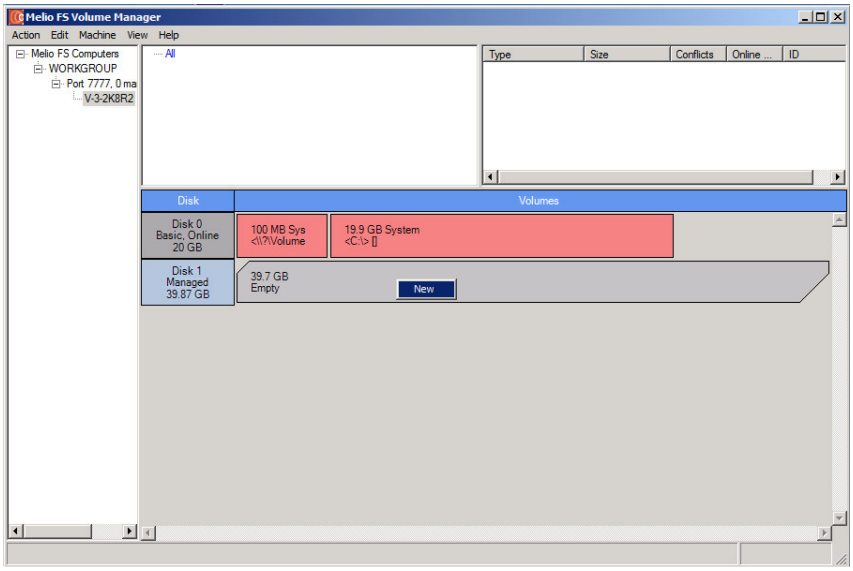
Note: *After clicking “OK” to manage the selected disk(s), a message will appear informing the user that the initial process of managing the disk(s) will take approximately five minutes.*

It is important to note that the process of managing a disk can take as long as 10 minutes due to the number of tasks involved, regardless of the number of disks selected or the size of the disk(s). Please do not attempt to cancel this process until it has completed successfully.

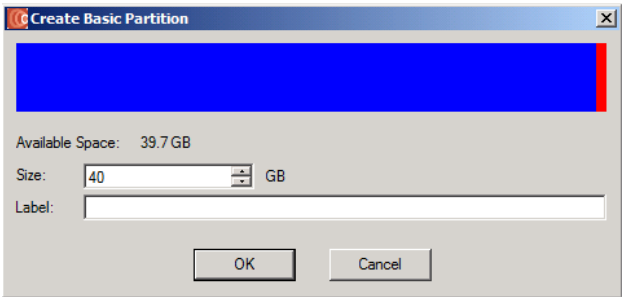
After the disks are managed, the following screen is displayed.



To create a partition on a managed disk, right-click on the disk (where it shows “Empty”) and select “New.”

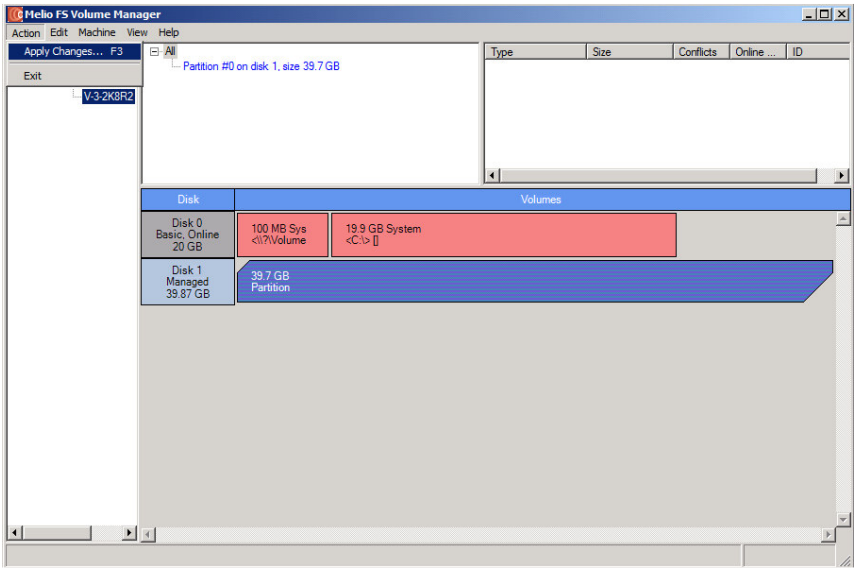


Select the desired partition size by entering numbers in the “Size” field or using the red slider bar. To create a partition using the entire available space, simply click “OK.”

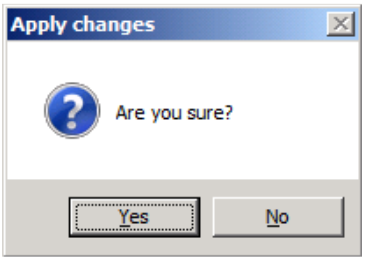


When this step is completed, the new partition (displayed below in blue) will appear in the tree view in the upper left-hand window pane. A blue partition indicates that the partition is ready to be created.

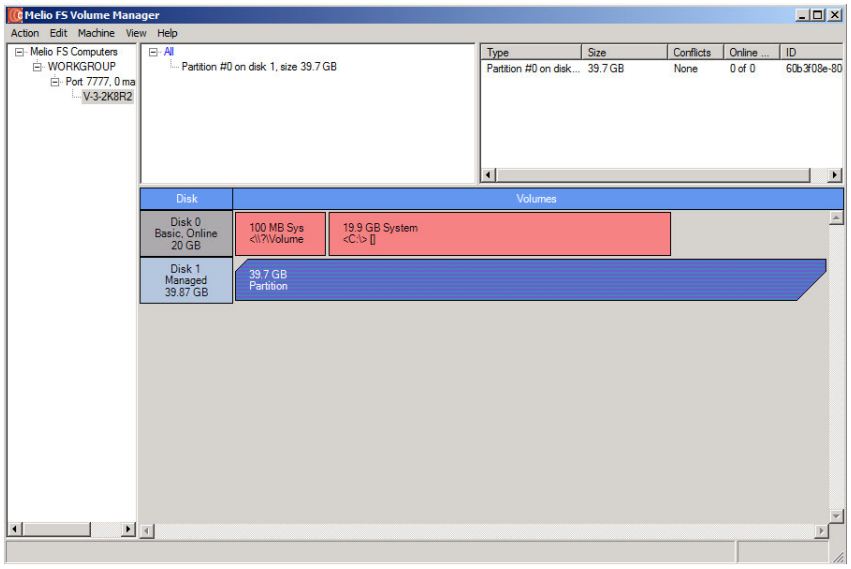
To create the partition, select “Action > Apply Changes” from the toolbar or press F3.



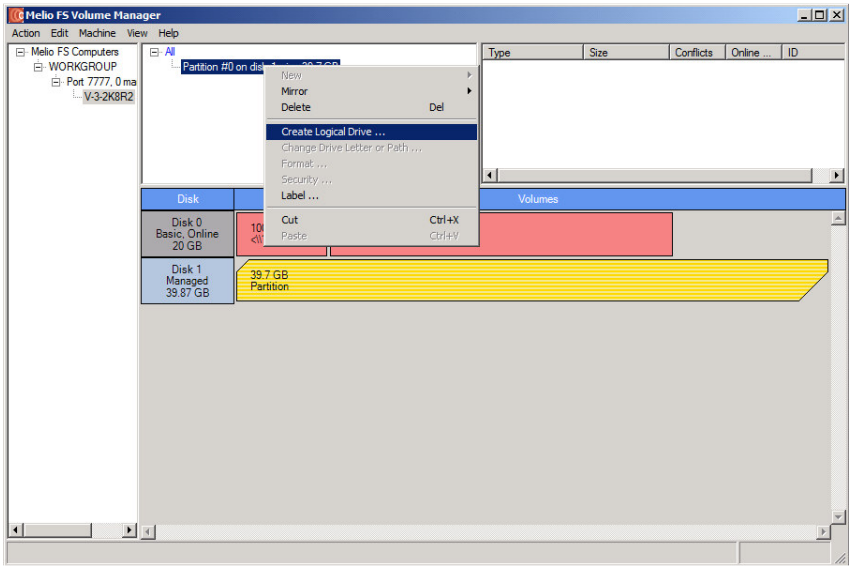
A pop-up window will be displayed asking for confirmation. Click “Yes.”



Once the changes are committed to the disk, the color of the partition will change to black, indicating that the partition has been created.

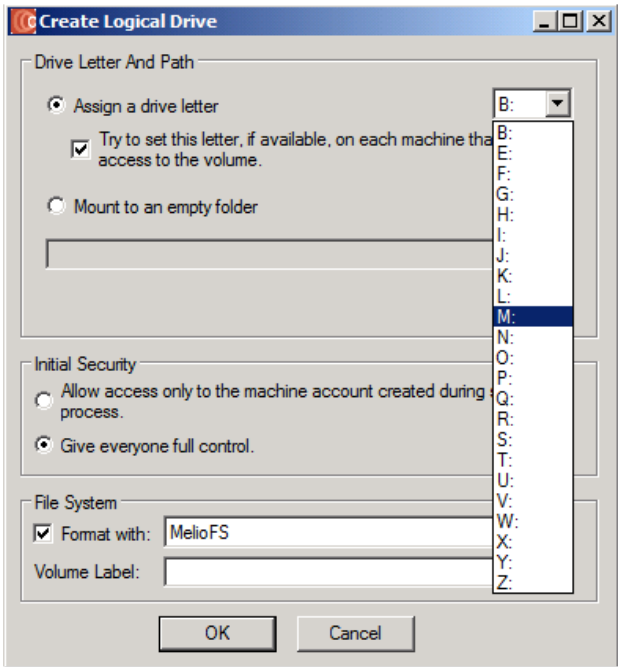


Now the partition can be converted to a logical drive (volume) that can be accessed by Windows.



Right-click on the partition in the upper left-hand window pane and select “Create Logical Drive…”

A dialog window will appear asking you to assign a drive letter to the new volume. The setting "Try to set this letter, if available, on each machine that has access to the volume" means the Melio Volume Manager will attempt to supply Windows with the same drive letter for this volume on all machines that will be sharing access to the volume. In cases where the drive letter is already in use by a machine, Melio Volume Manager will supply that particular machine with the next available drive letter for this volume. It is also possible to mount a Melio volume on an empty Melio FS or NTFS folder using mount points. To mount a volume on an empty folder, check the radio button labeled “Mount to an empty folder” and enter the path to the folder.



Under “Initial Security,” select the option “Give everyone full control.”

Under “File System,” leave the option to format the volume with “Melio FS.”

Enter a label for the volume in the “Volume Label:” field. (Optional)

Click “OK” to create the volume. A window containing messages about the volume creation process will appear.

Note: During the volume creation process, if Windows prompts you to format the volume, click “Cancel” as the volume is already being formatted with Melio FS.

Note: If Windows prompts you to restart the machine, click “Cancel”. Restarting the machine is not necessary.

If you receive a warning message about a non-signed driver being installed, click “Continue Anyway” to proceed with the driver installation.

Once the volume has been created, a message will appear in the window stating that all steps have completed successfully. Click “OK” to close the window and return to the Melio Volume Manager.

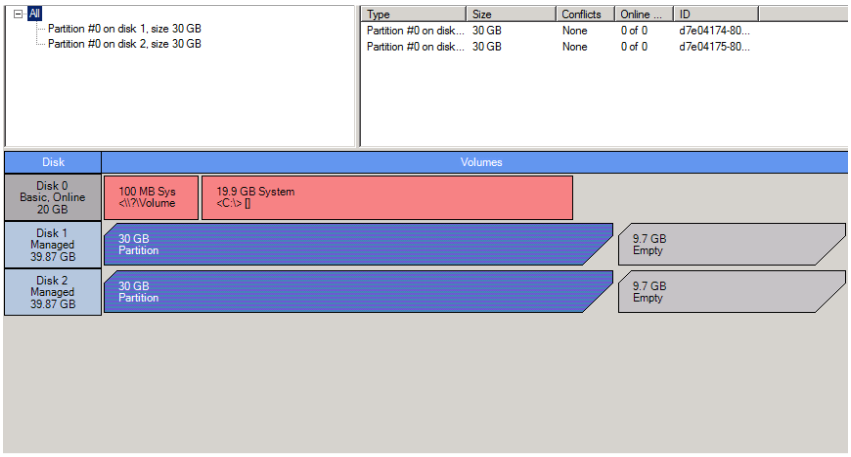
Notice: A disk that cannot be managed by the Melio Volume Manager is displayed as “Unknown” or “Foreign.” This indicates that another volume manager is actively managing the disk. To manage the disk with the Melio Volume Manager, it must first be unmanaged by the other volume manager. To accomplish this, you need to delete all partitions on the disk. If the disk is “dynamic,” you must convert it to a “basic” disk using Windows Disk Manager. Note that deleting partitions on a disk or converting a disk from dynamic to basic will delete all data stored on the associated volume. Make sure that any data you need is backed up to another volume PRIOR to deleting partitions or converting the disk.

Creating a Stripe Set

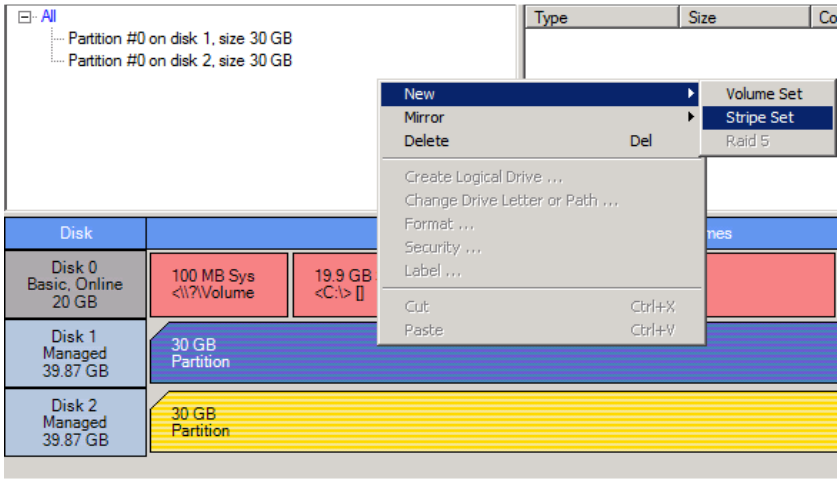
On your storage controller, create at least two LUNs of identical size.

Note: All partitions making up a stripe set must be *exactly* the same size.

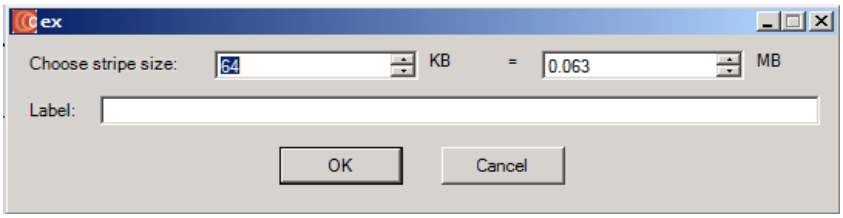
Follow the instructions provided in the previous section to create at least two partitions managed by the Melio Volume Manager.



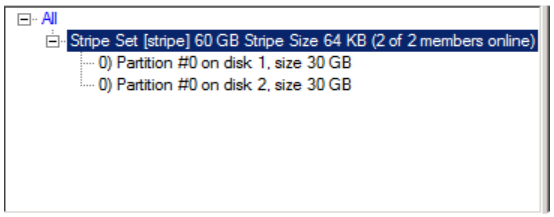
Right-click in any open area in the top left window pane and select “New > Stripe Set.”



A pop-up window will be displayed, asking for the size of the stripe set. By default, the stripe size is set to 64 KBs, which corresponds to the default stripe size of most contemporary disk arrays.



A new empty placeholder for the stripe set will appear in the top left window pane.



Add the partitions to the stripe set by left-clicking on them (one at a time) and dragging and dropping them onto the stripe set.
From the toolbar, select “Action > Apply Changes” to create the stripe set.

To make the stripe set visible to Windows as a logical drive (volume), follow the steps described previously to create a logical drive.

Creating a Volume Set

To create a volume set, follow the same steps used to create a stripe set, only this time, right-click on any empty space in the upper left-hand window pane and select “New > Volume Set.”

Note: Unlike stripe sets, the partitions making up a volume set do not have to be the same size.

Drag and drop partitions onto the volume set placeholder and select “Action > Apply Changes” from the toolbar to create the volume set.

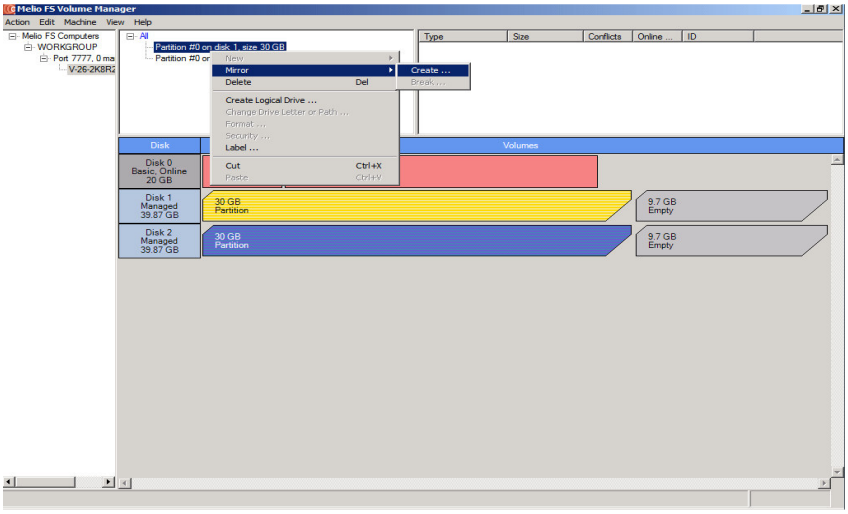
To make the volume set visible to Windows as a logical drive (volume), follow the steps described previously to create a logical drive.

Creating a Mirror Set (RAID1)

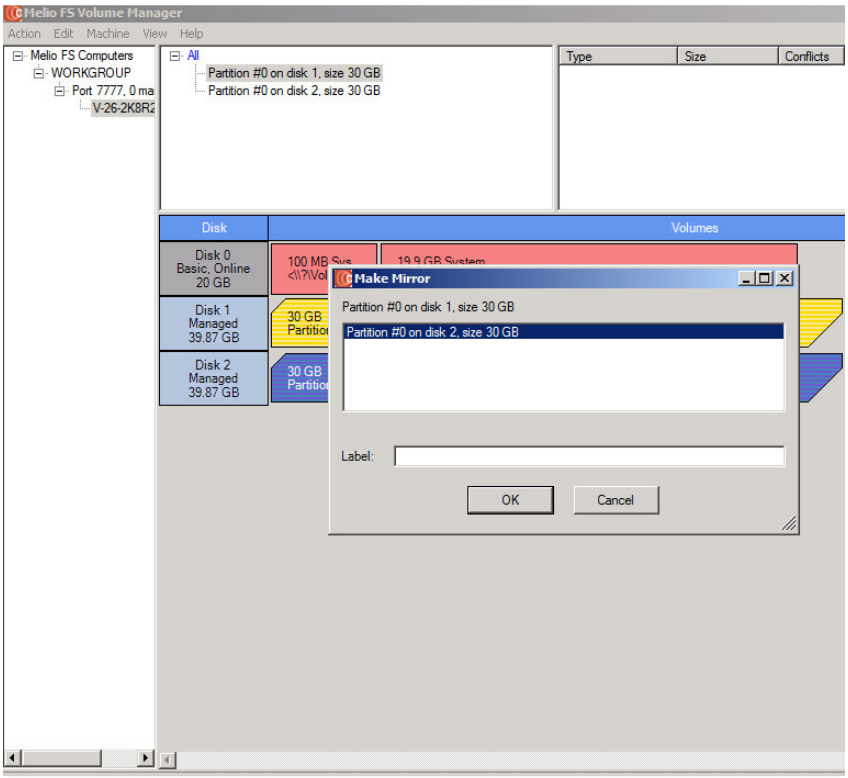
Follow the instructions provided earlier to create at least two partitions managed by the Melio Volume Manager.

Note: The partitions making up a mirror set **must** be *exactly* the same size.

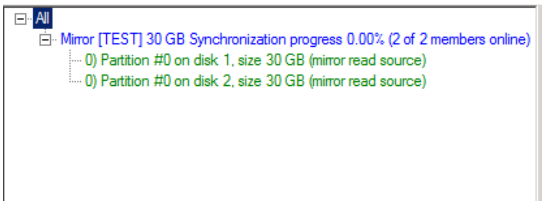
Right-click on one of the partitions and choose “Mirror” > “Create…”



In the “Make Mirror” window, select the other partition that will be used for the mirror and click “OK.”

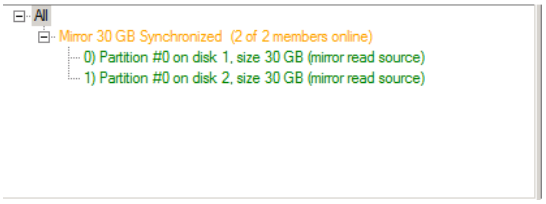


The mirror will appear in blue.



From the toolbar, select “Action” > “Apply Changes” to create the mirror set.

The mirror will appear in orange, indicating that it is synchronizing.

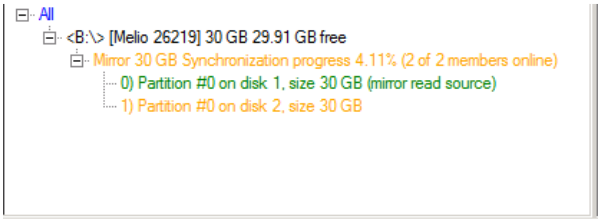


Once synchronization has completed, the mirror will appear in green.

You can now create a logical drive (volume) on the mirror set.

To make the mirror set visible to Windows as a logical drive (volume), follow the steps described previously to create a logical drive.

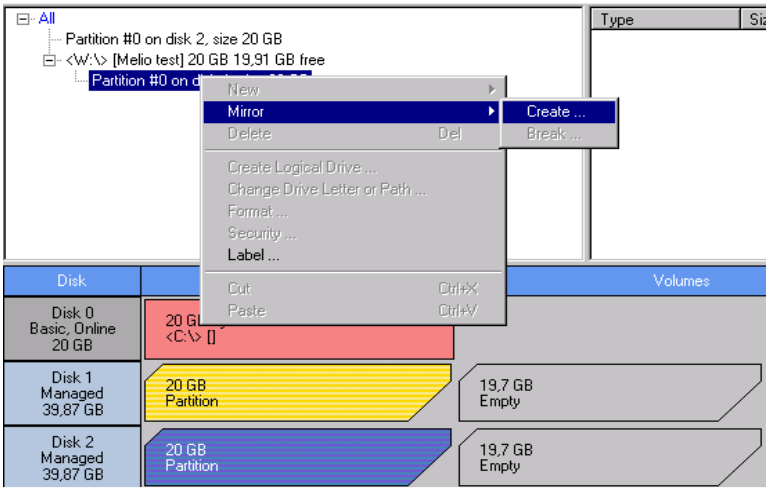
Once the logical drive has been created, the mirror will resynchronize.



After synchronization has completed, the logical drive (and its partitions) will appear in green, indicating it is ready for use.

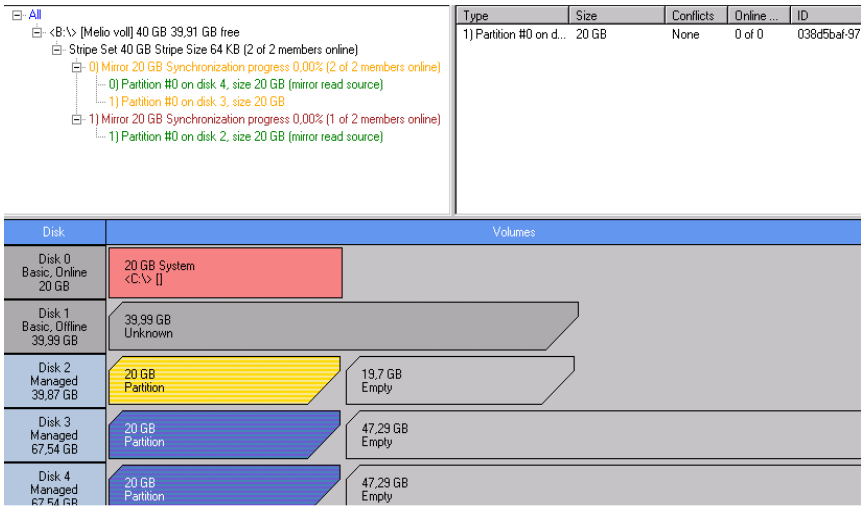
Online Volume Mirroring

An existing volume can be mirrored while the volume is mounted and active. The volume will continue to be operational during the mirror creation and synchronization process.



Creating a Highly Available Volume

When a volume structure is mirrored and contains more than one mirror, the volume can remain online and accessible even if some disks are missing. In order for this to occur, there must be at least one functional pair of mirrored disks and the disks participating in the failed mirror set must have participated in the last volume mount.

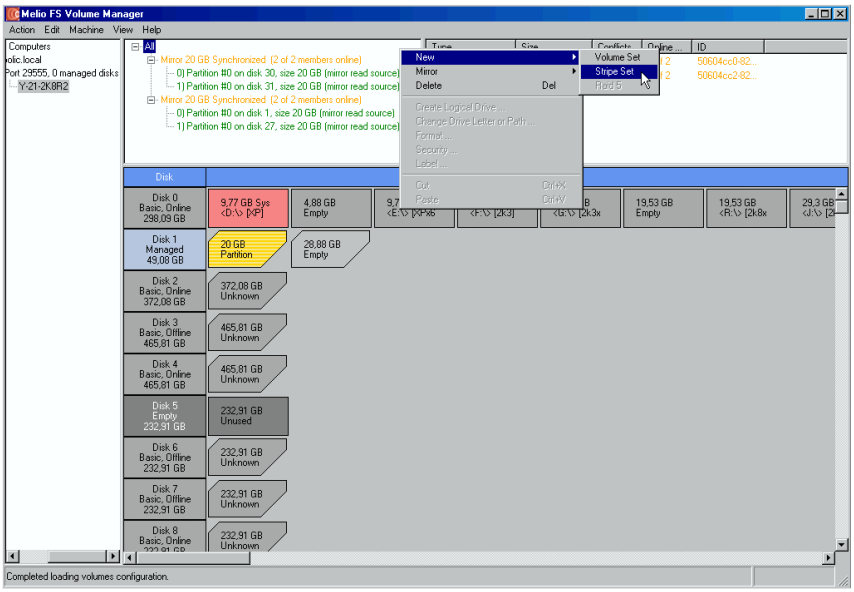


With a missing disk, volume B: is still online and operational.

To break a mirror, right-click on the mirror set and select “Mirror” > “Break…”

Creating a Striped Set comprised of multiple Mirror Sets (RAID10)

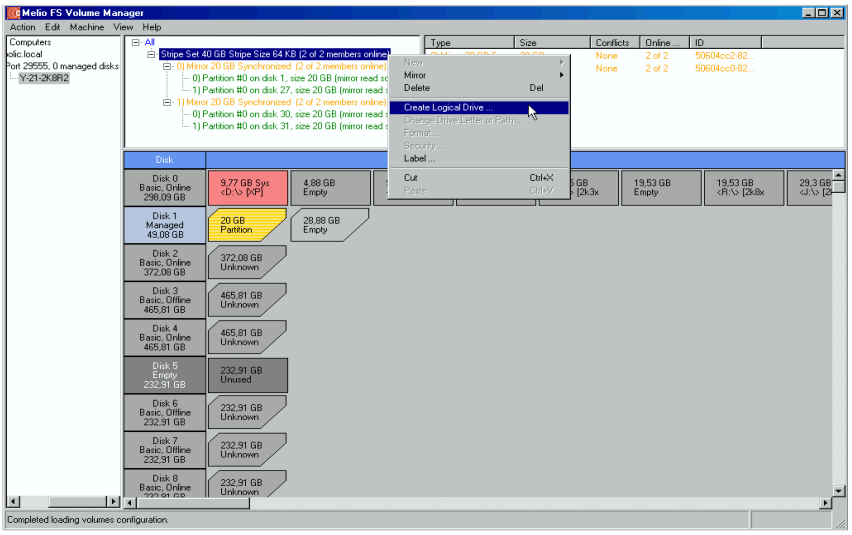
Create two mirror sets as described in the previous section.



Then create a new stripe set and drag and drop the two mirror sets (one at a time) onto the strip set.

From the toolbar, select “Action > Apply Changes.”

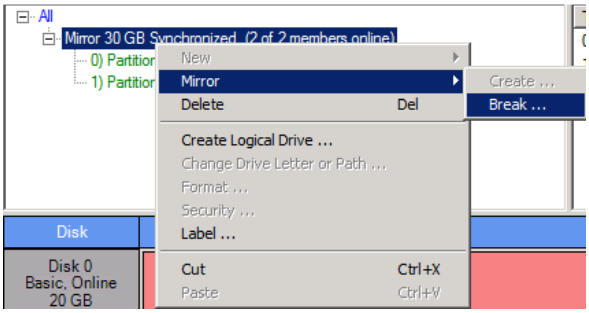
The two mirror sets will now appear under the stripe set.



To make the stripe set visible to Windows as a logical drive (volume), follow the steps described previously to create a logical drive.

Breaking a Mirror

To break a mirror, right-click on the mirror set and select “Mirror” > “Break…”



Select a partition to remove from the mirror set and click “OK.”

From the toolbar, select “Action > Apply Changes.”

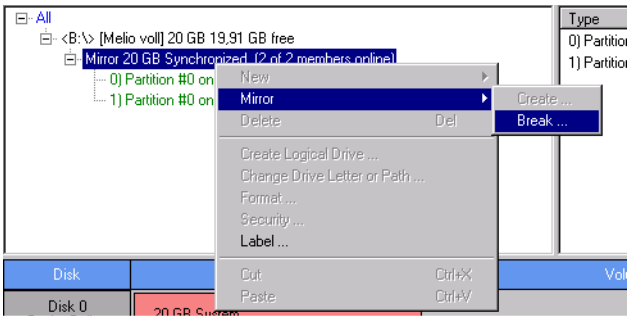
The logical drive will now be left with a single partition.

Simple volume mirroring – Breaking a mirror when a mirrored disk is missing

When a volume is comprised of a single mirror set and one of the disks in the mirror fails, the volume will become inaccessible. To make the volume accessible, follow the instructions provided above to remove the failed disk and break the mirror. Once the failed disk is removed from the mirror, the volume will become accessible.

Online volume mirror breaking

A mirror set can be broken while its volume is mounted and active. To break the mirror, the mirrored pair of disks must be fully synchronized. Follow the instructions provided above to remove one of the disks and break the mirror. The volume will continue to be operational while the disk is being removed from the mirror and after the mirror has been broken.



Volume Extension

Additional storage (i.e., partition, volume set, stripe set or mirror set) can be added to an existing volume without disrupting its operation. This process forms a volume set comprised of the original volume and the newly added storage.

To extend a volume (logical drive), follow the instructions provided previously to create a new partition, volume set, stripe set or mirror set and apply the changes. Drag and drop the new partition/volume set/ stripe set/mirror set onto the volume that you want to extend and apply the changes to extend the volume. Once the volume is extended, it will be displayed (with its new size) as a volume set in the Melio Volume Manager console.

Note: You cannot extend a volume set that contains only basic partitions with a Stripe set. This is due to the difference in sector sizes between the partitions and the stripe set.

Note: Volume shrinking is not supported.

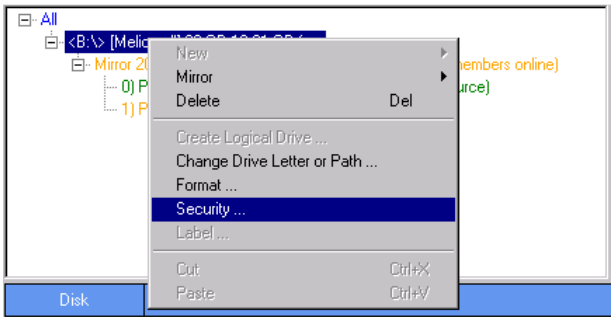
Extending a Disk

If you run out of free space on a disk, you may be able to add free space (provided there is unused storage resources available and your storage hardware supports LUN extension) using the storage management application for your storage hardware. Once the LUN is extended, select "View > Rescan Disks" from the toolbar at the top of the Melio Volume Manager to allow Melio Volume Manager to recognize the additional disk space. Right-click on the new disk space and select "New" to create a new partition. From the toolbar, select "Action > Apply changes" and then drag and drop the new partition onto the original volume (logical drive). Apply the change a second time to extend the volume on the fly (without rebooting the system). The extended volume will be displayed in the Melio Volume Manager console.

Note: Shrinking a disk is not supported.

Volume Security

Since Melio Volume Manager is a cluster volume manager, it is important to remember that security permissions can be applied to a volume only and not to disks, partitions, volume sets, stripe sets or mirror sets. A volume is the resource for which users are granted/denied access. Like any other protected object in Windows, each volume has a security descriptor that defines user access to it. When security permissions can be applied to a particular object, the respective option is enabled in the context menu.



Two agents can operate with volumes:

1. A **machine user account** represents the machine from where the volume is accessed. The credentials of the machine user account are necessary in order to start the Melio Volume Manager service. The rights of the machine user account define the following:
    a. Whether the volume will be visible on a particular machine or not, AND
    b. If the volume is visible, what access rights are enabled for it: read only, write only or read/write.

2. A **common user** (i.e., John, Mary, etc.) – Individuals who can make changes, edit configurations, etc. To make changes from the User Interface of the Melio Volume Manager, the credentials of the common user apply.

Most likely, the machine user account will be the account entered during the installation of the Melio software. If this account or its credentials need to be changed, you can make these changes from the Melio Volume Manager service tab of the Global Settings dialog.

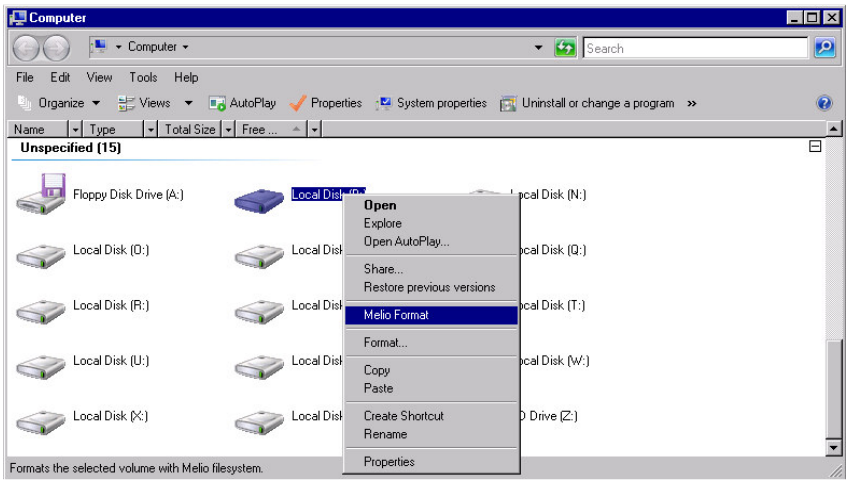
Using Melio to format a disk managed by another disk manager

Important note: Melio works with “basic” disks only and does not support “dynamic” disks. Converting basic disks that will be formatted with Melio FS to dynamic disks can lead to volume instability.

Although Sanbolic *strongly* recommends managing Melio volumes with Melio Volume Manager, volumes managed by Windows Disk Manager or another third-party volume manager can be formatted with Melio FS to allow such volumes to be shared amongst multiple Windows servers.

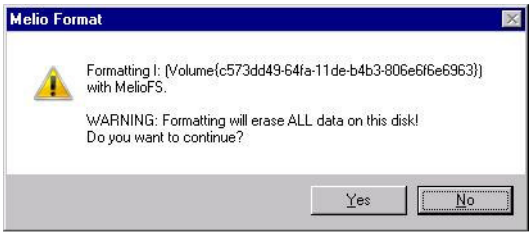
Note: Prior to formatting a volume with Melio FS, a drive letter must be assigned to the volume, which can be achieved using the Windows diskmgmt.msc management console. Make sure the disk has been assigned to all machines running Melio that will need to access it. Since Windows Disk Manager is not designed to manage shared volumes, it may be necessary to launch Windows diskmgmt.msc on each machine and assign the volume a drive letter.

To format a volume with Melio FS, right-click on the associated drive in Windows Explorer and select "Melio Format".



Note: Formatting a volume with Melio FS via the Windows context-sensitive (right-click) menu *must* be performed from ***one*** machine only. Once the volume has been formatted, all servers running Melio will automatically discover and mount the shared volume.

A confirmation message will be displayed:



Click “Yes” to format the volume with Melio FS.

Formatting a volume with Melio FS may take several minutes to complete. Please allow the formatting process to complete before attempting to access the drive.

Reformatting a volume with Melio FS – If the volume was previously formatted with Melio FS and other machines are accessing it, the reformat operation will fail and an error message will be displayed. To format the volume, you must ensure it is not in use by other machines and that there are no open handles referencing it. The simplest way to accomplish this is to shut down all machines accessing the shared volume except the one machine being used to reformat it.

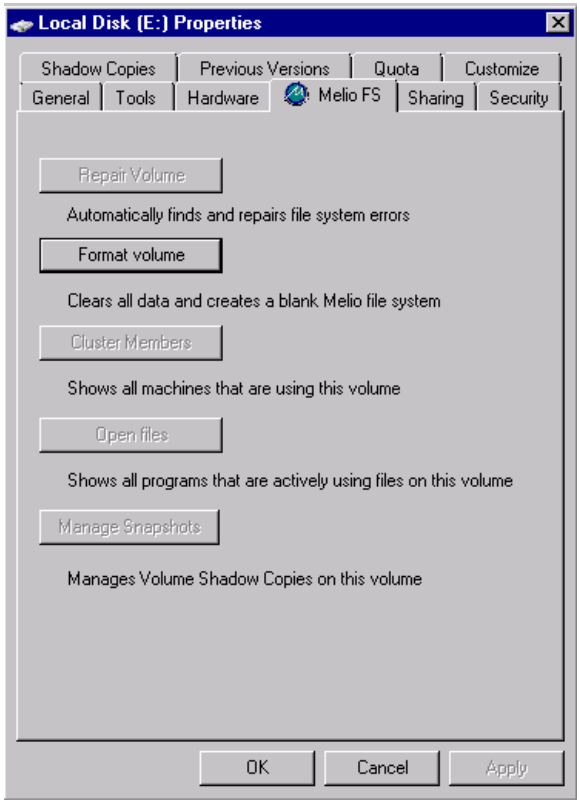
Note: Formatting a volume previously formatted with a file system *other* than Melio FS is ***not*** recommended as it could lead to volume performance or stability issues. In the event that a previously formatted volume must be used, it is imperative that all machines accessing the volume except one be disconnected from the storage or shut down prior to reformatting the volume with Melio FS.

Sanbolic *strongly* recommends formatting only new (raw) LUNs with Melio FS.

Melio Shell Extension

The following tasks can be performed using the Melio Shell Extension:

- Repair volume
- Format volume
- Check all machines that are using a volume
- Check all programs that are accessing files on a volume
- Manage Snapshots on a volume



Usage

Melio is a shared file system that supports all standard file system operations such as creating, copying, moving, renaming and deleting files and directories, reading from and writing to files, changing file and directory attributes, locking whole files or particular sections only, etc.

Since Melio is a shared file system, all of the above operations can be safely performed on a volume by multiple machines simultaneously.

At the core of Melio is a kernel level driver whose functionality is accessed indirectly through Windows Explorer and all user applications using operating system commands such as "copy" or "dir" or via the standard Win32 programming functions such as CreateFile(). Melio is tightly integrated with Windows Server 2003 and 2008 operating systems and supports all commands and system API functions natively. Thus an application that works with NTFS will also work with Melio.

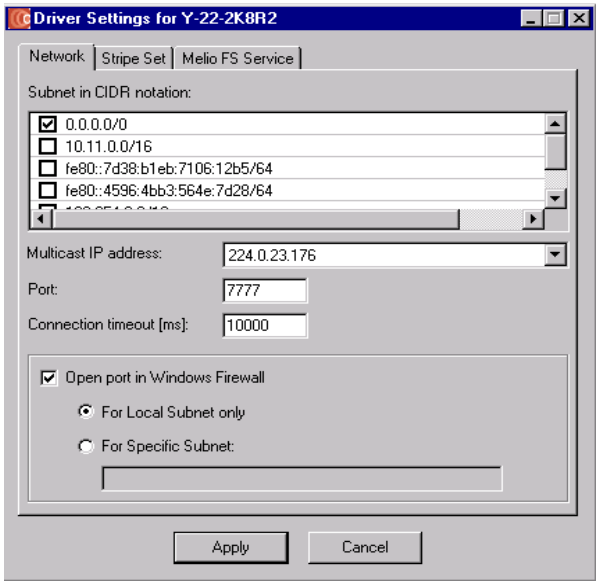
Melio is a fully-journaled file system, which means that all metadata changes are recorded in a special area on the disk called a journal (transaction log). If a machine crashes for example, the file system may be left in a non-consistent state, potentially leading to data corruption. To prevent this, all interrupted operations are checked and replayed using the journal as soon as the volume is accessed by one of the machines in the cluster (not necessarily the crashed machine). It is important to note that, depending on the number of operations that were taking place during the failure, the process of replaying a journal can take some time and during this time delays in I/O operations can be expected.

Additional tuning of Melio

Additional parameters can be configured within the Melio Configuration utility (*Start > All Programs > Sanbolic > Melio Configuration*).

Important note: The default parameters and values for Melio are designed to work under the majority of configurations. Modifications made to any of the parameters described below should ***not*** be made without first conferring with Sanbolic Technical Support.

Configuring TCP/IP settings for Melio



Melio uses both TCP and UDP protocols for communications between Melio instances running on all machines participating in a Melio cluster. A Subnet Range address must be selected if a machine has more than one IP address (select “View > Driver Settings” in the Melio Volume Manager console). If a machine has only one IP address, you can leave the value at the "Default IP" setting.

Note: Melio supports the following network configurations:

Dynamic Host Configuration Protocol (DHCP)
IPv6
Multiple subnet ranges

Note: Multicast IP address – If you experience network problems in the Failover Cluster, select a different Multicast IP address. Change it for all cluster members.

Fine tuning Melio

Disk Flush Disabled - Setting this option may help in situations where hardware issues exist. Certain disk storage does not support this command or support it effectively (usually when the command is issued it takes a lot of time to be completed by the underlying storage). When checked, Melio will not issue disk flush commands. If unsure, leave unchecked.

Pre-allocation Disabled – Setting this option is ***not*** recommended unless advised by Sanbolic Technical Support.

Modifying cluster-wide times

These times affect the operation of *all* machines participating in a Melio cluster. The parameters are volume-specific and once changed, are written to the respective volume and propagated throughout the entire cluster.

Note: Cluster Times values are written directly on the volume, which requires that the volume be locked temporarily by one machine. This will make the respective volume inaccessible to all other machines in the cluster for a short time while the changes are written. Also, you must ensure there are no open files and/or handles for this volume on the other machines, as this will prevent the volume from being locked. If there are any open files and/or handles for the volume, the message "Failed to lock volume. Access is denied." will be displayed. Note all times are in milliseconds.

Max IO Time - This is the maximum time an operation to or from the shared disk can last.
Heartbeat Period - This is the time interval at which the heartbeat check is invoked.
Max Net Roundtrip - This is the maximum time in which a machine expects to receive an answer from the other computers in the cluster to its request over the TCP/IP network.
Max OS Response Delay - The interval between the expected start of a system operation in the computer and its real start. Unless the computer is under constant 100% load, this value should not be changed.
Min Crash Recovery Delay - This is the minimum time it takes for the cluster to determine that a machine is not responding and evict it from the cluster. While this process takes place, I/O operations may be disrupted, depending on the file system's read/write pattern. This is because machines must refrain from changing data on the disk in order to ensure its integrity. This delay depends on all the preceding parameters. It cannot be directly changed and is calculated based on the other values.

Clicking the "**Reload**" button refreshes the volume values. After applying changes to Cluster Times values, press the "**Reload**" button to see the latest values.

Viewing/modifying registration details

Using the registration window (see screen below) you can transition the operational mode of Melio from "Trial" to "Full" mode, apply a new Melio license to upgrade to another edition of Melio, or check which features are currently enabled.

Transitioning from "Trial" to "Full" mode takes place dynamically. Simply enter the user name, company name and serial number and click "Apply."

Note: Every machine participating in a Melio cluster that is running in "Full" or "Registered" mode ***must*** have a *unique* license key installed. Machines using the same license key will be removed from the cluster and will not be able to access any Melio shared volumes until unique license keys have been applied. Running different editions of Melio on machines participating in the same cluster is also not supported. In either of these situations, a message will be written to the System event log.

Per Process tweaks

There are a number of settings that affect the way a process behaves.

- **Report fs as NTFS –** Specifying a value other than zero enables this setting, which some applications may require in order to work properly with Melio.
- **Disable Access Time Update** - Specifying a value other than zero enables this setting, which suppresses the "Date accessed" property of files. With this parameter enabled, a significant increase in performance may be observed when working with files and/or directories, i.e., viewing directory contents, reading files, opening multiple files, etc.

Warning: *This parameter should* ***only*** *be enabled when instructed by Sanbolic technical support!!! Enabling this parameter on your own accord may present undue risk.*

- **Block application access -** Specifying a value other than zero enables this setting, preventing the specified application from accessing the file system.
- **Ignore Write Through** - Specifying a value other than zero enables this setting, causing the file system to ignore the FILE_FLAG_WRITE_THROUGH.

Warning: *This parameter should* ***only*** *be enabled when instructed by Sanbolic technical support!!! Enabling this parameter on your own accord may present undue risk.*

- **Ignore No Buffering -** Specifying a value other than zero enables this setting, causing the file system to ignore the FILE_FLAG_NO_BUFFERING.

Warning: *This parameter should* ***only*** *be enabled when instructed by Sanbolic technical support!!! Enabling this parameter on your own accord may present undue risk.*

- **Enforce Write Through** - Specifying a value other than zero enables this setting, which enforces the FILE_FLAG_WRITE_THROUGH. This setting may fix fluctuations in the performance of certain applications, i.e., video applications.

Warning: *This parameter should* ***only*** *be enabled when instructed by Sanbolic technical support!!! Enabling this parameter on your own accord may present undue risk.*

- **Enforce No Buffering -** Specifying a value other than zero enables this setting, which enforces the FILE_FLAG_NO_BUFFERING. This setting may fix fluctuations in the performance of certain applications, i.e., video applications.

Warning: *This parameter should* ***only*** *be enabled when instructed by Sanbolic technical support!!! Enabling this parameter on your own accord may present undue risk.*

- **Dirty Page Threshold –** Specifying an integer value informs the system of the threshold for dirty pages within the system's cache before they are flushed. For example, if there are multiple files opened by the specified process, this setting will affect the dirty pages of each file. The default value is 0, indicating that there is no threshold. This setting is on a per file basis.

Warning: *This parameter should* ***only*** *be enabled when instructed by Sanbolic technical support!!! Enabling this parameter on your own accord may present undue risk.*

- **Allow Open Paging File**
- **Strict Write Through**
- **Ordered Asynchronous NO_BUFFERING IO`s**
- **Cluster Size [bytes]**

The settings that correspond to the [Default] process are global settings* - they affect all processes. If a process is added, its settings will override the global ones.

You can add a process by right-clicking in the Process pane. This will allow you to browse for the executable file. To add the preferred settings, you must select the desired process first and then right-click in the "Tweaks for process" window pane. You will notice that the relevant process is displayed after "Tweaks for process".

*** Note**: It is not recommended to change global settings as this may lead to unexpected behavior of the file system. Instead, changes should be made on a per process basis.

Per Volume tweaks

These tweaks manage the behavior on a per volume basis. These can be set globally for all Melio volumes by using them on the [Default] placeholder or individually for each volume available.

There are two per volume tweaks.

1. Quality of Service /QoS/ - Select the appropriate volume, right click in the "Tweak Name" column and choose "Add Enable QoS" from the menu. A value of 1 (enabled) will be added to the tweak. **Note:** QoS is disabled by default.
2. Level 1 batch oplocks. Enabling this tweak (specifying a value other than zero) disables Level 1 batch oplocks on the specified volume.

Quality of Service (QoS)

To use this feature, please enable it as described in “Per Volume Tweaks.” QoS allows a user to assign a specific amount of the total throughput available in a storage controller to one or more processes running on a machine and/or one or more VHDs.

Priorities are managed by a point system starting with the lowest priority (1) and ending with the highest priority (1000). You can add a process by right-clicking in the Process window pane, which will allow you to browse for the executable file. To add the preferred settings right-click, select a process and edit the “Points” column by entering the desired value.

The following is an example of how to use QoS:

There are two processes – A and B, both of which are bandwidth intensive, and two other processes – C and D, which do not require as much bandwidth. Here is a scheme of the processes points:

A – 10 points
B – 10 points
[Default] – 5 points
C – 1 point
D – 1 point

Based on the above described point scheme, with Process A and Process C running at the same time, IO bandwidth will be redistributed between them as follows: Process A will have 9/10 (90%) of the bandwidth reserved, while Process C will have only 1/10 (10%) of the bandwidth.

QoS by Filename works in conjunction with the per process scheme described above. Points assigned to a file/file group/folder are added to the ones for the process and then bandwidth reservations are calculated as above. If wildcards are used to generalize particular types of files, the process accessing them will get points added for all of them as a whole. Of course QoS can be set on a file by file basis by assigning weights to individual files, not groups.

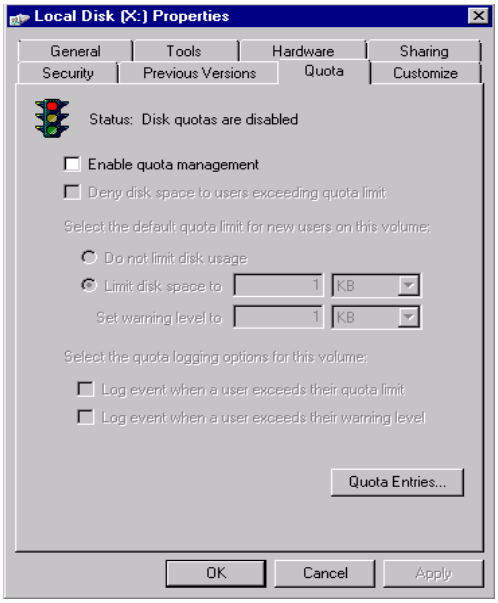
It is important to note that every process participating in QoS computation has points assigned - either explicitly set or using the default.

Supported features in the registered version

You can obtain a registered version of Melio with partial or all features enabled. Melio offers the following features:

Number of machines allowed simultaneous access to a volume – Licenses can be purchased that allow a specific number of machines or an unlimited number of machines to share access to one or more Melio volumes.
Modify security – With this feature enabled, you can modify the files and directories security.
Extend volumes – This feature allows you to extend Melio shared volumes. Note the ability to extend a Melio volume is only available when the volume is managed by Melio Volume Manager.
Reparse points – Enabling this feature will allow a user to make use of the reparse points’ functionality.
Sparse files – These are files that are mostly empty, enabling this feature allows you to use software that requires sparse files.
Modify cluster affinity – Cluster Affinity allows a specific cluster machine (or group of clustered machines) to keep the connection to a shared volume after it has lost communications with the remaining machines participating in the cluster.

QoS – This feature can be used to define how storage throughput is shared amongst applications accessing a particular volume. QoS can be set on a process or file/class of files basis.
Extended file attributes – Allows users to associate computer files with metadata not interpreted by the file system. This feature enables NTFS compatible extended file attributes on Melio.
Open file by ID – File ID is a 64bit reference number for a file. This number is assigned by and specific to a particular file system. An application can use a file_id to open the corresponding file.
Windows folder and file sharing – This feature allows files and folders stored on Melio shared volumes to be shared via file-sharing protocols (i.e., CIFS or NFS).
Volume shadow copy (Snapshot)/ Writable Snapshot – The snapshot capability allows fully-journaled snapshots to be created from any machine in the cluster. The snapshot capability supports standard APIs and can be invoked by industry-standard VSS backup software.
Hard links – Directory entry that associates a name with a file on a file system.
Quota – Specify access permissions to Melio shared volumes for Windows users or groups.



Full layout repair with new UI – Supported in Melio from Melio Shell Extension.
Per-volume activation with dynamic server-side feature selection – Melio is licensed on a per-volume basis, which can be activated online or manually via the Melio Configuration utility.
SCSI reservations – Melio supports SCSI reservations.

Command line utilities

set_cluster_affinity.exe* – This utility is located in the Melio installation folder (*C:\ Program Files\Sanbolic\Melio* by default) and is used for cluster affinity feature administration. Weights can be assigned on the same Melio volume from different machines. By default all volumes on all machines have a cluster weight of 1, making them equal. The syntax is as follows:

set_cluster_affinity.exe \\.\x: <weight> or
set_cluster_affinity.exe \\?\Volume{dab8cf5f-eede-11d9-935e-0011d89ce0a0} <weight>

In case of TCP/IP network connection loss between one or more machines, the cluster can split into several isolated clusters attempting to access the shared volume. Normally this can lead to a split-brain situation in which different cluster groups think they own the same volume exclusively, which can result in data corruption. To prevent this situation from occurring, fencing mechanisms are used to dismount the volume on “misbehaving” machines. When cluster affinity is set, weights are summed up and the heaviest cluster (highest total weight value) becomes the current owner of the volume, with all remaining machines removed from the cluster.

For example, if you set the weight for a particular volume on one of the machines greater than the number of cluster members and deliberately disrupt the network connection between them (i.e., changing the Melio TCP/UDP port number), all machines except the one with the heaviest weight will leave the cluster.

Note: Cluster affinity is available in ***Melio Enterprise*** and ***Melio Private Cloud*** editions and will return an "Incorrect function" error message in the ***Melio VDI*** edition.

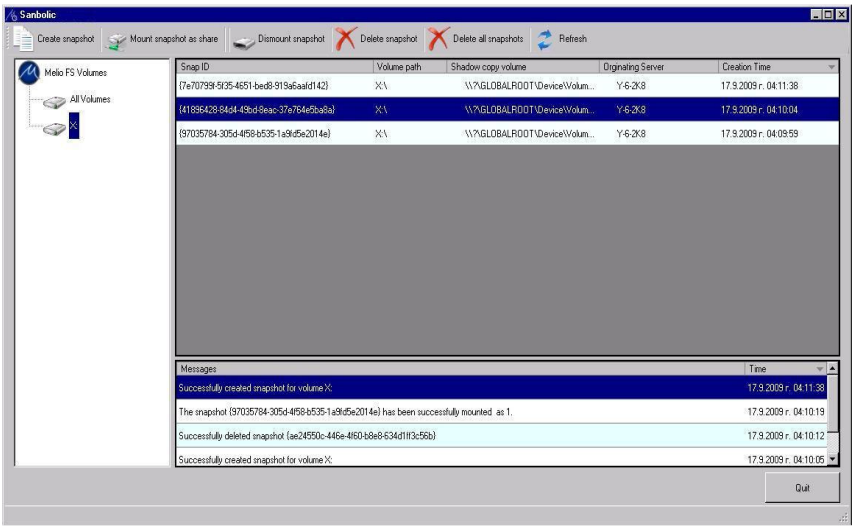
vss_client.exe* – This utility is located in the Melio installation folder (*C:\ Program Files\Sanbolic\Melio* by default) and allows the manipulation of the cluster wide Melio VSS compatible snapshots. Below is a list of supported commands:

Create Shadow - create a new volume shadow copy
Delete Shadows - delete volume shadow copies
Delete ShadowSet - delete an empty shadow set
List Shadows - list existing volume shadow copies
List Providers - list registered volume shadow copy providers
List Volumes - list volumes eligible for shadow copies
Expose Shadow - expose the shadow copy as a regular mount point or a network share
Unexpose Shadow - remove an exposed shadow copy
The syntax is very similar to the default vssadmin Volume Shadow Copy Service administrative command-line tool included in all Windows operating systems supporting VSS. For example, to create a volume shadow copy of a Melio volume:
C:\Program Files\Sanbolic\Melio >vss_client.exe create shadow /for=X:
Melio Volume Snapshots management tool.
Successfully created shadow copy for 'X:'
Shadow Copy ID: {ae24550c-446e-4f60-b8e8-634d1ff3c56b}
Shadow Copy Volume Name: \\?\GLOBALROOT\Device\Volume{ae24550c-446e-4f60-b8e8-634d1ff3c56b}
Then the shadow copy can be deleted, exposed as a network share, etc.

Note: There is also a GUI application called ***Snapper*** (included with Melio) that can be used to create and manage volume shadow copies. This application can be accessed from the Sanbolic folder in the Start menu.

Sanbolic VSS GUI tool (Snapper)

Melio includes an easy-to-use graphical utility called ***Snapper*** that makes working with Melio VSS Snapshots extremely simple. This utility allows users to create and delete snapshots and mount/dismount (expose) them either locally via Explorer.exe or as a network share accessible via UNC, thereby allowing the read only point in time copy of the whole volume to be accessed via the standard Windows file and folder sharing feature. Each action has a corresponding event in the "Messages" section in the bottom-right window pane of the interface, showing the operation status returned – success or a particular error message. (See illustration on following page.)



Troubleshooting

This section includes several steps that can be performed if issues arise when using Melio shared storage.

- First, make sure that your storage hardware is working properly. Check the system and application event log for error messages. If there are timeouts, controller or device errors, or something else, fix them according to your storage manufacturer's guidelines.
- Confirm that all machines participating in the cluster are running in the same mode (Trial or Full). If the machines are running in Full mode, ensure that each machine is using a unique license key for the same edition of Melio (i.e., Melio *Enterprise*, *Private Cloud* or *VDI*). Mixing different editions in the same cluster is not supported. To check which mode and edition of Melio is running, go to *Start > All Programs > Sanbolic > Melio Configuration > Help > About*.
- Confirm network connectivity between all the Melio machines in the cluster. This is especially important on multi-homed systems (systems with several IP addresses). Make sure Melio uses the correct IP addresses on the machines so Melio instances can communicate across the network. Also ensure that all Melio instances are set to the same port number (this applies to both TCP and UDP).
- Check the Event log for messages generated by Melio. The file system reports information, warning and error messages in the System event log that can offer insight regarding how to proceed with troubleshooting (i.e., pointing to a network connectivity issue, disk array problem, etc.).
- Check the version of Melio being using by checking the information shown via *Help > About* in the Melio Configuration tool. This will help you determine if you need to download an update for Melio.
- If you experience any anomalies, you can compare Melio with NTFS by running the same operations on an NTFS volume. If both file systems behave the same, then this is the intended behavior and is not indicative of a problem.

How to request technical support

For technical assistance, contact Sanbolic Technical Support through one of the following methods:

Online: Log into the Sanbolic clients system at http://clients.sanbolic.com/ and enter a support ticket.
Email: support@sanbolic.com
Phone: 617-833-4242

When you submit a support request, please refer to the following guidelines:

1. Supply information on your hardware and software.
2. Supply the exact Melio version.
3. Describe the steps to reproduce the problem.
4. Supply System event logs from all machines participating in the Melio cluster.
5. Supply the exact error message(s).
6. Specify how many times the problem has occurred.
7. State the actual results.
8. Describe the expected results.

1. Supply information on your hardware and software

Use the All programs-> Accessories-> System tools -> System information or other product that will give details about the software and hardware being run on the system.
Please describe the configuration of your central storage. Specify the type and speed of the connection to the hosts, the type of the disk array - JBOD or RAID, the model of the hard disks. Also describe the RAID controller, the RAID level, type of RAID (hardware/software), what software achieves the RAID functionality (Windows or third-party). Describe the topology of your storage network (how many hosts, how many disk arrays, how many loops, etc.).

2. Supply Melio version

The version of Melio can be obtained by using the Melio configuration tool. Launch the tool, select from the menu Help- >About and write down the driver information at the bottom of the message box. Please make sure that you run the same version of Melio on all your machines. If for some reason this is not the case, please state the version of Melio on each of the machines.

3. Describe the steps to reproduce the problem

Please write down the exact steps that led to the problem. If Sanbolic Technical Support is unable to reproduce the problem, it may be difficult to identify, investigate and fix the problem.

Due to the distributed nature of Melio, you will have to include some additional information as well. Take notes of the order in which machines were started - this directly corresponds to the order they enter the cluster and also affects some other aspects of Melio operation.

4. Supply System event logs

Please send system and application event logs from all your systems forming a cluster. Melio writes its information in the System event log, but other software (e.g. MS SQL) enters important information in the Application event log. The event logs should be in native binary format (not as text files). To do so, perform the following steps:

- Launch Event viewer (Start menu -> Run... -> type "eventvwr" without the quotes)
- Select System Log, from the ‘Action’ menu select ‘Save Log File as…’ Make sure the type of the file is “Event Log (*.evt(x))”.
- Choose "Event Log (*.evt(x))" type of the log while saving.

To help Sanbolic Technical Support get as much information as possible out of log files, please provide the approximate time the issue occurred.

5. Supply the error message(s)

If an error message is displayed in a message box, write down the exact text of the message. Please translate the text into English, if the message is in some other language. Also you may perform a screen capture of the error message as follows:

A. Make sure that the error message is the active window. Press Alt+PrtScn to place a bitmap copy of the window in the Clipboard.

B. Open the built-in MS Paint bitmap editor, and paste the image.
C. Go to "File->Save as" and choose a filename.

In case a STOP error occurs that leads to a "blue screen of death", it is important to obtain the kernel memory dump that should be created at %SystemDrive%:\Windows\Memory.dmp. If you review the memory dump and suspect the STOP error may be Melio related, compress and upload the memory dump via the file manager in your account at http://clients.sanbolic.com or to ftp.sanbolic.com. Then contact support@sanbolic.com with a problem description according to the steps provided in this section. A Sanbolic Technical Support engineer will analyze the memory dump and offer suggestions to resolve the error based on his/her findings.

6. Specify how many times the problem has occurred

The best property a problem may have is to be reproducible every time a particular test is run. Unfortunately this is not always the case, if a something shows up only once chances are it won't be discovered.

Please specify the frequency with which a particular bug is occurring - every time you use the same steps, intermittent (how many times in how many tests), just once.

7. State the actual results

Describe the exact results achieved during the test using quantitative values, when possible. For example, avoid saying just "the machine hangs". Instead say something along the lines of "Windows Explorer stopped responding (hanged), we waited for X minutes, nothing changed, we had to kill the explorer process".

8. Describe the expected results

Please describe in detail the expected test results.

Contacting Sanbolic

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